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Susceptibility of Mental Disorders:

Examining the Comorbidity of Seasonal Affective Disorder

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Abstract

This literature review examines the symptoms, theorized causes, and comorbidity of seasonal affective disorder (SAD). Although causes of SAD remain unknown, researchers have observed a common pattern of vitamin D deficiency among patients with SAD. The importance of vitamin D in regulating serotonergic activity has been well documented, including the positive correlation between decreased serotonin levels and increased depressive symptoms. For more than 30 years, researchers have hypothesized that decreased serotonin activity is linked to symptoms of SAD. Furthermore, patients with other mental disorders, including depression, bipolarity, obsessive-compulsive disorder, etc. are likely to experience aggravation of symptoms during peak SAD months. Findings indicate that modifications to humans' natural environment—dictated by modern culture—may contribute to the onset of SAD. Such modifications include spending significantly more time indoors and avoiding ultraviolet radiation. Such cultural adaptations contribute to inadequate levels of vitamin D, which increase a patient's risk for chronic disease and mental illness, such as SAD. Health professionals and patients are encouraged to consider lifestyle adjustments in addition to other forms of treatment in alleviating symptoms of SAD.

Susceptibility of Mental Disorders: Examining the Comorbidity of Seasonal Affective Disorder

Generally, society at large is curious about mental health—especially during certain seasons of the year. In fact, data collected from Google Trends showed that mental health queries substantially rise when seasonal depression has been typically known to strike, regardless of location in the world (Ayers, Althouse, Allem, Rosenquist, & Ford, 2013). Scientists have also noted increased symptoms of depression in patients during specific seasons of the year, particularly during autumn and winter (Winthorst et al., 2017, p. 196). This seasonal depression is clinically referred to as seasonal affective disorder or simply SAD. Although the cause of SAD remains unknown (National Institute of Mental Health, 2016), research points to one theory in particular: the insufficiency or deficiency of vitamin D in patients (Melrose, 2015, p. 2). In addition, researchers have discovered a strong positive correlation between patients that experience SAD symptoms and other mental disorders (Tan, Metin, Ünsalver, & Sayar, 2017, p. 169; Morales-Muñoz, Koskinen, & Partonen, 2017, p. 9). Incidentally, several mental disorders are distinguished by a vitamin D insufficiency (Boerman, Cohen, Schulte, & Nugter, 2016; Winthorst et al., 2014).

Vitamin D is asserted as vital in the development and maintenance of the nervous system and brain (Yazici, K., Yazici, P., & Ustundag, 2018, p. 173). The most generous form of vitamin D is obtained from the sun, as it is absorbed through the skin (Office of Dietary Supplements, 2018). According to Boerman et al. (2016), it is approximated that 1 billion people experience a vitamin D insufficiency or deficiency worldwide (p. 588; Nair & Maseeh, 2012). Boerman et al. further theorized that this worldwide insufficiency stems from cultural realities such as working indoors, commuting in personal and public transit, and—especially since 1980—avoiding ultraviolet radiation. In essence, people have cut off a major supplier of vitamin D in their lives.

SAD is defined as a subset of clinical depression (Jurvelin et al., 2014, p. 2; Winthorst et al., 2014, p. 522) The National Institute of Mental Health's website (2016) clarifies this definition by noting that SAD fluctuates by normally originating in the fall or early winter and regressing in the spring and summer. Jurvelin et al. (2014) noted the following symptoms as common for patients with SAD: "lowered mood, energy loss, excessive sleep with difficulty waking, cravings for carbohydrates, weight gain, irritability, social withdrawal, daytime fatigue, and loss of concentration" (p. 2). SAD symptoms can often be confused with symptoms of persistent clinical depression. Researchers have encouraged health care professionals to treat seasonal depressive symptoms by determining the onset of depression in patients as an identifier of SAD, particularly during winter months (Winthorst et al., 2014, p. 522).

In addition, women experience SAD symptoms more often than men (Tan et al., 2017, p. 168). In fact, the National Institute of Mental Health (2016) startlingly reported that women are diagnosed with SAD four times more frequently than men. Additional risk factors of SAD include living in regions of the world with less sunlight and longer, colder winters; being diagnosed with depression or bipolar disorder; genetic disposition; and being at a younger age (Winthorst et al., 2017, p. 196; Föcker et al., 2017, p. 1044). Patients diagnosed with other mental disorders may notice common symptoms exacerbated during typical months when SAD peaks (Jurvelin et al., 2014, p. 2; Tan et al., 2017, p. 166).

