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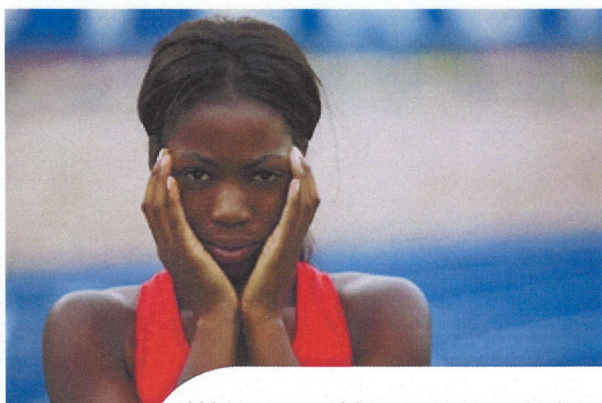
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Can Stress Increase Joint Pain?

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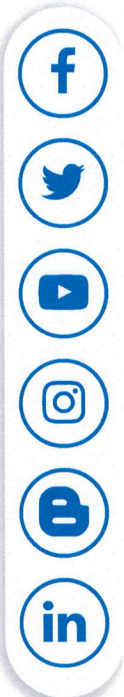
It's no secret that psychological stress can also impact athletic performance. Many of my patients are collegiate and professional athletes who are under tremendous pressure to perform. This stress can also affect their ability to heal and recover from an injury.

There is a direct link between stress and inflammation. Joint pain and sport-related injuries can be aggravated by increased stress levels. The body releases stress hormones like cortisol and adrenaline as part of the stress response which can cause muscle tightening and increased pain sensitivity.

These hormones tell our bodies to go into fight-or-flight mode, releasing pro-inflammatory molecules and causing inflammation.³ The body produces cytokine molecules continuously due to long-term stress, resulting in joint swelling and pain.⁴ If the immune system is activated too long, it can cause chronic inflammation, leading to joint pain and damage.⁵

Joint pain and discomfort can be incredibly complex. A person's stress and anxiety are affected by nutritional intake, hormones, and their organ function. Research indicates that mindfulness can reduce cortisol levels in response to a stressor, anxiety, and negative emotions.⁶

Rest, recovery, and relaxation are essential to maintaining overall health. Maintaining a [nutritious diet](#) and finding effective ways to cope with stress can prevent joint pain from flaring up and help athletes perform better.



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Anxious ... and Off Balance

Which comes first? Dizziness and falls? Or the fear of either happening? Anxiety and balance problems can become a feedback loop.

Julie A. Honaker, PhD, CCC-A

<https://doi.org/10.1044/leader.FTR2.23072018.54>



Peggy was a healthy 54-year-old who never worried about her balance. But that changed a year ago when she lifted her head off her pillow one morning and found the room spinning around her. No matter which way she moved her head, she felt symptoms of vertigo. Finally, five minutes later, they stopped.

She hasn't experienced any such episodes of extreme vertigo since, but she now feels "off," as if she is riding on a boat or "floating," especially during and after physical activity. She notices this sensation when she is upright and walking. Overall, she feels better when sitting

Seeking relief, Peggy consulted an audiologist, who recommended vestibular therapy focusing on central adaptation exercises (**vestibulo-ocular reflex [VOR] exercises**). She attended several training sessions and tried some at-home exercises—a walking program, gaze stabilization exercises and standing balance tasks. However, she could not tolerate the exercises because they made her symptoms worse.

Unable to continue her work as a marketing associate, Peggy is on long-term disability and fears she will lose her job. She avoids usual activities like driving, shopping, working on the computer and even gardening, and is gravely concerned she will experience another vertigo episode. Her symptoms of dizziness are starting to take over her life, causing stress to her and her family. Her medical workup to date has been unremarkable and has ruled out any life-threatening cause for her symptoms, but she worries that her dizziness will never resolve.

When working with patients like Peggy, we audiologists are tasked with understanding the past and present causes of vestibular symptoms. In her case, her current symptoms may not relate to the past reason for her vertigo episode, and there may be an underlying psychogenic cause. Similar to the chicken-and-egg scenario, which comes first: the emotional response (anxiety, panic or depression) or the dizziness? The answer is both can be the case. Thus, as audiologists, we need to understand the emotional aspects of balance disorders and how we can better identify and help patients manage these aspects.

Perceived threat of falling could relate to advanced age or impaired physical function, but the emotional response (anxiety) may be most responsible for activity restriction and changes in the balance system.

Psychiatric aspects of imbalance

The idea that persistent dizziness could have nonvestibular origins dates back to the late 1800s. Psychiatric disorders including panic, anxiety or depression can have associated vestibular symptoms (vertigo, dizziness, unsteadiness). Additionally, patients with these psychiatric conditions may report lower quality of life, physical and functional decline, and perceived handicap (see sources). In addition to reported symptoms and concerns, patients with psychiatric disorders may show changes in their balance control, such as increased body sway (see sources).

The threat of balance problems and resulting injury can bring on anxiety, which can, in turn, hamper balance function. For example, older people who have not fallen may develop a

restriction and changes in the balance system.

