

Migraine and Anxiety in the Context of the COVID-19 Pandemic

By

Emma Gray

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ABSTRACT

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Migraine and anxiety are common health conditions that are highly comorbid. In this study, I examined the relationship between migraine and anxiety in the context of migraine triggers and the COVID-19 pandemic. 188 participants (mean age = 34.18 years; 10.63% male, 85.63% female, 3.72% other) who were recruited online completed two measures of state-level anxiety and two measures of migraine disability. The first two measures prompted participants to report the anxiety and migraine disability they experienced before the COVID-19 pandemic. The second two measures prompted participants to report the anxiety and migraine disability they experienced during what they personally believed to be the worst period of the pandemic. My first hypothesis was supported: Migraineurs reported greater state-level anxiety and greater migraine disability during what they believed to be the worst months of the COVID-19 pandemic in comparison to before the COVID-19 pandemic. My second hypothesis was not supported, as state-level anxiety did not increase more severely for migraineurs who were unaware of or unable to avoid their triggers. Potential limitations include the considerable amount of time elapsed between the beginning of the pandemic and data collection, which may have affected participant's ability to accurately remember their past state-level anxiety and migraine disability. Future research should continue to examine the relationship between migraine, anxiety, and migraine triggers, particularly in the event of future public health crises. In sum, my results suggest that migraineurs' state-level anxiety and migraine disability increased during the COVID-19 pandemic. Thus, considering the high current and lifetime prevalence of migraine,

the results of this study emphasize that it is imperative to research the mental health of this population.

Migraine and Anxiety in the Context of the COVID-19 Pandemic

Migraine is one of the most common health conditions in the world. It is estimated that migraine affects 10% of the global population, and its lifetime prevalence may be as high as 14% globally (Chawla, 2021). In the United States alone, the 2018 prevalence of migraine was 15.4% among adults (Burch, Rizzoli, & Loder, 2020). Anxiety, too, is highly common in the United States, affecting about 18% of adults nationally (ADAA, 2022). Moreover, recent studies of the prevalence of anxiety have shown a dramatic rise in anxiety in the wake of the COVID-19 pandemic (e.g. Santabárbara et al., 2021). Considering how common both migraine and anxiety seem to be, it is unsurprising that the two conditions are comorbid. In a review, Karimi and colleagues found that the global prevalence of comorbid migraine with anxiety ranged from 16% to as high as 83%, and the United States prevalence ranged from 43% to 56% (Karimi et al., 2020). Given these statistics, in this study I will examine potential changes in overall migraine disability and state-level anxiety before and during the COVID-19 pandemic.

The Connection Between Migraines and Anxiety

Numerous studies have demonstrated an association between migraine and anxiety. For instance, Fuller-Thomson et al. (2017) tested whether Canadian adults with migraine met the criteria for Generalized Anxiety Disorder (GAD) in the past 12 months more or less frequently than adults without migraine. The researchers also tested whether or not the pain and limitations in instrumental activities of daily living (IADLs) associated with migraine headaches mediated the relationship between migraines and GAD. Approximately 21,000 Canadian adults participated in the study, and of this sample, around 2,200 adults were migraineurs. Participants were screened for GAD and were asked about their ability to successfully complete household

tasks. The results revealed that 6% of adults with migraine met the criteria for an anxiety disorder in comparison to 2.1% of non-migraineurs. Further, migraineurs were almost three times as likely as non-migraineurs to have GAD. This relationship was exacerbated by both the severity of the pain associated with one's migraines and one's ability to complete household responsibilities, such that those with more painful migraines or those less able to complete IADLs were more likely to meet the criteria for GAD. In sum, these results suggest that migraineurs are more likely to develop anxiety disorders than are non-migraineurs, and the ability to complete IADLs is an important factor in this association.

Similarly, Smitherman et al. (2011) examined migraine, migraine-related disability, overall quality of life (QOL), and psychiatric symptoms in United States undergraduate students. Participants filled out the ID Migraine, a three-item diagnostic measure for migraine; the Migraine Disability Assessment Questionnaire (MIDAS; Stewart et al., 2000); and measures of general health, depressive symptoms, and anxiety symptoms. Of the 391 participants, 101 were migraineurs. Results demonstrated that participants who screened positive for migraine reported more symptoms of both anxiety and depression in comparison to those without migraine. Migraineurs also had lower QOL. In fact, just over 40% of the participants with migraine reported symptoms that indicated clinically significant impairment.

