HIGH SCHOOL EDITION
Journal of Student Research
Volume 12 Issue 1 (2023)

Emotional and Visual Processing Are Impaired in Those with Psychopathologies Like Schizophrenia, Bipolar Disorder, and Dissociative Identity Disorder

Jieon Ki[1] and Cindy Philpot[#]

[1]South Forsyth High School, Cumming, GA, USA
[#]Advisor

ABSTRACT

Context: Current research shows that nearly one in five adults in the United States suffer from mental illnesses (NIMH, 2022). Of these mental illnesses, schizophrenia, bipolar disorder, and dissociative identity disorder are some of the most debilitating disorders that impact patients. Schizophrenia is often associated with disruption in facial emotion recognition (Tomlinson et al., 2006). Those with bipolar disorder show impairment in non-verbal emotion processing (Rheenen & Rossell, 2013). People who experience long-term trauma are prone to developing dissociative identity disorder, which may affect their social and occupational functioning (Robitz, 2018). In this paper, we will be analyzing current scientific research and determining how these psychopathologies disturb emotional and visual processing. The lack of consolidating research creates a need for this review on these illnesses. Methods: We searched up key words such as "emotional dysregulation" and "impaired visual processing" pertaining to all three disorders through Google Scholar and selected only articles that were peer-reviewed and published through reliable networks. We also read through each article in order to test the relevance of the articles we found. Conclusions/Discussion: We hope for these results to inspire future research on how to create therapeutic targets for the disrupted pathways in these diseases. We also want to bring awareness to how these illnesses affect patients on a day-to-day basis and help build scientific understanding on how these disorders manifest biologically in the brain. Although there is significant evidence that points towards significant impairment of emotional and visual processing for those with psychopathologies, conflicting evidence presents that emotional and visual processing is not as significantly impaired as current research suggests.

Background

One in five adults are affected by mental illnesses in the United States (NIMH, 2022). From the broad scope of mental disorders, schizophrenia, bipolar disorder, and dissociative identity disorder are the most inhibiting for a patient's daily life. Studies show that facial emotion processing, which is impaired in these psychopathologies, is significant for social interaction (Pavuluri et al., 2006). Along with dysregulation of facial processing comes cognitive deficits and disruptions in emotional processing in patients who have these illnesses (McTeague et al., 2020). Current research shows that patients who are diagnosed with psychiatric disorders are at a ten times higher risk for suicide than those in the general population, which raises an urgency and necessity for treatment to be researched (Bachmann, 2018). The deficits in the emotional and visual processing in schizophrenia, bipolar disorder, and dissociative identity disorder may contribute to their debilitating nature.

Schizophrenia is a personality disorder that affects the brain. Some symptoms are hallucinations, exaggerated perception, difficulty in expressing emotions, and disordered thinking (Torres, 2020). Those with schizophrenia are also at a risk of misusing substances than those in the general population (Torres, 2020). Treatment for schizophrenia exists, but there is no resolved cure for this illness (Torres, 2020).

Bipolar disorder is a mood disorder that causes strong mood swings. Some symptoms are manic episodes, depressive episodes, or mixed episodes (Medline Plus, 2021). Manic episodes cause feelings of elation, jumpiness, or even irritability (Medline Plus, 2021). On the other hand, depressive episodes cause feelings of worthlessness and can consist of thoughts about death or suicide (Medline Plus, 2021). Mixed episodes consist of both manic and depressive episode symptoms, such as feeling energized but also empty inside (Medline Plus, 2021). Bipolar disorder is known to be mostly genetic, for people with bipolar disorder tend to have family members who were also diagnosed (Medline Plus, 2021). There are some treatments for bipolar disorder such as medication or talk therapy, but the most severe patients are treated with electroconvulsive therapy (ECT) in order to stimulate their brain to relieve symptoms (Medline Plus, 2021)