As a result, the fear of falling may lead to less mobility, decreased quality of life, lower muscle tone and strength, poor balance, and increased risk of future falls. Indeed, when people fear falling, it's not unusual to see them reduce their gait speed and step length, and change their posture. They may stand with their feet spread wide apart, increase the time that both feet are on the ground during walking, and lean backward and sway their body more than usual.

This raises the question: Why can balance fears affect balance function? Research by Brunel University London rehabilitation psychology researchers indicates **fear of falling may alter people's attention**, which could negatively affect their motor control.

Another team of researchers, led by Mayo Clinic psychiatrist Jeffrey Staab, describes a **stiffening strategy that reduces range of motion during postural control** tasks. This strategy could change body sway patterns (lower-amplitude, higher-frequency sway). People who fear falling may also limit their head movement, which can limit proper initiation of the vestibulo-ocular reflex to promote gaze stability (see sources).

As we move about during our daily lives, we must quickly integrate sensory input from our environment, and a stiffening behavior may reduce our capability to perform activities of daily living. Clinicians see this pattern even in those without balance problems when they walk across a narrow beam raised above the ground. Their gait slows and their strides shorten, and this gait pattern declines even more when adding tasks on top of walking (for example, talking while walking). They tend to develop compensatory strategies to maintain their upright stance and prevent a fall, but these strategies are maladaptive.

Such balance-compromising behaviors are not limited to changes in gait patterns and postural control; they may extend to visual behaviors. For example, an adult who is anxious about falling may fixate on an obstacle that they must navigate over or around. They use this compensatory strategy to ensure accurate and safe approach, but they may look away from the obstacle prior to stepping. This can result in missing the obstacle, rather than stepping over it.

Also, when approaching multiple obstacles, these people may not focus on what is steps ahead—only what is directly front of them, thus reducing their ability to generate a spatial map (see sources). In sum, increased fear and anxiety can lead to stiffening movement and altered postural control, gait, head movements and visual search strategies. All of this can impede balance.

Balance-compromising behaviors are not limited to changes in gait patterns and

Dogged by dizziness

As with falling, anxiety and/or depression may contribute to problems with dizziness, or vice versa. Upwards of 50 percent of patients with vestibular disorders may develop anxiety, depression or panic disorders (per this [Current Opinion in Neurology](#) article). Anxiety and depression may also affect recovery of balance function, leading to prolonged symptoms.

For instance, in an article published this year in *Frontiers in Neurology*, researchers from Shengjing Hospital of China Medical University found that **patients with anxiety and/or depression and benign paroxysmal positional vertigo (BPPV) had lower first-time treatment success rates** than comparative patients without psychological comorbidities.

For some patients, overwhelming concern about experiencing another vertigo episode may lead them to steer clear of public places or even to avoid leaving their house (agoraphobia), as with Peggy, the patient in the opening example. Like Peggy, these patients may also experience postural instability and increased sensitivity to visual stimuli. Personality traits like neuroticism and introversion only make a person more susceptible to such symptoms after a vestibular insult (see sources).

Research out of Seoul National University indicates that **people with high anxiety may respond more strongly to visual over vestibular inputs**. As a result, they may depend more on visual cues (over-relying on vision to help with balance function), which could be maladaptive and a source of persistent vestibular symptoms, such as visually provoked symptoms.

This brings us to diagnosis, and what we call chicken-or-egg anxiety-related dizziness. We can choose from a host of names for the phenomenon, including phobic postural dizziness, space-motion discomfort, visual vertigo, chronic subjective dizziness, and the newly introduced persistent postural-perceptual dizziness (PPPD, see sidebar below). In Peggy's case, her chronic dizziness met the diagnostic criteria for PPPD and her treatment began with educating her on the disorder and reasons for her dizziness symptoms.

For some patients, overwhelming concern about experiencing another vertigo episode may lead them to steer clear of public places or even to avoid leaving their house.

Pathways to Recovery

Whether related to dizziness or falls, anxiety can clearly play a role in balance disorders. But what can we do as clinicians to better assess, address and manage these co-occurrences? We need to address both physical and emotional aspects of the patient's condition.

When we first see a patient, we need to start with the clinical history, a physical examination and integration of vestibular and other laboratory results. In the 2016 book "**Balance Function Assessment and Management**" (page 741), the Mayo Clinic's Jeffrey Staab suggests we address these three questions:

- Does the patient have an active neurologic condition (neurological disorder of the ear)?
- Does the neurologic condition explain all of the patient's symptoms?
- Does the patient have behavioral symptoms indicative of psychiatric morbidity?

These questions, Staab says, help us to sort past from present symptoms and to identify any co-morbidities—including behavioral symptoms such as activity avoidance or restrictions. A number of screening tools can also help identify any psychiatric co-morbidities. These include the Patient Health Questionnaire (PHQ-9), Generalized Anxiety Disorder 7-item (GAD-7) and the Hospital Anxiety and Depression Scale (HADS). Also look for activity restrictions and avoidance behavior with the Dizziness Handicap Inventory (DHI) or Activities Specific Balance Confidence Scale (ABC).