Vitamin D insufficiency has been proposed as a possible impetus for several mental disorders, including SAD (Anglin, Samaan, Walter, & McDonald, 2013, p. 100; Boerman et al., 2016, p. 588). Vitamin D is a key neurotransmitter that regulates serotonin levels, the deficiency of which has been known to cause increased depressive symptoms (Melrose, 2015). Theories about the interconnectedness of mental disorders identify vitamin D insufficiency as increasingly

common, especially for SAD (National Institute of Mental Health, 2016). The purpose, therefore, of this literature review is twofold: first, to show how vitamin D insufficiency is common among many mental disorders, especially SAD; and second, to also show how the likelihood of experiencing SAD increases when a patient has been diagnosed with any other mental disorder, often linked by vitamin D insufficiency.

SAD: A Potential Cause

Although the cause of SAD remains unknown, researchers have identified specific symptoms as common, making SAD diagnosable and treatable (National Institute of Mental Health, 2016). One prevailing theory regarding the cause of SAD has been found among researchers: vitamin D deficiency (Melrose, 2015; Anglin et al., 2013). The inclusion of the below section on vitamin D is to accomplish the following: 1. To introduce the most plausible theory for the origin and cause of SAD; 2. To link and compare SAD to other mental disorders by showing a common lack of serotonin activation via vitamin D among mental disorders mentioned; and 3. To illustrate common treatment methods that can be administered to alleviate symptoms of mental disorders, particularly SAD.

Vitamin D

The importance of Vitamin D cannot be overstated in contributing to positive mental and physical health (Föcker et al., 2017). Vitamin D is crucial in regulating optimal serotonin levels (Melrose, 2015, p. 1). According to Boerman et al. (2016), the molecular form of vitamin D also manages calcium and phosphorus levels in the body (p. 588), and—if absorbed through the sun—contributes to normal bodily functions by passing through the liver and kidneys (The Office of Dietary Supplements, 2018). Vitamin D also contributes to the growth of the nervous system and brain (Yazici et al., 2018, p. 173). It has been further hypothesized that deficient levels of

vitamin D may contribute to the overproduction of melatonin, a hormone associated with regulating circadian rhythms, and, by extension, normal sleep (National Institute of Mental Health, 2016).

“Insufficiency” and “Deficiency”

According to Boerman et al. (2016), what is considered adequate levels of vitamin D fluctuates depending on the task being assessed. In the matter of preventing rickets, a disease identified in children by causing a softening of the bones, blood levels with 30 ng/mL of vitamin D or above are considered optimal (Genetic and Rare Diseases Information Center, 2013; Boerman et al., 2016, p. 588). Vitamin D insufficiency is recognized with blood levels at or below 20 ng/mL. Deficiency is recognized with blood levels at or below 10 or 12 ng/mL depending on the task being assessed (Gallagher & Sai, 2010, p. 2630).

SAD and Vitamin D Deficiency

Vitamin D deficiency, a common component of SAD, may likely contribute to symptoms outlined in the “serotonin hypothesis of winter depression” (Schwartz et al., 1999). The initial hypothesis was asserted by researchers prior to Schwartz et al. and was incidentally referred to as the “serotonin hypothesis (5-HT) of seasonal affective disorder” (as cited in Rosenthal et al., 1984). The hypothesis asserted that diminished sunlight during winter months yielded a decrease in serotonergic activity, specifically referred to as hypothalamic 5-HT activity. Increased winter depressive symptoms known to be managed by hypothalamic 5-HT were accordingly noted in patients (Schwartz et al., 1999, p. 10). As vitamin D synthesis has been linked to healthy serotonergic activity, it is plausible that vitamin D deficiency is a main cause of SAD (Melrose, 2015, p. 2).

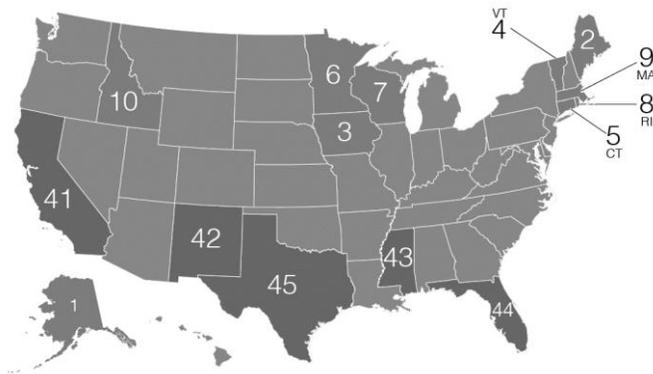


Figure 1. States with most queries. Using data from Google Trends, states are rated with the most queries for the search term “seasonal affective disorder” for the year 2015. Note how the states with most queries are farther from the equator. Data includes the top 45 states in the United States. Alaska is not to scale.