Dissociative Identity disorder (DID) is a form of dissociation that causes little or no connection in people's thoughts, actions, or identity (Bhandari, 2022). This disorder is thought to be a form of coping mechanism for those who experience severe trauma. People who are at risk for DID are those who had severe, long lasting trauma or neglect in early stages of childhood development (Bhandari, 2022). Symptoms of DID are the presence of split identities that "take over" a patient's mind and/or body, amnesia, depersonalization, and self-sabotage (Bhandari, 2022). Those with DID are also known to have coexisting illnesses such as depression, anxiety, insomnia, or auditory/visual hallucinations (Bhandari, 2022). There is no "cure" for DID, but long-term treatments such as psychotherapy, hypnotherapy, and adjunctive therapy are usually used to help with DID (Bhandari, 2022). Although there is no medication to help DID, medicine for the coexisting illnesses are often used alongside psychological approaches to DID (Bhandari, 2022).

In visual processing, photoreceptor rods and cones in the retina cause action potentials that send signals through the optic nerve. The optic nerve in each eye contains two fibers (temporal and nasal) that connect and split up at the optic chiasm. In the optic chiasm, the nasal fiber and temporal fiber from the right eye form the right optic tract. Similarly, the nasal fiber and temporal fiber from the left eye form the left optic tract. Both optic tracts travel posteriorly and synapse in their ipsilateral lateral geniculate nucleus (LGN). These fibers then terminate in V1 of the visual cortex. Research shows that the visual pathway splits into the dorsal and the ventral streams, commonly known as the "where" and "what" pathways, respectively. While the dorsal pathway focuses on the larger picture, the ventral pathway focuses on specific details within view. The dorsal stream plays a significant role in visual and spatial attention while the ventral stream contributes to object recognition. The ventral stream travels into the V1 and V2 and through the extrastriate cortex to the inferior temporal cortex (IT). The dorsal stream travels into the V1, V2, and V5 to the Medial Superior Temporal (MST), which receives inputs from the medial temporal area that detects motion. Both the dorsal and ventral stream are integrated in order to help visual processing function properly.

Contrary to previous theories, distinct emotions are not localized to certain brain regions but rather a network of interconnected neural pathways (Lindquist et al., 2012). Some regions of the brain that are involved in this neural network are the amygdala and the prefrontal cortex (Raschle et al., 2016). In neurotypical subjects, the activation of the amygdala was typically observed in response to emotional stimuli (Townsend, 2012). Scientists also hypothesize that the amygdala may play an essential role in strengthening the perception of stimuli in the occipital and temporal cortex (Townsend, 2012). The amygdala is responsible for handling positive and negative emotions (Raschle et al., 2016). For example, fearful, sad, and humorous stimuli cause activity in the amygdala (Fossati, 2012). Deficits in the amygdala are recognized through impaired social behaviors such as issues in regulating interpersonal distance and high levels of social approach (Fossati, 2012). The amygdala is most commonly associated with fear response, and a study found that damage to the amygdala caused reduced response to fear, which was commonly seen in patients with anxiety disorders (Fossati, 2012). Those with anxiety disorders have an abnormal response to a fearful face, similar to those with amygdala lesions (Fossati, 2012). The amygdala is also found to be sensitive to social cues, and those with amygdala lesions have shown impaired social behaviors (Fossati, 2012).

The prefrontal cortex also plays a significant role in emotional and visual processing. Typically associated with emotional regulation is the medial and ventromedial prefrontal cortex (Suzuki and Tanaka, 2021). Data also presents that the prefrontal cortex (PFC) has a role in regulating activity in extrastriate visual regions (Paneri and Gregoriou, 2017). Research found a critical role of the PFC in modulating attention of different signals of attention such as firing rates, inter-neuronal variability, and neural synchrony (Paneri and Gregoriou, 2017). However, the largeness of the PFC raises questions on whether or not the PFC is the sole part of top-down influence on visual stimuli (Paneri and Gregoriou, 2017).