This phenomenon is nothing new; older studies also noted a positive relationship between migraine and anxiety. Price and Blackwell (1980) tested a total of 31 women with migraine and 26 women without migraine. These participants filled out the Trait Anxiety Inventory (TAI; Spielberger, 1983) and the Taylor Manifest Anxiety Scale (TMAS; Taylor, 1953). Migraineurs had significantly higher scores on both the TMAS and the TAI in comparison to those without

migraine, suggesting that anxiety was a more common personality trait in migraineurs than in non-migraineur controls. Seven years prior, Henryk-Gutt and Rees (1973) tested 237 individuals, 100 of whom were migraineurs. Participants filled out measures of their personality traits and also engaged in a semi-structured interview. The results suggested that migraineurs were significantly higher in neuroticism than healthy controls as indicated by scores on the Eysenck Personality Inventory (EPI; Eysenck & Eysenck, 1964) and by their semi-structured interviews. In addition, female but not male migraineurs scored significantly higher on the anxiety subscale of the Minnesota Multiphasic Personality Inventory (MMPI; Hathaway & McKinley, 1943) in comparison to female non-migraineurs. Overall, then, these earlier studies show a similar positive correlation between migraine and anxiety as is demonstrated in more recent studies (e.g. Smitherman et al., 2011).

Comparable findings have come from studies in European countries. For instance, Lantéri-Minet et al. (2005) examined migraine, depression, and anxiety in France. Over 10,000 participants completed a questionnaire which screened for migraine, anxiety, and depression, and also assessed migraine disability using the MIDAS (Stewart et al., 2000) and health-related quality of life. About 2,100 participants were migraineurs. Results revealed that participants who experienced migraine were significantly more likely to suffer from anxiety, depression, or both when compared to participants who did not experience migraine. Moreover, migraine sufferers had lower overall health-related quality of life than non-migraine sufferers (Lantéri-Minet et al., 2005). Similarly, Oedegaard et al. (2005) carried out a study of around 50,000 Norwegian adults, 12.3% of whom experienced migraines. Participants were screened for symptoms of anxiety and

depression. Results indicated a significant, positive association between both migraine and depression and migraine and anxiety disorders (Oedegaard et al., 2005).

Researchers in Turkey carried out a similar study. A total of 128 individuals, 87 of whom met the diagnostic criteria for episodic migraine, participated. Participants filled out the Depression, Anxiety, and Stress Scale (DASS; Akin & Cetin, 2007) and Pittsburgh Sleep Quality Index (PSQI; Ağargün, Kara, & Anlar, 1996). Both measures had been validated for use in Turkish populations. In addition, the participants who met the criteria for migraine filled an assessment of their migraine symptomatology and precipitating factors and the MIDAS (Stewart et al., 2000). Results indicated a positive correlation between MIDAS scores and scores on the PSQI, suggesting that migraine disability is associated with sleep disturbances (Dikman, Yavuz, & Aydinlar, 2015).

South American researchers have also studied the association between migraines and anxiety. A total of 782 Brazilian adults filled out the General Anxiety Disorder-7 Scale (GAD-7; Spitzer, Kroenke, Williams, & Löwe, 2006) to assess recent anxiety symptomatology, the Patient Health Questionnaire-9 (PHQ-9; Kroenke, Spitzer, & Williams, 2001) to measure their depressive symptoms, and a series of questions to diagnose migraine. Approximately 214 of the 782 participants met the criteria for migraine. Results indicated that the higher a participant scored in the GAD-7, the more likely they were to have also met the criteria for migraine (Peres et al., 2017). While there was also a significant correlation between depression and migraine, anxiety was a far better predictor of migraine diagnosis.