Much can be gained from simply talking with the patient about any avoidant behavior, anxiety and alterations in activities. This discussion not only strengthens your case for additional management options, but helps the patient better understand how these concerns may affect their balance.

Indeed, patient education is a key aspect of treating emotional aspects of balance disorders (see sources)—something Peggy's audiologist knew. When Peggy revealed how much her dizziness was limiting her activities, the audiologist explained to her exactly how her PPPD can play a role.

Much can be gained from simply talking with the patient about any avoidant behavior, anxiety and alterations in activities.

Other treatment avenues include referral to a psychiatrist for medical management and/or referral to a mental health professional for psychotherapy (cognitive-behavioral therapy), which demonstrates promising short- and long-term benefits (see sources). To help control the patient's anxiety and/or depression, a psychiatrist may prescribe selective serotonin re-

problematic ones.

Yet another treatment option is vestibular and balance rehabilitation therapy, provided by a trained vestibular therapist, in which gentle habituation exercises combat visually provoked symptoms. This treatment may include repeated exposure to visual stimuli. An effective management plan for these patients reduces symptoms, retrains the patient to use balance strategies, and helps them overcome avoidance behaviors. For Peggy, this strategy helped her regain balance confidence and reduce her symptoms of dizziness.

Peggy's case illustrates the importance of a clinician taking the time to understand a patient's anxieties and concerns related to balance. Identifying and managing these symptoms can ultimately improve that patient's balance outcomes. One of the most important tools available to clinicians is a compassionate discussion with patients about avoidant behaviors. Questioning the true source of their symptoms can be key to conquering those symptoms.

What Exactly Is Persistent Postural-Perceptual Dizziness?

Known as PPPD, persistent postural-perceptual dizziness became an official disorder last year, with defining criteria as a chronic functional vestibular disorder that includes both physical and psychological symptoms.

A subcommittee of the [Bárány Society's Committee for Classification of Vestibular Disorders](#) issued a statement outlining PPPD's main criteria: persistent nonvertiginous dizziness exacerbated by upright postural and spatial perception stimuli.

PPPD diagnosis requires that all Bárány Society criteria be met:

- Symptoms persist and are present for most of the time for three months or more. These symptoms may last for long periods of time (hours), but can alternate in severity.
- Symptoms may not have a provocative feature, but can be exacerbated by upright posture, active or passive movement, or complex visual stimuli.
- Symptoms often have some triggering event (such as vestibular neuritis, BPPV, migraine) that causes initial symptoms of dizziness, vertigo or unsteadiness.
- Symptoms cause distress and avoidance behavior. Patients may appear at their wits' end due to functional impairment of symptoms.
- Symptoms are not better explained by another condition.

Diagnosis begins with taking a careful history and may include synthesizing information from physical examination, vestibular laboratory testing and diagnostic neuroimaging. Patients with PPPD may have co-existing anxiety and depression, but this is not a diagnostic

Author Notes

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Additional Resources

We recommend

Life in Balance

Julie A. Honaker et al., The ASHA Leader, 2013

Fall Prevention: Patient-Centered Outcomes

Julie Honaker, The ASHA Leader, 2021

When Dizziness Lingers

Steven DoettlAuD et al., The ASHA Leader, 2013

On Shaky Ground: How Balance Ebbs With Age

Julie Honaker, The ASHA Leader, 2021

Help 'Make Vestibular Visible' This Balance Awareness Week

The ASHA Leader, 2023

Does weight loss affect the center of pressure of children with obesity: a follow-up study

Linshan Zhang et al., Journal of Leather Science and Engineering, 2022

The dynamic characteristics of the center of pressure for toe-out gait: implications for footwear design

Bo Li et al., Journal of Leather Science and Engineering, 2022

Energy spreading, equipartition, and chaos in lattices with non-central forces

Arnold Ngapasare et al., Chinese Physics B, 2022

Quantitative study on the tension-compression yield asymmetry of a Mg-3Al-1Zn alloy with bimodal texture components

Lingyu Zhao et al., Journal of Magnesium and Alloys, 2022

High-throughput calculations combining machine learning to investigate the corrosion properties of binary Mg alloys

Yaowei Wang et al., Journal of Magnesium and Alloys, 2022

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Relationships Between Tinnitus And The Prevalence Of Anxiety And Depression

[Jay M. Bhatt](#), M.D., [Neil Bhattacharyya](#), M.D., F.A.C.S., and [Harrison W. Lin](#), M.D.

Abstract

Objective

Quantify the relationships between tinnitus, anxiety and depression among adults.

Study design

Cross-sectional analysis of national health survey.

Methods

Adult respondents in the 2007 Integrated Health Interview Series tinnitus module were analyzed. Data for tinnitus symptoms and severity and reported anxiety and depression symptoms were extracted. Associations between tinnitus problems and anxiety, depression, lost workdays, days of alcohol consumption, and mean hours of sleep were assessed.