Disorders

In patients with schizophrenia, deficits in visual and emotional processing have been documented (Butler et al., 2009). In a study intended to observe how sensitive patients were to light contrast, and to test a hypothesis for the correlation of light contrast sensitivity and emotion processing, experimenters found that those with schizophrenia had trouble with contrast sensitivity (Butler et.al, 2009). In regard to the hypothesis, significant correlation was found with contrast sensitivity and emotional processing (Butler et.al, 2009). In other words, contrast sensitivity was a predictor of emotional processing with decreased sensitivity for decreased emotional processing. This provides evidence for the connection between emotion recognition and visual processing, since the ability to discern images based on emotions correlated with magnitude of contrast. Another experiment within the study tested how much contrast was needed for subjects to correctly identify an emotion. It was observed that patients of schizophrenia needed at least twice the contrast that controls needed to recognize an emotion (Butler et.al, 2009). The overall observation made was that there was significant magnocellular deficit within schizophrenic patients, indicating magnocellular involvement for emotional processing (Butler et.al, 2009). Magnocellular carries information about larger, faster images, while parvocellular carries information about smaller, slower images (Olman). Both the parvocellular and magnocellular pathways are involved in higher order processing, like perception and object recognition. This implies that if one pathway is impaired, the more advanced visual processes are impaired. The observed general deficit in emotions also suggests that schizophrenia does not affect a singular region of the brain (Butler et.al, 2009). Another experiment analyzed how facial emotion processing could differ from static pictures to moving pictures in schizophrenic patients (Tomlinson et.al, 2006). To support the idea that those with schizophrenia have an even greater difficulty in recognizing emotion on moving faces relative to static ones, the study utilized point-light imaging (Tomlinson et.al, 2006). These methods replicated those in a previous paper that provided evidence for the theory that motion is selectively impaired when recognizing facial emotions (Tomlinson et.al, 2006). To prove or disprove that motion underlies the deficit in facial emotion processing, the study used dynamic and static point-light images of happiness, disgust, fear, sadness, and surprise that the subjects had to identify (Tomlinson et.al, 2006). Results showed that there was a trend for anger, sadness, and surprise being recognized more accurately by the control group in static imaging (Tomlinson et.al, 2006). Also, those in the neurotypical control group were found to be trending towards accuracy in recognizing emotions in moving images than the schizophrenic group, which calls attention to potential deficits in visual processing (Tomlinson et.al, 2006). Schizophrenic patients in another study that tested contextual modulations of contrast, luminance, and size were also found to have weakened identification of contrast in visual stimuli, but regular identification of luminance and size (Yang, 2013).

Bipolar disorder consists of manic and depressive episodes, each with their own distinct biological processes. Those with bipolar disorder have been observed to have impairments in visual and emotional processing as well. Reduced activation of the prefrontal cortex was observed in MRIs of bipolar patients when responding to angry and happy faces in comparison to neutral faces (Pavuluri et.al, 2006). Not only was reduced

activation found in the prefrontal cortex, but scientists observed reduced activation in the occipital cortex (Pavuluri et.al, 2006). The results point to an impairment in the visual and emotional process, which could potentially be the cause of social difficulties and emotional dysregulation in bipolar patients (Pavuluri et.al, 2006). In manic episodes, subjects with BD usually displayed a more sensitive response to emotional faces than healthy subjects (Townsend, 2012). More specifically, there was an increase in the left amygdala activity in comparison to neurotypical people (Townsend, 2012). Although most studies have been consistent, variation in amygdala activation depends on valence and strength of emotional stimuli (Townsend, 2012). Several studies also observed a dampening of activity in the ventrolateral prefrontal cortex (vlPFC) in manic episodes of bipolar patients (Townsend, 2012). In a study that found an increase in vlPFC activation, both happy and fearful faces were processed, which is distinct from the lack of vlPFC activity for happy faces in controls (Townsend, 2012). Hypoactivation of other regions of the prefrontal cortex have also been observed in several studies of manic episodes (Townsend, 2012). Dysfunction in the connectivity of regions in emotional processing could be the cause of dysregulation of emotions and large range of mood shifts typically found in manic episodes of those with bipolar disorder (Townsend, 2012). Unlike manic episodes, there was a higher observed difference in activation patterns in depressive episodes between bipolar patients and neurotypical subjects (Townsend, 2012). In a particular study where subjects were presented with positive versus neutral pictures, a greater activation of the left amygdala was observed in BD patients in comparison to healthy controls (Townsend, 2012). However, a more recent study observed no significant difference of the amygdala activity between BD subjects and neurotypical subjects, but rather a hypoactivation of the prefrontal cortex in BD patients (Townsend, 2012). Scientists also found that bipolar depressed subjects had increased PFC and amygdala connectivity when viewing sad faces than healthy subjects (Townsend, 2012). As subjects changed moods, the connectivity of the PFC and amygdala seemed to shift along with mood states (Townsend, 2012). There seems to be a similar underlying pattern between the manic and depressive episodes with dysregulation of either the amygdala or regions of the prefrontal cortex that causes mood shifts in patients with bipolar disorder. However, more studies are needed to provide a more conclusive theory. In a study that observed how well schizophrenic and bipolar patients could identify luminance, magnitude, and contrast, bipolar manic patients with greater manic symptoms tended to have weaker contrast modulation (Yang et.al, 2013). This could imply that those with greater manic symptoms are more prone to visual disruption than those with milder symptoms or neurotypical patients.