The Office of Dietary Supplements’ (2018) website states that the most effective method for initiating vitamin D synthesis is via sunlight making contact with the skin. Given that vitamin D is intended to mostly be absorbed via sunlight, it is not uncommon for patients who live farther from the equator to be vitamin D deficient (Melrose, 2015, p. 3). Patients that live farther from the equator

experience less sunlight and are more likely to have longer, colder winters as a result of the Earth’s axial tilt (NASA, n.d.). With less sunlight, vitamin D production decreases, resulting in a decrease of serotonergic activity (Schwartz et al., 1999, p. 10; Melrose, 2015, p. 2). The Office of Dietary Supplements’ website further states that vitamin D does not naturally appear in many foods, noting that dietary supplements may be advised for patients with deficient or insufficient levels of vitamin D. Patients may be encouraged to begin taking vitamin D supplements before the onset of winter to anticipate and prevent symptoms of SAD (Melrose, 2015, p. 3).

Vitamin D deficiency and other disorders. Many mental and physical disorders, including SAD, have been characterized by a vitamin D deficiency. Patients with bipolar disorder, schizophrenia, and schizoaffective disorder have been shown to be 4.7 times more likely to suffer from a deficiency of vitamin D (Boerman et al., 2016). Another study found that individuals diagnosed with autism spectrum disorder were two times more likely to be found with a vitamin D deficiency (Vinkhuyzen et al., 2017, p. 87). Yet another study found that young

adults were more likely to be found with an eating disorder when they were vitamin D deficient (Modan-Moses et al., 2015). It is interesting to note a key characteristic that defines the appearance of SAD—vitamin D—is also a key characteristic that defines many other mental disorders. As Boerman et al. (2016) acknowledged, cultural modifications that affect what may be considered humans’ natural environment may be attributable for the onset of many mental disorders.

SAD and Other Mental Disorders

Aside from research performed to investigate the presence of vitamin D deficiency, further research indicates that SAD tends to be comorbid with other mental disorders (Morales-Muñoz et al., 2017, p. 9). More often than not, symptoms of a previously diagnosed mental disorder are more vigorous during peak seasons for which SAD is commonly known (Tan et al., 2017, p. 169). This introduces an added layer of complexity to health professionals attempting to treat patients, particularly with knowing how or what to treat (Winthorst et al., 2014, p. 522). The sections below will introduce common mental disorders and show how symptoms may be aggravated by the presence of SAD. Then, conclusions will be drawn about the interconnectedness of SAD and other mental disorders.

Depression

General depression is a mental disorder known for producing symptoms of “emptiness” and can include a wide array of additional symptoms, including, but not limited to, the following: “feelings of hopelessness, irritability, guilt, [and/or] worthlessness; loss of interest or pleasure in hobbies and activities; [and] decreased energy or fatigue” (National Institute of Mental Health, 2018). SAD has been proposed as a subset of depression (Winthorst et al., 2017, p. 196; National Institute of Mental Health, 2018). Researchers have insisted on utilizing subcategories to identify

depression in its different forms to determine an appropriate treatment (Morales-Muñoz et al., 2017, p. 12). Common variations include major depressive disorder (MDD) and dysthymia, a mild, though lasting, form of depression (Morales-Muñoz et al., 2017).

Depression and SAD. Winthorst et al. (2014) noted that participants in their research generally indicated a worsening of depressive symptoms during winter months, including participants in the control group. Symptoms assessed include the following non-comprehensive list: “feels worst”, “least energy”, “least socially active”, “sleeps most”, etc. However, the proportion of participants with a depression diagnosis reported markedly higher ratings for depressive symptoms during winter months than the control group (p. 521). This is significant in two ways: first, it is common for many people without a mental disorder to experience SAD depressive symptoms; and second, it is common for patients with a depression disorder to encounter heightened SAD depressive symptoms during winter months.

Decreased serotonin levels and/or serotonin activity could be an underlying link between SAD and depression (Melrose, 2015, p. 1). Jurvelin et al. (2014) noted the effectiveness of bright light therapy in alleviating symptoms of SAD, specifically in restoring optimal circadian rhythms and, likely, serotonin levels (Cléry-Melin, Godwood, Friedman, & Even, 2018, p. 353). Bright light therapy has been shown to be effective in the treatment of bipolar depression as well (Kupeli, Bulut, Bulut, Kurt, & Kora, 2018). The aggravation of depression symptoms during SAD peak seasons adds to the evidence that SAD tends to be comorbid with patients experiencing symptoms of other mental disorders.