Results

Among 21.4 ± 0.69 million adult tinnitus sufferers, 26.1% reported problems with anxiety in the preceding 12 months, while only 9.2% of those without tinnitus reported an anxiety problem

A yellow rectangular button with a speech bubble icon and the word "Feedback" written vertically.

($p < 0.001$). Similarly, 25.6% of respondents with tinnitus reported problems with depression, while only 9.1% of those without tinnitus reported depression symptoms ($p < 0.001$). Those reporting tinnitus symptoms as “big” or “very big” problem were more likely to concurrently report anxiety (odds ratio 5.7; CI: 4.0–8.1; $p < 0.001$) and depression (OR 4.8; CI: 3.5–6.7; $p < 0.001$) symptoms. Tinnitus sufferers reported significantly fewer mean hours of sleep per night (7.00 vs 7.21; $p < 0.001$) and greater mean days of work missed (6.94 vs 3.79, $p < 0.001$) compared to those who did not report tinnitus. Mean days of alcohol consumption between the two groups were not significantly different.

Conclusion

Tinnitus symptoms are closely associated with anxiety, depression, shorter sleep duration, and greater workdays missed. These comorbidities and sequelae should be recognized and addressed to optimally manage patients with chronic and bothersome tinnitus.

Keywords: tinnitus, depression, anxiety, sleep, work, productivity, substance abuse

Introduction

Tinnitus is the perception of sound in the absence of an external auditory stimulus, affecting 8 to 25.3% of the population of the United States and the world.¹⁻⁷ Psychiatric disorders such as anxiety and depression are often comorbid in patients with chronic tinnitus,⁸⁻¹⁰ and these conditions can not only be troublesome and debilitating, they have been shown to increase morbidity and the risk of suicide among patients with tinnitus.¹¹

Previous work has shed considerable light on the relationships between tinnitus symptoms and mood disorders. Sullivan and colleagues reported a 78% lifetime and 60% current prevalence of major depression among patients with tinnitus, which were rates substantially higher than the non-tinnitus control subjects (21% and 7%, respectively).¹² Similarly, Belli and associates found that patients with chronic tinnitus had significantly higher Beck Anxiety Inventory and Beck Depression Inventory scores.¹³ Notably, anxiety and depression severity have been correlated with tinnitus severity,¹⁴ and tinnitus prevalence may even decrease within a cohort as depression symptoms improve.¹⁵ Tinnitus is furthermore associated with sleep disorders, including insomnia, and can cause difficulty in initiating and maintaining sleep and lead to poor overall quality of sleep.¹⁶ These patients often suffer from greater distress and difficulty with concentration, irritability, and loss of control.¹⁷

In contrast, Shargorodsky et al., in their study of the National Health and Nutrition Examination Survey data, failed to find a significant association between frequent tinnitus and major depression.⁶ Accordingly, we aimed to better evaluate the relationship of tinnitus symptoms with rates of mood disorders among adults by utilizing the tinnitus module from the 2007 National Health Interview Series. Additionally, we sought to further expand on the comorbidities associated with tinnitus by looking specifically at the relationship to sleep, work days missed, and alcohol abuse.

Methods

Adult responses in the household-based 2007 National Health Interview Series were analyzed as aggregated in the Integrated Health Interview Series.¹⁸ The study protocol was deemed exempt from review by Partners Committee on Clinical Investigations as it analyzes de-identified data that is publicly available. We have previously used the NHIS data to analyze and describe the epidemiology of other otologic conditions in the United States.^{19,20} However, beginning in 2007, the NHIS began including a specific module that assessed multiple tinnitus-related variables.

Corresponding responses from the data were extracted for all adult patients (age \geq 18.0 years) and imported into SPSS (version 22.0) for analysis. The prevalence of self-reported tinnitus was determined along with the self-reported level of severity of the tinnitus problem (“no problem”, “a small problem”, “a moderate problem”, “a big problem”, “a very big problem”). In addition to the tinnitus variables, also extracted were data for frequent anxiety in the past 12 months, feeling frequently depressed in the past 12 months, hours slept per night, workdays missed and mean days of alcohol consumption per year. The prevalences of anxiety and depression were compared between tinnitus sufferers and non-sufferers with chi-square. Subgroup analyses were conducted for respondents reporting tinnitus as a big or very big problem for both anxiety and depression. Mean hours of sleep per night, mean number of workdays missed and mean days alcohol consumption were also compared between tinnitus sufferers and nonsufferers.

Sample weights and survey statistics were used to allow extrapolation from the raw sample size to representative statistics for the national population in the United States. Overall data are reported as the mean and its associated standard error of the national estimate. The standard error (SE) reported here results from extrapolation to the larger national population per the weight directed by the survey data gathering process, performed in order to obtain the true estimates of reported data in the population. Statistical comparisons were conducted with chi-square, with significance set at $p=0.05$. It is important to note that this data analysis describes the relationships between tinnitus, anxiety and depression but is unable to provide evidence on causality.