Due to the controversy regarding the diagnosis of DID, there is a scarcity of research done specifically on visual and emotional processing in DID patients. However, there is research done on the structural differences between DID patients and neurotypical subjects. A study found that the amygdala was smaller in size and shape than controls (Blihar et.al, 2020). Depersonalization has also been connected to changes in the left amygdala (Blihar et.al, 2020). Scientists also speculate that changes in the amygdala may lead to the manifestation of DID (Blihar et.al, 2020). Not only are there changes in the amygdala, but the hippocampi, which is associated with learning and memory, of DID patients were found to be significantly smaller than neurotypical people (Blihar et.al, 2020). Participants who had recovered from DID had larger hippocampi than those that did not complete therapy or recover, which bolsters the argument that the size of the hippocampus changes with DID (Blihar et.al, 2020). Previous studies have suggested that stress is a leading cause for change in the hippocampus, which raises questions on the correlation of stress and DID (Rutkofsky et.al, 2017). The systematic review also found that DID patients had smaller white, or myelinated matter in regions associated with visual processing, which could manifest in functional differences in visual processing, which have not been defined yet. Many results of studies found that the medial prefrontal cortex had connection to the different self-states of DID patients and the ability of conscious reflection for such states (Staniloiu et.al, 2012). Those with DID were also found to have higher activation in areas such as the prefrontal cortex that are associated with working memory and had fewer mistakes with increasing task load than other healthy subjects had (Staniloiu, et.al, 2012). However, DID patients reported feeling more anxious and less focused, showing a slight contradiction to the results of the working memory task (Staniloiu et.al, 2012). Other research has found that the orbitofrontal

cortex (OFC), typically associated with decision making, has reduced blood flow in the brains of DID patients (Rutkofsky et.al, 2017). As a result, those with DID may have more impulsivity than neurotypical patients, which also affects the social lives of affected patients.

Discussion

Visual deficits such as in vernier acuity (ability to find offset in position, more reliant on higher level cortical processing of visual stimuli), visual backward masking, and early sensory processing are commonly found in both schizophrenia and bipolar disorder (Yang et.al, 2013). The similar deficits often found in these two disorders may cause misdiagnosis of schizophrenia for bipolar disorder or vice versa. Current evidence also suggests that schizophrenia and BD have similar cognitive impairments with milder deficits in BD (Reavis et.al, 2020). This overlap suggests that perceptual deficits in schizophrenia could apply to deficits in functioning in BD patients (Reavis et.al, 2020). Not only are characteristics such as cognitive impairments and disturbance in emotional regulation similar for patients, but social cognitive skills have been found to be interrelated in BD and schizophrenia patients (Frajo-Apor et.al, 2021). A study conducted on the temporal responses of both schizophrenia and BD patients found that those with schizophrenia showed a deficit in initializing and sustaining regulation, but those with BD had a more general deficit (Zhang et.al, 2019). Another study suggested that recovery for BD and schizophrenia may differ from each other despite the similarities of deficit (Frajo-Apor et.al, 2021). DID patients and schizophrenia patients show similarities in reduced activation and differing size of regions in the brain from neurotypical patients, which may indicate a correlation in altered brain region size and those disorders. Specifically, DID patients often had a smaller hippocampus than neurotypical people, while BD patients had deficits in connectivity and regulation within the amygdala. Despite sharing some characteristics with DID, BD is more associated with activation than change in sizes of regions that control regulation. Within BD, those with mania show hypoactivation of the prefrontal cortex while those with depressive BD show hyperactivation of the amygdala. Overall, with the lack of randomized controlled trials with DID patients it is difficult to determine if DID has any significant characteristic similarities to schizophrenia or BD.