Anxiety

Persistent generalized anxiety is a mental disorder distinguished by unyielding symptoms of worry, discomfort, and apprehension, often to the extent that these symptoms disrupt daily life (National Institute of Mental Health, 2016).

Anxiety and SAD. Belleville et al. (2013) intended to discover if mental disorder symptoms increased during certain lunar cycles and during certain seasons of the year. Although their research effectively debunked misconceptions about mental disorder symptoms worsening during lunar changes, they discovered that patients were 58% more likely to experience symptoms of an anxiety disorder during summer, a deviation from what is typically considered the normal SAD peak period (Belleville et al., 2013, p. 193). Though separate from anxiety, the same study indicated that the chance of encountering a panic attack during spring increased 37% and decreased 37% during fall (Belleville et al., 2013, p. 193). The cause of the abnormal seasonal increase of disorders is not answered in the study above. However, Frick et al. (2015) produced a fascinating study in which overactive serotonin activity was strongly correlated with symptoms of anxiety, specifically in patients with social anxiety disorder (p. 798). In addition, the National Institute of Mental Health's website (2016) states, though less common, summer seasonal affective disorder may include increased symptoms such as anxiety. Curiously, imbalanced levels of serotonin—high or low—can contribute to a variety of mental disorder symptoms in patients.

In a separate study, Winthorst et al. (2014) cited that symptoms specific to anxiety have been known to increase slightly during typical peak SAD months (as cited in de Graaf et al., 2005). Although there is evidence to suggest that patients with anxiety disorders will experience seasonal symptoms, research about anxiety and SAD specifically is limited (Winthorst et al.,

2014, p. 522). It is recommended that further research be performed to assess the seasonality of anxiety and SAD.

Obsessive-Compulsive Disorder

Obsessive-compulsive disorder, or OCD, is a mental disorder characterized by causing patients to suffer from unremitting disturbing thoughts and recurring patterns of behavior (Barrera et al., 2018 p. 1). The prevalence of OCD is felt world-wide, attributable as a significant cause of disability (Barrera et al., 2018). OCD manifests itself in thousands of ways, including some of the following common obsessions (unyielding thoughts) and compulsions (repetitive behaviors).

- Obsessions: “excessive concerns about contamination or harm, the need for symmetry or exactness, forbidden sexual or religious thoughts”, and so on.
- Compulsions: “cleaning, repeating, checking, ordering and arranging, mental compulsions”, and so on (American Psychiatric Association, 2017).

SAD and OCD. It is theorized that OCD symptoms are caused by findings similar to other mental disorders: decreased serotonin levels (Tan et al., 2017, p. 166). In the same study, Tan et al. measured the severity of symptoms in patients suffering from OCD at predetermined intervals designed to correspond with peak and trough SAD times. Data showed that patients with OCD were more likely to experience seasonal variations in mood during peak SAD times. In addition, worsened symptoms include depression and, specifically, compulsions (Tan et al., 2017, p. 169). Additionally, Tan et al. reported that bright light therapy has been shown to be useful in treating patients that experience symptoms from both SAD and OCD (as cited in Brinkhuijsen et al., 2003). It is recommended that further research be performed to specifically assess serotonin activity in patients with both OCD and SAD diagnoses.

Summary

The above list of mental disorders is by no means comprehensive. Indeed, SAD may manifest itself through mental disorders not mentioned such as bipolarity, schizophrenia, and so on as a result of vitamin D insufficiency (Boerman et al., 2016). However, the disorders are included for the following reasons: to illustrate how SAD often runs parallel with other mental disorders; to show how mental disorder symptoms can compound during peak SAD times; and to convey an underlying connection between serotonin activity, SAD, and patients' mental health.

Conclusion

SAD is a mental illness that can negatively transform patients' lives, especially those that suffer from additional mental disorders. In considering the implications of decreased serotonin activation, particularly through vitamin D synthesis, one must consider cultural practices that may contribute to decreased mental health. For example, Nair & Maseeh (2012) referred to then-current studies that suggested humans generally need more vitamin D than what is normal to prevent chronic disease. As was mentioned earlier, Boerman et al. (2016) acknowledged specific practices that prohibit humans from garnering enough vitamin D worldwide. As such, it is incumbent to consider questions such as the following: Is avoiding sunlight entirely healthy? What is the ideal work environment or form of transportation? What can patients experiencing symptoms of SAD do to alleviate symptoms naturally? It is recommended that further research be performed on the effectiveness of changing lifestyle to compensate for cultural expectations in lessening symptoms of SAD. It is also recommended that health care professionals and patients be aware of the comorbidity of SAD and other mental disorders in attempting to lessen dual symptoms.

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