Results

Among the 21.4 \pm 3.4 million subjects who reported tinnitus within the past 12 months, 26.1% (5.59 \pm 0.31 million adults) also had problems with anxiety in the same period. Comparatively, among those who did not report tinnitus in the past 12 months, only 9.2% (18.4 \pm 0.65 million adults) reported an anxiety problem ($p<0.001$) (Table 1). Similarly, 25.6% (5.47 \pm 0.29 million adults) of tinnitus sufferers reported problems with depression in the preceding 12 months, while only 9.1% (18.3 \pm 0.57 million adults) of those without tinnitus reported depression symptoms ($p<0.001$) (Table 1).



Table 1

Relationship of tinnitus on the rate of self-reported anxiety and depression symptoms in the past 12 months.

"Had anxiety in past 12 months"							
(+) Tinnitus	Respondents	SE	%	(-) Tinnitus	Respondents	SE	%
Yes	5,590,681	306,427	26.1	Yes	18,361,958	654,732	9.2
No	555,876	555,876	73.9	No	182,066,388	2,805,007	90.8
"Had depression in past 12 months"							
(+) Tinnitus	Respondents	SE	%	(-) Tinnitus	Respondents	SE	%
Yes	5,468,886	291,367	25.6	Yes	18,332,611	571,757	9.1
No	15,918,428	576,408	74.4	No	182,091,088	2,861,231	90.9

S.E.: Standard error

In subgroup analysis, among those reporting tinnitus symptoms as "big" or "very big" problem (1.54 ± 0.14 million), 40.4% (0.622 ± 0.084 million) had an anxiety problem in the preceding 12 months. In contrast, those without tinnitus or with tinnitus symptoms that are "not a big" problem (221.2 ± 3.4 million), only 10.6 % (23.5 ± 0.75 million, odds ratio: 5.7; CI: 4.0-8.1; $p < 0.001$) self-reported anxiety symptoms (Table 2). Correspondingly, 36.5% (0.563 ± 0.074 million) of those reporting tinnitus symptoms as "big" or "very big" problem reported having symptoms of depression in the prior 12 months, while only 10.6% (23.5 ± 0.65 million, odds ratio: 4.8; CI: 3.5-6.7; $p < 0.001$) of those without tinnitus or reporting their tinnitus symptoms as "not a big" problem had depression symptoms (Table 2).

Table 2

Relationship of tinnitus severity on rates of self-reported anxiety and depression symptoms in the past 12 months.

"Had anxiety in past 12 months"				
	Tinnitus is "not a big problem" (%)	Tinnitus is "big/very big problem" (%)	p	Odds ratio
Yes	10.6	40.4	<0.001	5.695
No	89.4	59.6		
"Had depression in past 12 months"				
	Tinnitus is "not a big problem" (%)	Tinnitus is "big/very big problem" (%)	p	Odds ratio
Yes	10.6	36.5	<0.001	4.85
No	89.4	63.5		

S.E.: Standard error

Furthermore, those with tinnitus symptoms had fewer mean hours of sleep per night (7.00 versus 7.21 hours, $p < 0.001$) and greater mean days of work missed (6.94 versus 3.79 days, $p = 0.001$) compared to those who did not report tinnitus. Mean days of alcohol consumed in the last 12 months between the two groups were not significantly different (64.35 versus 61.61, $p = 0.431$) ([Table 3](#)).



Table 3

Relationship of tinnitus on self-reported mean hours of sleep, days of alcohol consumption, and days of missed work in the past 12 months.

Tinnitus	Mean hours of sleep	SE	95% CI	p
Yes	7.00	0.044	7.19-7.23	
No	7.21	0.012	6.91-7.08	<0.001
Mean days of alcohol consumption in past 12 months				
Yes	64.35	1.101	59.44-63.77	
No	61.61	3.424	57.61-71.09	0.431
Mean days of missed work in past 12 months				
Yes	6.94	.157	3.48-4.10	
No	3.79	.913	5.15-8.74	0.001

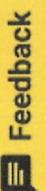
S.E.: Standard error

C.I.: Confidence interval

Discussion

Tinnitus is the perception of sound in the ear or head without an external source. Multiple components of the peripheral and central auditory system and brain have been implicated as potential contributors to the tinnitus percept. Recent population-based evidence has revealed close associations between mental illnesses and tinnitus, and significantly higher rates of comorbid anxiety, depression and low self-esteem have been reported in tinnitus sufferers. Although there are a number of pathologic conditions that can result in intolerable tinnitus, such as Meniere's disease, vestibular schwannoma, and noise trauma, proposed neurophysiologic and psychoacoustic models of tinnitus suggest that the tinnitus perception is a common and non-pathologic condition that is typically habituated by the majority of people. For those reporting and seeking treatment of bothersome and intolerable tinnitus, however, it has been suggested that the tinnitus percept may produce an inappropriate activation of the limbic and sympathetic components of the autonomic nervous systems.²¹