The current therapeutic approaches to these three disorders address the lifelong deficits of patients. For schizophrenia patients, antipsychotic medicine reduces the psychotic symptoms that they may experience (NIMH). Psychosocial treatments may include cognitive behavioral therapy and training behavioral skills in order to help schizophrenia patients in their daily lives (NIMH). Educational sessions for family and friends help those around the affected patient provide support through treatment (NIMH). Those with schizophrenia may also attend sessions to help with substance misuse, as it is common for schizophrenia patients to abuse substances (NIMH). Bipolar disorder also uses a mix of medication and therapy for treatment (NIMH). Medication typically involves mood stabilizers and targets anxiety for patients (NIMH). BD patients need to take medication for their entire life because rebound may cause manic or depressive symptoms to be worse (NIMH). Similar to schizophrenia, doctors may recommend BD have psychotherapies that involve cognitive behavioral therapy and education for those around BD patients in order to treat conditions (NIMH). Newer therapies designed specifically for BD patients are being researched to target bipolar disorder at its earlier stages (NIMH). As mentioned previously, there is therapy for DID patients that include trauma-focused care and acknowledgement of dissociative symptoms. With more studies on DID and its correlation with schizophrenia and BD, scientists will be able to develop new forms of therapy to help those with DID. The current therapies for DID do not hold a specific target, and finding DID's connection to deficits found in schizophrenia and BD may change this. If scientists find more evidence that supports the correlation between visual and emotional deficits in BD and schizophrenic patients, medication that helps both symptoms may be soon developed. In order to help patients of these three disorders assimilate socially into the community, more research should be conducted and analyzed to reduce their debilitating nature. While there may be no "cure" to these psychiatric disorders, research on the disorders will advance science in terms of correlating psychiatric disorders. Insight into the

primary visual and emotional deficits that are present in these disorders can lead to potential early detection and better targeted therapies for patients.

Acknowledgments

I would like to thank my advisor for the valuable insight provided to me on this topic.

References

Bhandari, S. (2022, January 22). *Dissociative identity disorder (multiple personality disorder): Signs, symptoms, treatment*. WebMD. Retrieved June 30, 2022, from https://www.webmd.com/mental-health/dissociative-identity-disorder-multiple-personality-disorder

Blihar, D., Delgado, E., Buryak, M., Gonzalez, M., & Waechter, R. (2020, February 12). *A systematic review of the Neuroanatomy of Dissociative Identity disorder*. European Journal of Trauma & Dissociation. Retrieved August 8, 2022, from https://www.sciencedirect.com/science/article/pii/S246874992030017X

Broadhouse, K. M., Britt, Z., Park, K. S., & Peña, J. (2016, September 12). *Emotions and the brain – or how to master "the force"*. Frontiers for Young Minds. Retrieved July 7, 2022, from https://kids.frontiersin.org/articles/10.3389/frym.2016.00016

Butler, P. D., Abeles, I. Y., Weiskopf, N. G., Tambini, A., Jalbrzikowski, M., Legatt, M. E., Zemon, V., Loughead, J., Gur, R. C., & Javitt, D. C. (2009, September 30). *Sensory contributions to impaired emotion processing in schizophrenia*. OUP Academic. Retrieved July 25, 2022, from https://academic.oup.com/schizophreniabulletin/article/35/6/1095/1844694?login=true