Migraine Triggers Moderate the Association Between Migraine and Anxiety

Some researchers have noted that migraine triggers, the specific factors that precede migraine attacks, are an important element in the relationship between migraine and anxiety. Smitherman et al. (2015) tested the relationship between migraine and anxiety sensitivity, focusing on headache disability and triggers. Anxiety sensitivity is defined as fear of physiological arousal due to a belief that arousal always arises from a negative event. For instance, a person high in anxiety sensitivity may believe a slight elevation in their heart rate means that cardiac arrest is about to set in. Anxiety sensitivity is highly comorbid with anxiety disorders (Smitherman et al., 2015). About 2,300 participants completed a measure of anxiety sensitivity, headache impact, headache triggers, and recent depression, anxiety, and stress. Results demonstrated that migraineurs had higher levels of anxiety sensitivity when compared to non-migraineurs. Interestingly, participants with greater anxiety sensitivity also reported having more potent headache triggers than those with lower anxiety sensitivity (Smitherman et al., 2015). In another study, Baldacci et al. (2015) found that migraineurs with higher scores on the GAD-7 and the PHQ-9 had more migraine triggers than migraineurs with lower scores on these measures. This suggests that greater anxiety is associated with having a greater number of triggers in migraineurs.

There is also evidence that migraineurs may make a concerted effort to avoid migraine triggers. Puschmann and Sommer (2011) examined reactions to a common migraine trigger (negative affect, or negatively valenced emotions like stress, anger, or sadness) displayed by migraineurs and non-migraineur controls. A total of 53 participants, 33 of whom had either frequent or episodic migraine, participated in two emotional Stroop tasks: the first contained negative affect words written in various font colors and the second contained images of facial

expressions of emotions (namely anger, neutrality, and happiness) with colored borders.

Participants were asked to name the color of the words or the borders as fast as possible. Results showed that participants with frequent migraines responded significantly faster to negative facial expression images than to those images that were neutral or positive. This may be evidence of a learned avoidance behavior—perhaps anxiety motivates migraineurs to avoid potential migraine triggers as quickly as possible (Puschmann & Sommer, 2011). In line with these findings, Estave et al. (2021) interviewed migraineurs about migraine's impact on their overall quality of life and found that many participants reported experiencing persistent anticipatory anxiety about migraine attacks. Subsequently, they engaged in avoidance behaviors that interfered with their ability to take part in the activities they valued, to the detriment of their emotional well-being.

COVID-19, Anxiety, and Stress

Recent studies have indicated a rise in anxiety and stress in the wake of the COVID-19 pandemic. For example, Bendau et al. (2020) asked over 6,000 participants to report the amount of time per day they spent consuming COVID-19 related media (e.g., watching COVID-19 related television, reading COVID-19 related news, etc.) and filled out measures of their general anxiety, depression, and specific anxiety about COVID-19. Results indicated that the more time per day participants spent consuming COVID-19 related media, the more anxiety, depression, and COVID-19 fear symptoms they demonstrated. In addition, Shevlin et al. (2020) surveyed a sample of the UK population and found that general anxiety was significantly more prevalent in the UK during the COVID-19 pandemic than in previous studies of population-level anxiety (Shevlin et al., 2020). In a similar study with a more global focus, Santabárbara et al. (2021) conducted a meta-analysis of studies that examined the prevalence of anxiety over the past two

years (i.e., since the beginning of the pandemic). They found that the prevalence of anxiety in the general public was around 25%, which is nearly three times as large as anxiety's usual global prevalence rate (7.3%; Santabárbara et al., 2021).

Hypotheses

As anxiety and general stress are common causes of migraines (e.g., Puschmann & Sommer, 2011), I examined potential changes in migraine-related disability and state-level anxiety among migraineurs in the context of the COVID-19 pandemic, with particular attention paid to migraine trigger awareness and avoidance. Fuller-Thomson et al. (2017) demonstrated that migraineurs with more severe symptoms were more likely to meet the criteria for GAD than migraineurs with less severe symptoms. Thus, I hypothesized that migraine sufferers would report experiencing more severe migraine symptoms and greater state-level anxiety during the COVID-19 pandemic than before the COVID-19 pandemic. Additionally, although Smitherman et al. (2015) and Puschmann and Sommer (2011) showed that triggers are an important factor in the relationship between migraines and anxiety, few studies have examined whether migraineurs' anxiety is moderated by how aware they are of their triggers and how well they can avoid those triggers. Therefore, I hypothesized that people who report being aware of their migraine trigger(s) and can avoid the trigger(s) without interfering with activities of daily living (ADLs) will report more modest increases in state-level anxiety than participants whose migraines are, to their knowledge, unpredictable and unpreventable.

