



What Factors Would Cause Mood Disorders and Schizophrenia and How Do These Diagnoses Impact Behavior and Brain Structure in Teenagers?

Aloha Xia

Abstract

Depression and anxiety are common mental health conditions that can significantly impact one's life, especially during the teenage years when individuals become more aware of their mental health. Anxiety disorders can be triggered by a range of life experiences, including traumatic events. There are various types of anxiety disorders, such as Generalized Anxiety Disorder, Panic Disorder, and Social Anxiety Disorder, each with its distinct symptoms and traits. Major Depressive Disorder is the most common type of depression associated with significant personal suffering and physical and mental disability. Previous research has identified specific areas of the brain that are relevant in cases of schizophrenia, which are commonly observed in family studies. These mental disorders can be observed using MRI studies. Teenagers worldwide experience stress in various aspects of their lives, examples would be academic pressure, social challenges, and family conflicts which can all have impacts on mental health. Similarly, screen time and COVID-19 are environmental factors that can impact an individual's physical and mental health. Overall, this paper reviewed the changes in brain structure in teenagers who are diagnosed with anxiety, depression, and schizophrenia and the impact of their diagnosis on daily life. As research in the fields of psychology and neuroscience continues to advance, new data is likely to emerge, further enhancing our understanding of these mental disorders.

Keywords: Mood disorders, anxiety, schizophrenia, brain structure, adolescents

Background Information

Depression occurs in 1.1% of adolescents aged 10–14, 2.8% of 15–19-year-olds, 5% of the world's adults, and 5.7% of adults above age 60 (World Health Organization, 2021). Depression is a common mental health condition that can have a significant impact on one's life, especially in teenagers, as it is a period when individuals become more aware of their mental health. Recent studies suggest a significant positive connection between pediatric anxiety disorders and depression, as they share common genetic factors and cognitive traits. Approximately 25-50% of young people with depression also have anxiety disorders, and around 10-15% of those with anxiety also experience depression. In randomized controlled trials, treatment options such as selective serotonin reuptake inhibitors and cognitive-behavioral therapy have shown effectiveness for both conditions. This indicates that pediatric anxiety disorders and depression may be influenced by a genetically determined neurobiological component involving neural circuits regulated by serotonergic neurons and dopamine (Axelson & Birmaher, 2001).

Prevalence rates of depression have increased in recent years, and so has the suicide rate, with a 37% increase among females and 49% in children and adolescents (Sher, L., 2020). Suicide is a top public health problem and a leading cause of injury and death at a worldwide level, with approximately one million people who die by suicide per year and an estimated one suicide death occurring every 40 seconds (Orsolini et al., 2020). Suicide is ranked as the second leading cause of death among people aged 10 to 34 and the tenth among all age groups. Notably, suicidal behavior has been implicated as a co-morbidity of several neuropsychiatric disorders, including borderline personality disorder, schizophrenia, bipolar disorder, and major depressive disorder (MDD), being considered one of the leading causes of preventable death amongst people affected with mental disorders (Ferrari et al., 2013).

During the short and dark days of winter, many people experience seasonal affective disorder (SAD), characterized by sadness and low energy (Melrose et al., 2015). Some of the factors that maintain SAD include avoiding social situations or facing them with typical behaviors. Treatment options include antidepressants, light therapy, Vitamin D, counseling, and exposure treatment in cognitive behavior therapy (Heimberg et al., 2014). On the other hand, bipolar disorder is a persistent condition marked by fluctuations in mood and energy levels. It is a significant contributor to disability among young individuals, often resulting in cognitive and functional challenges and an increased risk of mortality, particularly from suicide (Vieta et al., 2018). Due to the lack of reliable biomarkers; or in other words, obvious positive symptoms, accurately diagnosing the disorder can be difficult, especially since it often starts with a depressive episode. Therefore, clinical evaluation is essential, and recognizing hypomania periods is crucial for distinguishing the disorder. Keeping abreast of emerging treatment approaches is also vital (Levenberg & Cordner, 2022).