Butler, P. D., Schechter, I., Zemon, V., Schwartz, S. G., Greenstein, V. C., Gordon, J., Schroeder, C. E., Javitt, D. C., Frankle, W. G., Hashimoto, T., Chen, Y., Sachsse, U., Duggal, H. S., Kéri, S., Butler, P. D., & Doniger, G. M. (2001, July 1). *Dysfunction of early-stage visual processing in schizophrenia*. American Journal of Psychiatry. Retrieved August 21, 2022, from https://ajp.psychiatryonline.org/doi/full/10.1176/appi.ajp.158.7.1126

Fossati, P. (2012, September 6). *Neural correlates of emotion processing: From emotional to Social Brain*. European Neuropsychopharmacology. Retrieved July 7, 2022, from https://www.sciencedirect.com/science/article/abs/pii/S0924977X12001903?fr=RR-2&ref=pdf_download&rr=73e816d0dc93b0e7

Frajo-Apor, B., Pardeller, S., Kemmler, G., Mühlbacher, M., Welte, A.-S., Hörtnagl, C., Derntl, B., & Hofer, A. (2021, May 5). *The relationship between emotional intelligence and quality of life in schizophrenia and bipolar I disorder - quality of life research*. SpringerLink. Retrieved August 17, 2022, from https://link.springer.com/article/10.1007/s11136-021-02843-z

Lindquist, K. A., Wager, T. D., Kober, H., Bliss-Moreau, E., & Barrett, L. F. (2012, May 23). *The brain basis of emotion: A Meta-Analytic Review: Behavioral and brain sciences*. Cambridge Core. Retrieved July 31, 2022, from https://www.cambridge.org/core/journals/behavioral-and-brain-sciences/article/brain-basis-of-emotion-a-metaanalytic-review/80F95F093305C76BA2C66BBA48D4BC8A

Hu, M. L., Ayton, L. N., & Jolly, J. K. (2021). The Clinical Use of Vernier Acuity: Resolution of the Visual Cortex Is More Than Meets the Eye. *Frontiers in neuroscience*, *15*, 714843. https://doi.org/10.3389/fnins.2021.714843

MedlinePlus. (2021). *Bipolar disorder*. MedlinePlus. Retrieved June 30, 2022, from https://medlineplus.gov/bipolardisorder.html

NIMH. (n.d.). *Bipolar disorder*. National Institute of Mental Health. Retrieved June 30, 2022, from https://www.nimh.nih.gov/health/topics/bipolar-disorder

NIMH. (n.d.). *Schizophrenia*. National Institute of Mental Health. Retrieved June 30, 2022, from https://www.nimh.nih.gov/health/topics/schizophrenia

Olman, C. (2022, January 1). *Magnocellular and parvocellular pathways*. Introduction to Sensation and Perception. Retrieved July 31, 2022, from https://pressbooks.umn.edu/sensationandperception/chapter/magnocellular-and-parvocellular-pathways/#:~:text=The%20magnocellular%20pathway%20carries%20information,frequency%2C%20low%20temporal%20frequency

Paneri, S., & Gregoriou, G. G. (1AD, January 1). *Top-down control of visual attention by the prefrontal cortex. functional specialization and long-range interactions*. Frontiers. Retrieved July 7, 2022, from https://www.frontiersin.org/articles/10.3389/fnins.2017.00545/full

Pavuluri, M. N., O'Connor, M. M., Harral, E., & Sweeney, J. A. (2006, November 9). *Affective neural circuitry during facial emotion processing in pediatric bipolar disorder*. Biological Psychiatry. Retrieved July 25, 2022, from https://www.sciencedirect.com/science/article/abs/pii/S0006322306009073

Reavis, E. A., Lee, J., Altshuler, L. L., Cohen, M. S., Engel, S. A., Glahn, D. C., Jimenez, A. M., Narr, K. L., Nuechterlein, K. H., Riedel, P., Wynn, J. K., & Green, M. F. (2020, October 25). *Structural and functional connectivity of visual cortex in schizophrenia and bipolar disorder: A graph-theoretic analysis*. OUP Academic. Retrieved July 31, 2022, from https://academic.oup.com/schizbullopen/article/1/1/sgaa056/5939751