Method

Participants

The participants in this study were 188 adults whose ages ranged from 18 to 67 with a mean age of 34.18 years. The total sample of participants consisted of 161 women, 20 men, 1 nonbinary individual, 1 demigirl, and five individuals who did not report their genders. I recruited participants from four migraine support groups on Facebook.com and from the r/migraine subreddit on Reddit.com.

Materials

I utilized a total of six measures in this study. The first was a modified version of the State-Trait Anxiety Inventory (STAI; Spielberger, 1983). The STAI assesses an individual's present level of anxiety and their trait-level anxiety. Participants in this study only completed the state-level anxiety subscale of the measure. In this subscale, there are 20 items total, and each item is a phrase describing a current state (e.g., "I feel strained", "I feel frightened", etc.). Participants rate how well each item describes their present state on a scale from 1 (not at all) to 4 (very much so). I altered the instructions of the measure such that they prompted participants to describe their state-level anxiety on a typical day **before** the COVID-19 pandemic began. In addition, I changed the tense of each item (e.g., "I feel calm" became "I felt calm"). I will refer to this measure as "STAI-before."

The second was a similarly modified version of the STAI, with this iteration prompting participants to recall their state-level anxiety on a typical day during what they felt were the worst weeks of the COVID-19 pandemic. Again, participants filled out only the state-level anxiety subscale and I altered the instructions and the tense of each of the items. I will refer to this variable as "STAI-during."

Next, I utilized a modified version of the Migraine Disability Assessment (MIDAS; Stewart et al., 2000). The MIDAS consists of five items, each of which requires participants to report the number of days in the past three months that their migraines interfered with their activities of daily living (ADLs). For example, Item 3 reads, “On how many days in the last 3 months did you not do household work (such as housework, home repairs and maintenance, shopping, caring for children and relatives) because of your headaches?” I modified this scale to refer to the weeks immediately preceding the beginning of the COVID-19 pandemic. I will refer to this variable as “disability-before.” For 21 participants, one of the items in disability-before was coded incorrectly. Thus, the data for Item 2 of disability-before was deleted for these individuals.

The fourth measure was a similarly altered version of the MIDAS, which I changed to refer to what each participant personally believed were the worst weeks of the COVID-19 pandemic; I will refer to this variable as “disability-during.”

The final two measures were questions referring to participants’ subjective awareness of their migraine triggers and their ability to avoid their triggers without interfering with ADLs. Participants rated their awareness on a 5-item scale from “Not at all aware” to “Very aware,” and they rated their ability to avoid their triggers on a 5-item scale from “Not well at all” to “Extremely well.” These measures were followed by two demographic questions which prompted participants to report their age and gender identity.

Procedure

Participants filled out the questionnaire electronically. The questionnaire opened with an informed consent page which explained that all data would be kept anonymous and confidential

and that participation was voluntary. Next, participants completed the four measures. They then provided demographic information about their gender and their age, and they were also given the opportunity to voice any questions or concerns regarding the questionnaire. Finally, participants were electronically debriefed.

Results

Chronbach's alpha analyses were conducted to assess the reliability of each of the measures utilized in this study. Both STAI-before and STAI-during manifested satisfactory reliability, with coefficients of $\alpha = .95$. Similarly, disability-before had a reliability of $\alpha = .81$, and disability-during had a reliability of $\alpha = .87$. Next, a paired samples *t*-test was used to determine whether participants experienced more severe migraine symptoms (as indicated by scores on the MIDAS) during the COVID-19 pandemic as opposed to before the COVID-19 pandemic. I hypothesized that migraine sufferers would report experiencing more severe migraine symptoms during the COVID-19 pandemic ($M = 2.54$, $SD = 1.73$) than before the COVID-19 pandemic ($M = 2.02$, $SD = 1.42$), and the analysis supported my hypothesis ($t(203) = -5.044$, $p < .001$).