Generalized anxiety disorder is characterized by excessive worry that is difficult to control, often accompanied by physical symptoms such as restlessness, fatigue, difficulty concentrating, irritability, muscle tension, and sleep disturbance. These symptoms must be present for at least six months to meet the diagnostic criteria for GAD (Terlizzi et al, 2020). People with Social Anxiety Disorder feel apprehensive in social situations and fear being humiliated or embarrassed. Common anxieties include sweating, shaking, blushing, stuttering, and appearing anxious or inept (Leigh & Clark, 2018). Meanwhile, individuals with panic disorders may experience intense anxiety episodes known as panic attacks, with physical symptoms such as racing heartbeat, sweating, shortness of breath, chest pain, dizziness, nausea, or numbness. Panic disorder involves spontaneous attacks without a specific trigger, leading to avoidance of certain situations and the potential development of agoraphobia. Without treatment, it can lead to social withdrawal, school dropout, and even suicidal thoughts (Josephine Elia, 2023).

Understanding the neural underpinnings of these conditions is important, as there is a growing interest in studying the impact of mental health disorders on quality of life (Kenwood et al., 2022). It's also important to assess the quality of life of people with mental health disorders as part of their treatment and evaluation; still, researchers are trying to understand more (Beha et al., 2009).

Meanwhile, schizophrenia has garnered increased awareness in recent years. Schizotypal personality disorder is commonly mistaken for schizophrenia, and mental conditions such as anxiety and depression are frequently thought of as the same. Individuals with schizotypal personality disorder share many similarities with patients who have chronic schizophrenia, including similar genetic, biological, and treatment response features. However, they are less affected by certain factors that may affect research on schizophrenia, such as long-term medication use, frequent hospitalizations, and prolonged functional impairment caused by chronic psychosis and social decline. While individuals with schizotypal personality disorder also exhibit persistent asociality and cognitive impairment, these symptoms are usually less severe than in schizophrenia. It's believed that these symptoms stem from similar risk factors that exist on a spectrum and are influenced by both nature and nurture (Siever et al., 2004).

As these mental disorders become more well-known, they are typically thought of among young people. Therefore, this paper aims to determine the causes of mood disorders and schizophrenia and how these diagnoses impact behavior and brain structure in teenagers as well as presents a unique approach by comparing and contrasting various mental disorders.

Method

In this paper, a literature review was conducted to understand the impact on behavior and brain structure in teenagers with these conditions. Google Scholar was used to identify relevant research papers for the literature review. The following search terms were used: brain structure,

behavior, depression, anxiety disorders, and schizophrenic disorders. Research studies were included if they discussed either behavior or brain structure changes in anxiety, depression, or schizophrenia in adolescents. Studies were excluded if participants were children, adolescents, or adults. Meta-analysis and true experiments were included. Experimenters observed the participant's brain structure before medication was taken. This paper also used controlled vocabulary and keyword terms that accurately searched for information and evidence.

Results

This literature search resulted in the identification of many relevant research studies. Upon review, 15 of these studies met inclusion criteria and will be described here.

Discussion

Anxiety

Anxiety disorders can be brought on by a range of life experiences, including traumatic events. Although the root causes of these disorders are not yet fully comprehended, individuals who are prone to anxiety are more vulnerable to developing them (Bandelow et al., 2004). There are various types of anxiety disorders, such as generalized anxiety disorder, panic disorder, and social anxiety disorder, each with its own set of distinct symptoms and traits.

Studies examining the amygdala volumes in youth with different anxiety disorders have produced conflicting findings. Some studies have reported smaller amygdala volumes in youth diagnosed with mixed anxiety disorder. In comparison, others have found larger amygdala volumes in youth with generalized anxiety disorder and higher levels of anxiety. Additionally, smaller hippocampal volumes have been identified in youth with mixed anxiety disorders. It is important to note that the majority of these studies were conducted with small sample sizes, which may have contributed to the inconsistencies in the results across studies (Merz et al., 2018).

There are several ways to treat anxiety. The main treatments for anxiety are psychotherapy and medication, or a combination of both. Cognitive-behavioral therapy, commonly known as CBT, is a type of therapy that spans a short duration and is also the most effective form of psychotherapy for anxiety disorders. It concentrates on equipping individuals with specific skills to alleviate symptoms and gradually reintroduce the patient to activities they may have been shying away from due to anxiety. CBT employs exposure therapy as a technique, which gradually exposes patients to the object or situation that triggers anxiety. This approach helps regain confidence in managing difficult situations and anxiety symptoms effectively. In the long-term, psychotherapy may be useful as it involves collaborating with a therapist to reduce anxiety symptoms, while simply confiding in a trusted friend can also provide relief from anxiety.