The consequent hyperactive state can be concomitant with and can contribute to anxiety, depression, and panic and sleep disorder symptoms. Belli and colleagues¹³ discovered that 26.7% of patients with tinnitus had at least one psychiatric diagnosis, while Marciano and others found that 77% of tinnitus patients met criteria for a psychiatric disorder, in both DSMIV-Axis I and Axis II spectrums.²² Additionally, tinnitus-associated dysfunctional cognition, including "catastrophic thinking" and "avoidance cognitions", is strongly correlated with measures of tinnitus distress, depression, and anxiety.¹⁷



The elevated prevalence of depression among tinnitus subjects has been reported to be as high as 60-80%,^{12,23} while nearly 50% with generalized anxiety disorders can have tinnitus symptoms.⁶ Geocze et al. showed in a systematic review that a total of 18 studies between 1982 and 2011 found a positive correlation between tinnitus and depression.²⁴ The authors postulate that there may be at least three potential relationships between depression and tinnitus: depression affecting tinnitus, tinnitus predisposing to depression, and tinnitus appearing as comorbidity in patients with depression. Majority of the studies reviewed found that depression either predisposes to tinnitus or occurs as a consequence of tinnitus. In the current study, we report substantial comorbidity of tinnitus and mood disorders: we found that when compared to those without tinnitus, there is a significantly higher prevalence of depression (25.6% versus 9.1%) and anxiety (26.1% versus 9.2%) among survey respondents who reported tinnitus over the last 12 months. Our data moreover revealed that those reporting tinnitus symptoms as a “big” or a “very big” problem were four to six times more likely to have symptoms of anxiety or depression in the prior 12 months when compared to those without tinnitus or in whom tinnitus was “not a big” problem. Although we are unable to remark on causative relationships between tinnitus and psychiatric illnesses, our data adds to the growing body of literature that strongly correlates intolerable tinnitus symptoms with comorbid anxiety and depression, supporting the role of psychiatric and psychologic forms of treatment, such as cognitive-behavioral therapy, which can notionally address both tinnitus intolerance and underlying mood disorders.

Sleep disturbance and annoyance are among the more frequently reported problems facing individuals with chronic tinnitus,^{25,26} and increased sleep disturbance has also been shown to closely correlate with increased tinnitus severity,²⁷ providing support for the hyperactive limbic and sympathetic system model for tinnitus intolerance. Similar to prior work correlating tinnitus symptoms with sleep disorders as measured by the Tinnitus Reaction Questionnaire and Insomnia Severity Index,²⁸ we found that tinnitus sufferers reported significantly fewer mean hours of sleep per night. Those with tinnitus symptoms had fewer mean hours of sleep per night (7.00 versus 7.21 hours, $p < 0.001$), which equals to over 80 minutes of sleep per week, or nearly equivalent to a whole night of sleep lost per month. Previous studies have shown that patients with tinnitus have statistically significant changes in sleep stages, including an increase in stage 1 and 2 sleep time, and reductions in stage 3, 4 and REM sleep time.²⁹ However, this is the first study incorporating a large sample that shows an actual reduction in total duration of sleep in tinnitus sufferers. Of note, elderly subjects with tinnitus, in particular, suffer from greater sleep disturbance, including poor sleep and frequency awakening, compared to the younger adults.²⁷ Accordingly, treatment and evaluation of insomnia, and administration of methods to modulate the limbic and sympathetic system reaction to tinnitus (e.g. cognitive behavioral therapy), particularly in the more vulnerable populations, could provide tinnitus patients substantial benefit to their sleep quality and quantity.

The data shows strong a strong and significant relationship between tinnitus symptoms and work days missed ([Table 3](#)). Those with tinnitus miss approximately 1.8 times more work (6.94 versus 3.79 days, $p = 0.001$) compared to those who do not suffer from tinnitus. Review of literature indicates that this is the first study to quantify the number of workdays that are lost in patients suffering with tinnitus in the United States. To further analyze these effects, the lost wages method, which is one of the most common methods to measure productivity loss,³⁰ was used to

calculate the financial consequences of absenteeism caused by tinnitus. The number of extra work days missed were multiplied by a median multiplier of 1.28³¹ and the 2007 employer costs for employee compensation of \$28.11 per hour, for a standard 8 hour work day.³² This calculation yields a loss of \$907 per tinnitus sufferer, with a total economic loss of \$19.4 billion dollars per year to the workforce of the United States. As evidenced here, the cost burden to the economy in lost wages and productivity from tinnitus is extravagant. Given the psychosocial and sleep disturbance issues related to tinnitus, it is understandable that these patients experience profound sequelae in different aspects of their lives, including their work and its related performance.

The data in this study is derived from a national database that samples the diverse population of the United States, from all 50 states and the District of Columbia. Given that the Center for Disease Control and Prevention (CDC) focuses on black, Hispanic, and Asian persons during the survey to allow for a precise estimation of health characteristics in these growing minority groups, the data reflects a true sampling of the country's population. The large, diverse sampling allows clear identification of relationships between tinnitus symptoms and their close association with anxiety, depression, shorter sleep duration, and greater workdays missed, along with its financial ramifications, which has previously not been reported in literature. Additionally, the data is gathered by trained interviewers with standardized questions, thus the reliability of its responses is credible as they are collected through an assured process. However, given that the questions are retrospective in nature, the potential for recall bias from the respondents is a real possibility. Additionally, because the respondents provide subjective feedback regarding the severity of their symptoms, the ability of the dataset to objectively quantify the severity of anxiety, depression, and sleep disturbance is limited. Finally, the retrospective and de-identified nature of the study unfortunately prevents subgroup analysis. Future studies with different datasets can be directed towards evaluating such intricacies, including but not limited to gender and racial differences in the cohort.