My second hypothesis was that participants would have greater state-level anxiety during the COVID-19 pandemic ($M = 61.45$, $SD = 13.03$) than before the COVID-19 pandemic ($M = 48.06$, $SD = 12.76$). This was also supported by my data, as the increase was highly significant, $t(182) = -12.909$, $p < .001$.

My final hypothesis was that people who report being aware of their migraine trigger(s) and can avoid the trigger(s) without interfering with activities of daily living (ADLs) would report more modest increases in state-level anxiety than participants whose migraines are, to

their knowledge, unpredictable and unpreventable. To determine if the data supported this prediction, a series of correlations were calculated. The correlation between trigger awareness and the difference in state-level anxiety during and before the pandemic was not significant ($r = .03, p = .73$), nor was the correlation between participants' ability to avoid their triggers and the change in state-level anxiety ($r = .08, p = .73$). Thus, the data did not indicate that participants who were not aware of or could not avoid their triggers experienced a greater rise in anxiety during the COVID-19 pandemic in comparison to participants who were aware of their triggers and able to avoid them.

Discussion

Migraine and anxiety are both common (Chawla, 2021; ADA, 2022) and debilitating conditions. They are also highly comorbid (Karimi et al., 2020), and as such, migraineurs with anxiety tend to score low on measures of quality of life (e.g. Smitherman et al., 2011). Numerous studies from various countries have shown that migraineurs are at a heightened risk for GAD (Fuller-Thompson et al., 2017), trait-level anxiety (Price & Blackwell, 1980), and depression (Oedegaard et al., 2005). In addition, migraine triggers seem to predict the relationship between migraine and anxiety. For instance, migraineurs with greater amounts of triggers are more likely to meet the criteria for GAD (Baldacci et al., 2015). Given these findings along with the rise in population-level anxiety in the wake of the COVID-19 pandemic (Santabárbara et al., 2021), I hypothesized that migraine sufferers would report experiencing more severe migraine symptoms and greater state-level anxiety during the COVID-19 pandemic than before the COVID-19 pandemic, and that people who report being aware of their migraine trigger(s) and can avoid the trigger(s) without interfering with activities of daily living (ADLs) would report more modest

increases in state-level anxiety than participants who are unaware of or unable to avoid their triggers.

As I hypothesized, migraineurs reported both a rise in general state-level anxiety during the COVID-19 pandemic as reflected by STAI scores and an increase in migraine symptom severity as indicated by MIDAS scores. The rise in state-level anxiety is similar to the recent increase in the prevalence of anxiety illustrated by Santabárbara et al. (2021), Shevlin et al. (2020), and Bendau et al. (2020). Further, the concurrent rise in migraine severity along with findings from Fuller-Thomson et al. (2017), who revealed that migraineurs with more severe symptoms were more likely to meet the criteria for GAD than were migraineurs with less severe symptoms, suggest that migraine severity is positively correlated with anxiety. While the first two of my hypotheses were supported, the third was not: STAI scores did not increase more severely during the pandemic for migraineurs who were unaware of their triggers or unable to avoid them than for migraineurs who were aware of or were able to control their triggers. This is not consistent with findings from previous research suggesting that migraine triggers are a major source of anxiety for migraineurs (e.g., Estave et al., 2021).

Implications

My results suggest that both state-level anxiety as measured by the STAI and migraine disability as measured by the MIDAS rose in tandem during what participants believed to be the worst months of COVID-19. This could constitute further evidence for a connection between migraine disability and anxiety in migraineurs. If migraine disability and anxiety are truly connected such that as one increases, the other increases and vice versa, perhaps this relationship could be manipulated to decrease both migraine severity and anxiety symptoms. For instance,

perhaps treating migraineurs' anxiety could in turn decrease their overall degree of migraine disability. In addition, it could be possible that ameliorating the severity of an individual's migraines will also diminish their anxiety.