There are other forms of therapies for anxiety as well, such as counseling and problem-solving therapy or PST (Cape et al., 2010).

Medications are used to help relieve symptoms if necessary, depending on the type of anxiety disorder and other comorbid mental or physical health conditions (Roy-Byrne et al., 2008). One example of medications commonly used to treat anxiety disorders include antidepressants, such as buspirone. In other circumstances, psychiatrists or other physicians treating anxiety may prescribe another type of medication, such as sedatives, also called benzodiazepines or beta blockers. These medications are for short-term relief of anxiety symptoms and are not intended to be used long-term. Finding the most effective treatment for the client's specific needs may take some time as some individuals utilize both medication and therapy in their treatment plans to address their mental health concerns comprehensively (Garakani et al, 2020).

Mood Disorders

MDD is the most common type of depression that is associated with significant personal suffering, and physical and mental disability. The association between MDD and suicide attempts (SA) and ideation (SI) has been well documented, with SI and suicidal behavior frequently reported during depressive episodes, with a suicide risk rate equivalent to around 15% (Orsolini et al., 2020).

Two main findings on bipolar emerged in a double counting in meta-analysis (in which arms of the same study are counted more than once) involving 5534 patients and 6651 healthy controls. Firstly, patients with bipolar disorder displayed more significant variability in the volumes of the amygdala and hippocampus compared to healthy individuals. The calculation of this variability within studies suggests that it is unlikely to be attributed to methodological differences between studies. Additionally, patients exhibited significantly higher variability ratios in the lateral ventricle, thalamus, third ventricle, white matter, and total brain volume compared to controls. However, these findings were less consistent as they did not reach significance for both variability measures. The second main finding indicates that individuals with bipolar disorder have larger lateral and third ventricle volumes and lower volumes of the hippocampus, gray matter, white matter, and total brain volumes. This meta-analysis builds upon previous research in two significant ways (Angelescu et al., 2021).

Recent studies showed that higher levels of depressive symptoms (mainly in MDD) were uniquely associated with reduced CT in vmPFC/medial OFC. Higher levels of impulsivity, but not anxiety or depression, were significantly associated with reduced CT in lateral PFC regions (rostral middle frontal gyrus, pars orbitalis) and the frontal pole. Higher levels of depressive symptoms, but not impulsivity, were significantly associated with smaller hippocampal volume and larger pallidal volume. These findings shed light on the similarities and differences in

underlying neuroanatomy of internalizing symptoms and impulsivity during childhood and adolescence (Merz et al., 2018).

Schizophrenia

Previous research has pinpointed specific areas of the brain that are relevant in cases of schizophrenia, such as the frontal cortex, temporal cortex, striatum, and thalamus. Structural changes in the temporal cortex, specifically the superior temporal gyrus, have been consistently observed in individuals with chronic schizophrenia. Research on both schizophrenia patients and their relatives has also shown reductions in the medial temporal regions, such as the amygdala and/or hippocampal complex (Shenton et al., 2001). The striatum and its connections to the cortex have been implicated in schizophrenia, primarily due to the involvement of dopamine as a key neurotransmitter in these regions and the fact that striatal structures are a principal target of dopamine D2 antagonism, a key mechanism of action of neuroleptic medications (Siever et al., 2004).

The thalamus serves as a crucial junction in the brain, facilitating the convergence of different circuits, including sensory inputs, with higher cortical regions that govern response planning. Some experts propose that the thalamus, alongside the cortex and cerebellum, could potentially play a vital role in the onset of schizophrenia (Jones, E. G., 1997). The thalamus, a key component of the circuitry involving the cortex and the cerebellum, has been suggested to have a significant role in the development of schizophrenia. Both postmortem and imaging studies support this suggestion. The thalamus is made up of various distinct nuclei with differing patterns of connectivity to other areas of the brain. For instance, the pulvinar, which is closely linked to temporal lobe structures, is seen to be reduced in individuals with schizotypal personality disorder, much like in those with schizophrenia, as compared to individuals without these conditions. However, the volume of the medial dorsal nucleus, which is associated with the prefrontal cortex, is not reduced in individuals with schizotypal personality disorder as compared to those without the disorder, unlike the reductions observed in individuals with schizophrenia. Thus, reductions in the subcortical nuclei relaying from the thalamus to the cortex appear to mirror reductions in associated cortical regions in schizotypal personality disorder - specifically, reductions in temporal but not frontal volume (Siever et al., 2004).