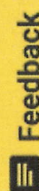
Conclusion

Through this large population-based study, we demonstrate a strong association among tinnitus, depression and anxiety. This association also bears a strength relationship between the severity of tinnitus and the likelihood of anxiety and/or depression. Additionally, we report reduced duration of sleep and increased days of work missed among individuals with tinnitus symptoms, with tinnitus sufferers sleeping less and missing significantly more work than non-sufferers. Such comorbidities and sequelae should be recognized and appropriately addressed to effectively manage patients with chronic and bothersome tinnitus.

Footnotes

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Feedback

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How Daily Stress Can Cause Vertigo

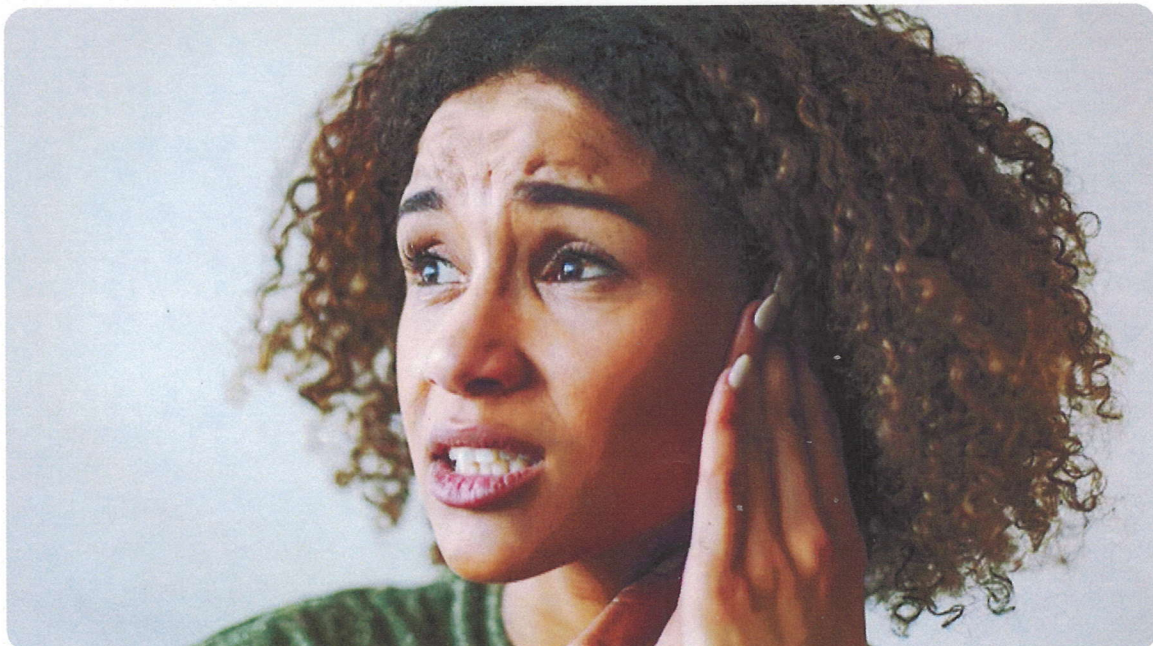


Written by [Anne Jacobson, MD, MPH](#) | Reviewed by [Katie E. Golden, MD](#)

Published on June 28, 2022

Key takeaways:

- Vertigo is a type of dizziness that causes a spinning sensation. It usually begins with an inner ear condition that affects your sense of balance.
- Vertigo activates stress hormones. In chronic stress, these chemical messages may lead to more vertigo.
- The best treatments for stress-related vertigo are strategies that address both body and mind.



vitapix/E+ via Getty Images

Stress is a common part of life. But it can cause unexpected effects on the body. Some people notice they feel dizzy when they're stressed or anxious. Vertigo is one type of dizziness. People often describe it as a feeling that the world around you is spinning.

For some of us, stress seems to bring it on. But is there a connection? Can stress or anxiety literally make you feel like you're spinning out of control?

What causes vertigo?

[Vertigo](#) is caused by a problem with your sense of balance. There are two parts of the body that control this:

1. The inner ear
2. The balance center of the brain

The [inner ear](#) has three canals filled with fluid and special hair cells. They detect movement and send messages to the balance center in the brain. The most [common causes](#) of vertigo come from inflammation or something that's out of place in the inner ear. This sends mixed signals to the brain that lead to vertigo.

In rare cases, vertigo happens because something is affecting the balance center of the brain — like a stroke or a tumor.