It is also noteworthy that there was no difference in the rate at which state-level anxiety increased for migraineurs who were aware of and able to avoid their migraine triggers and for migraineurs who were not aware of or were unable to avoid their triggers. Previous studies have found that other migraine trigger-related factors, such as trigger potency (i.e., the chance that exposure to the trigger will result in a migraine attack; Smitherman et al., 2015) and the amount of triggers one has (Baldacci et al., 2015), are positively related to anxiety (Baldacci et al., 2015; Smitherman et al., 2015). Not all migraine trigger-related factors appear to be positively correlated with anxiety, though, as my results suggest that migraine trigger awareness and one's ability to avoid one's triggers may be relatively inconsequential in their effects on migraineurs' anxiety.

Limitations

I hypothesized that migraineurs who report that they are aware of their migraine trigger(s) and able to avoid the trigger(s) without interfering with activities of daily living (ADLs) would report more modest increases in state-level anxiety than participants whose migraines are unpredictable and unavoidable. There are a few potential explanations for the fact that this hypothesis was not supported. First, migraineurs may not always accurately identify their triggers. Hougaard et al. (2013) asked 27 migraineurs to identify their migraine triggers, and afterward, they exposed the participants to their personal triggers. Only 3 of the participants (11%) actually experienced a migraine attack after being exposed to their reported triggers. Thus,

perhaps some of the participants in my study reported being aware of and able to avoid their triggers when they truly were not.

A second reason this hypothesis was not supported may be the fact that in this study, I asked participants to describe their general state-level anxiety and migraine severity as they perceived it to be before the COVID-19 pandemic began, which was over two years before the data were collected. Because a considerable amount of time had passed between that time and data collection, it is possible that participants' retroactive ratings were unreliable. Further, STAI-during and disability-during prompted participants to respond as they would have during what they personally believed to be the worst months of the COVID-19 pandemic. It is possible that each participant identified a different time period, and that each participant had different reasons for believing their chosen time period was the worst.

Future Directions

In the future, researchers should take care to begin longitudinal studies on migraineurs' anxiety levels before further public health issues arise (e.g. pandemics, epidemics, or outbreaks). For instance, if there were to be another pandemic in the United States 50 years from now, research should begin at the outset and continue for the duration of the pandemic. In addition, both migraineurs and non-migraineurs should be assessed so that researchers can observe any differences in anxiety levels between these two groups. It is likely that migraineurs would have greater state-level anxiety than individuals without migraine, as prior research has demonstrated. For example, Fuller-Thomson et al. (2017) found that migraineurs were nearly three times as likely to have GAD in comparison to non-migraineurs.

In addition, researchers should continue to explore the relationship between migraine, migraine triggers, and anxiety. While my study does not suggest that migraine trigger awareness or ability to avoid one's migraine triggers are connected to migraineurs' state-level anxiety, other trigger-related variables (e.g. trigger potency) may be involved. For instance, researchers have found a positive correlation between migraine trigger potency and anxiety sensitivity (Smitherman et al., 2015) and between the amount of migraine triggers and scores on measures of anxiety (Baldacci et al, 2015).

Finally, my study did not measure trait-level anxiety. Previous research has demonstrated that migraineurs report greater trait-level anxiety than non-migraineurs (Price & Blackwell, 1980). Thus, though my study did not suggest that state-level anxiety was related to migraine trigger awareness or ability to avoid triggers, it may be efficacious for future studies to examine the relationship between migraine trigger awareness, ability to avoid migraine triggers, and trait-level anxiety. It is likely that migraineurs who score higher on measures of trait-level anxiety will be more preoccupied with identifying and avoiding their migraine triggers than migraineurs with lower trait-level anxiety scores.

Conclusion

This study adds to an already sizable amount of research that has demonstrated a positive correlation between migraine and anxiety. My results show that migraineurs' state-level anxiety and migraine disability increased from before the COVID-19 pandemic to what participants believed to be the worst months of the pandemic. It is important that migraineurs' anxiety levels during future public health crises be further studied. While migraineurs' awareness of and ability to avoid their migraine triggers did not seem to be associated with a more drastic increase in

state-level anxiety as I hypothesized, there are still potential links between migraine triggers and anxiety that can and should be explored by ongoing research. Migraineurs make up 10% of the global population (Chawla, 2021). Therefore, the importance of research on the mental health of migraineurs cannot be overstated.

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