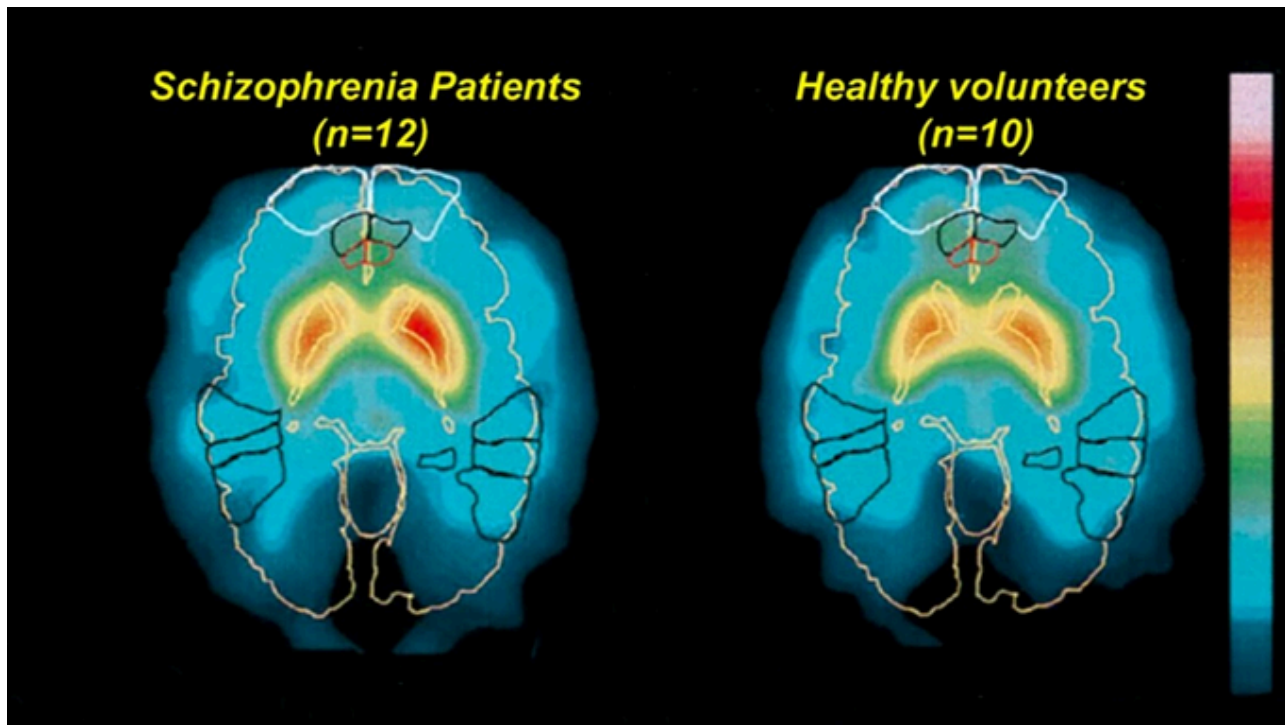


Figure 1: Brain structure between schizophrenia patient and typical person. Taken directly from Seunggu Han & Erica Hersh (March 30, 2022).

Research into the genetics of schizophrenia has shown that there is a genetic component, as evidenced by twin and adoption studies. However, the specifics of these genetic factors and how they manifest phenotypically are not yet fully understood. The presence of schizophrenia in only one of a pair of identical twins also indicates that non-genetic factors are involved in the development of the disorder. Interestingly, many co-twins of schizophrenia probands exhibit traits similar to schizophrenia, but the extent of these traits varies. Studies of families and twins suggest that individuals with a genetic connection to someone with schizophrenia may experience symptoms related to schizotypal personality disorders or other schizophrenia-related disorders (Siever et al., 2004).