Rutkofsky, I., Khan, A., & Sahito, S. (2017, May). *The neuropsychiatry of dissociative identity disorder: Why Split Personality Patients Switch Personalities Intermittently?* researchgate.net. Retrieved August 8, 2022, from https://www.researchgate.net/publication/316428531_The_Neuropsychiatry_of_Dissociative_Identity_Disorder_Why_Split_Personality_Patients_Switch_Personalities_Intermittently

Staniloiu, A., Vitcu, I., & Markowitsch, H. J. (2012, February 1). *Neuroimaging and dissociative disorders* . intechnopen.com. Retrieved August 8, 2022, from https://cdn.intechopen.com/pdfs/27253/InTech-Neuroimaging_and_dissociative_disorders.pdf

Suzuki, Y., & Tanaka, S. C. (2021, September 14). *Functions of the ventromedial prefrontal cortex in emotion regulation under stress*. Nature News. Retrieved July 11, 2022, from https://www.nature.com/articles/s41598-021-97751-0

Tomlinson, E. K., Jones, C. A., Johnston, R. A., Meadon, A., & Wink, B. (2006, April 27). *Facial emotion recognition from moving and static point-light images in schizophrenia*. sciencedirect.com. Retrieved July 28, 2022, from https://www.sciencedirect.com/science/article/abs/pii/S0920996406000983

Townsend, J. D. (2012, June). *Emotion processing and regulation in Bipolar disorder: A review*. researchgate.net. Retrieved August 1, 2022, from https://www.researchgate.net/publication/225045442_Emotion_processing_and_regulation_in_bipolar_disorder_A_review

Van Rheenen, T. E., & Rossell, S. L. (2013, March 28). *Is the non-verbal behavioural emotion-processing profile of bipolar disorder impaired? A critical review*. onlinelibrary.wiley.com. Retrieved July 25, 2022, from https://onlinelibrary.wiley.com/doi/abs/10.1111/acps.12125

Yang, E., Tadin, D., Glasser, D. M., Wook Hong, S., Blake, R., & Park, S. (2013, August 30). *Visual context processing in bipolar disorder: A comparison with schizophrenia*. Frontiers in psychology. Retrieved August 17, 2022, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3757289/

Yang, E., Tadin, D., Glasser, D., Hong, S. W., Blake, R., & Park, S. (1AD, January 1). *Visual context processing in bipolar disorder: A comparison with schizophrenia*. Frontiers. Retrieved July 31, 2022, from https://www.frontiersin.org/articles/10.3389/fpsyg.2013.00569/full#:~:text=Some%20commonly%20reported%20visual%20deficits,potentials%20

Yeh, H.-H., Westphal, J., Hu, Y., Peterson, E. L., Williams, L. K., Prabhakar, D., Frank, C., Autio, K., Elsiss, F., Simon, G. E., Beck, A., Lynch, F. L., Rossom, R. C., Lu, C. Y., Owen-Smith, A. A., Waitzfelder, B. E., Ahmedani, B. K., Center for Health Policy and Health Services Research (Yeh, … Rodgers, I. T. (2019, June 12). *Diagnosed mental health conditions and risk of suicide mortality*. Psychiatric Services. Retrieved July 25, 2022, from https://ps.psychiatryonline.org/doi/10.1176/appi.ps.201800346

Zhang, L., Ai, H., Opmeer, E. M., Marsman, J.-B. C., Meer, L. van der, Ruhé, H. G., Aleman, A., & Tol, M.-J. van. (2019, February 18). *Distinct temporal brain dynamics in bipolar disorder and schizophrenia during Emotion Regulation: Psychological Medicine*. Cambridge Core. Retrieved August 17, 2022, from https://www.cambridge.org/core/journals/psychological-medicine/article/distinct-temporal-brain-dynamics-in-bipolar-disorder-and-schizophrenia-during-emotion-regulation/54F8BBEFE90A6521BDD93F81BD9D5952