Unfortunately, schizophrenia cannot be completely cured, although antipsychotic medications such as haloperidol, olanzapine, quetiapine, and risperidone can help control hallucinations and delusions. It's important to note that children are particularly vulnerable to the side effects of these medications, which may include tremors, slowed movements, movement disorders, and metabolic syndrome (Josephine Elia, 2023).

Impacts On Daily Life

Anxiety and depression are prevalent conditions that affect many individuals worldwide. These disorders can cause significant disruptions in one's emotional state, leading to symptoms

such as persistent sadness, anxiety, irritability, and difficulty in concentration. Although mood disorders can affect anyone, genetic relationships can increase the likelihood of diagnosis. Genetic predisposition refers to hereditary traits that can increase the likelihood of developing a particular health condition. In the case of mood disorders, some individuals may inherit genetic mutations or variations that make them more susceptible to these conditions. Research has also shown that individuals with a family history of mood disorders are more likely to develop these conditions themselves (Mann et al., 2005).

It is worth noting that teenagers all over the world experience stress in various aspects of their lives that can lead to anxiety disorders. For example, academic pressure, social challenges, and family conflicts are common causes of anxiety in adolescents. The burden of schoolwork, such as exams, homework, and deadlines, can create significant stress among teenagers. Additionally, teenagers may face social anxiety due to difficulties in forming and maintaining friendships. Family issues such as parental separation, financial problems, and personal conflicts can also contribute to anxiety in teenagers. As technology develops, many youths (aged between 10 and 24) spend significant time watching videos, engrossed in tablet games, or messaging friends as common recreational activities. In teenagers, screen media activity (SMA) consumes up to 60% of their after-school time, and nearly 97% of US youth have at least one electronic item in their bedroom (Paulus et al., 2023). While many of us enjoy staying connected on social media, excessive use can fuel feelings of addiction, anxiety, depression, and isolation, due to cyberbullying and FOMO (Fear of Missing Out).

The ongoing coronavirus (COVID-19) pandemic has necessitated the implementation of social restrictions and lockdowns to contain its spread. Mental health repercussions of these stressful situations have been reported in the general population, including evidence that the student population is highly vulnerable (Kar et al., 2021), experiencing more anxiety and stress than others. Since the beginning of the pandemic, many people have lost loved ones, including soulmates, family members, and close friends, leaving a painful mark on their lives, leading to more diagnoses of anxiety and mood disorders (Orsolini et al., 2020).

Limitations

The information provided in this paper is limited in comparison to the vast amount of knowledge available on the subject. Due to this, there could be additional information that has not been included, which may affect the accuracy of the paper. As there exists a wealth of knowledge on the topic, it is possible that certain aspects may not have been covered in this paper. As a result, it is crucial to acknowledge that the paper may not offer a complete and all-encompassing understanding of the subject matter. There are many other sources out there that this paper did not include but are also reliable, therefore, it is important to keep this in mind.

Future Directions



As research in the fields of psychology and neuroscience continues to advance, new data will likely be discovered, which will improve our understanding of anxiety, mood disorders, and schizophrenia. This could include breakthroughs in areas such as brain imaging, genetic research, and the identification of new therapies and treatments. With the help of technology, psychologists, and neuroscientists may improve their ability to diagnose and treat these conditions, leading to better outcomes for patients and a greater understanding of the underlying causes of these disorders.

Conclusion

To summarize the study's findings, it was discovered that increased levels of depression during childhood and adolescence were associated with reduced cortical thickness in two areas of the brain - the ventromedial prefrontal cortex and medial orbitofrontal cortex. Additionally, higher levels of depressive symptoms were linked to a smaller hippocampal volume and larger pallidal volume. These results shed light on the overlapping and distinct neural structures associated with internalizing symptoms and impulsivity in young individuals. Disorders that share similarities with anxiety, such as depression may be amenable to treatment with antidepressant medication. On the other hand, schizophrenia is widely regarded as having a strong genetic influence, as evidenced by family studies linking genetic factors to the development of related disorders like a schizotypal personality disorder. Nonetheless, the future looks promising with new technologies and research advances.

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