[Benign paroxysmal positional vertigo](#) (BPPV) is the most common type of vertigo. It happens when a small crystal in the inner ear moves out of place. BPPV is vertigo that comes on with sudden movements or a change in position. BPPV isn't dangerous or life-threatening, but it's bothersome, disruptive, and uncomfortable.

Can stress cause vertigo? How are they connected?

When it comes to stress and vertigo, there are still a lot of unanswered questions. Let's take a look at the science we know so far.

Depression may increase stroke risk, impact stroke recovery



By [Katharine Lang](#) on March 10, 2023 — Fact checked by [Ferdinand Lali, Ph.D.](#)



Could depression impact stroke risk? Image credit: Klaus Vedfelt/Getty Images.

- According to the [World Health Organization](#) (WHO), depression is the leading cause of disability worldwide.
- It affects at least 5% of adults, with more women than men experiencing depression symptoms.
- A multinational study has found that people with depression symptoms are more likely to experience a stroke, and their recovery from stroke is often more difficult.
- In this study, people with symptoms of depression had a 46% increased stroke risk compared with those without such symptoms.



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depression is almost twice as common in women as it is in men, affecting some 10.4% of women in the United States.

[Psychological symptoms](#) of depression include persistently depressed mood, feelings of worthlessness, loss of interest in pleasurable activities, difficulty concentrating, and even thoughts of suicide.

In addition, depression may cause physical symptoms, such as [fatigue](#), lack of appetite, [headaches](#), chronic pain, and digestive issues.

[Research](#) has also linked depression with [cardiovascular disease](#) (CVD), with [one study](#) finding that depression increased the risk of mortality in patients with [coronary heart disease](#).

Now, an international study, published in [Neurology](#), has found that people with depressive symptoms have an increased risk of both [ischemic and hemorrhagic stroke](#), and worse recovery after a stroke.

[Dr. Curtis Benesch](#), medical director of the University of Rochester Medical Center Comprehensive Stroke Center, not involved in this study, commented on the findings for *Medical News Today*.

“This paper describes a well-done observational study. It relies on self-reported symptoms of depression, though, and there is some subjectivity in that. [...] However, the authors have done an excellent job in generating the potential impact of a prior stroke by matching cases with controls that mirror age, other risk factors, race and ethnicity, and to some extent location.”

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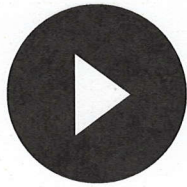
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How does inflammation factor in?

One phenomenon that might mediate the impact of diet and gut bacteria on mental health might be [inflammation](#). Inflammation can contribute to many health problems, including [cardiovascular diseases](#), a [decrease in cognitive performance](#), and even [cancer](#) ✓.

Recently, [some research](#) has also suggested that inflammation could impact the availability of neurotransmitters such as [dopamine](#), thereby contributing to some symptoms of depression, such as a lack of motivation.

“We already know that about [33%](#) of the cases [of depression] are somehow related to inflammation,” Dr. Amin said in the podcast. “But the thing [is] that most of these cases of inflammation are actually having a comorbid condition like for instance, diabetes or [hypertension](#), or any other disease that is causing the inflammation, and then [people] develop depression.”

“**But in my own studies — two papers are coming out very soon — [I and my colleagues] have analyzed hundreds of chemicals floating in the blood. And what we found is [that it is] the energy metabolism, the oxidative stress that is disrupted.**”

In cells, she explained, tiny structures, or organelles, called [mitochondria](#) ✓ are responsible for producing energy. When cells undergo oxidative stress — which can be caused by a number of factors, including disease and inflammation — the mitochondria are also affected.

And inflammation, she noted, can be caused by a [poor diet](#) ✓, [leaky gut syndrome](#) ✓, or even [chronic exposure to everyday stressors](#) ✓.

“What happens is that when you are not having enough energy and also, let’s say, your gut microbiota is disturbed, or there is

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oxidative stress. And when mitochondria start breaking down, or when they are affected, not enough energy is being produced. And that's what I think is happening — [...] your body first is going to inflammation, the inflammation is killing your mitochondria and then you are not able to produce enough energy.”

– Dr. Najaf Amin

“And one of the key symptoms of depression is that you don't have energy,” Dr. Amin pointed out.

How to improve diet to fight depression

Both Kelly and Dr. Amin believe that, by taking positive control of one's diet, people can take a step forward in fighting the symptoms of depression — or perhaps even in preventing it altogether.

While they both acknowledge that depression is a complex condition that can have multiple causes, they argue that dietary interventions can be an easy, self-empowering way of working towards better mental health.

And, importantly, a healthy diet does not come with a list of potential side effects, as does some of the most common [antidepressant](#) medication, such as [selective serotonin reuptake inhibitors](#) (SSRIs).

A therapeutic approach to depression that comes free of life-disrupting side effects — “this is what we are working towards, you know,” said Dr. Amin.

So what, then, might be some easy dietary changes that could reduce the impact of depression? Speaking from her own life experience and based on the nutrition research she has read, Kelly suggested taking small steps

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For instance, she suggested that [dark chocolate](#) can be a healthier and more beneficial alternative to milk chocolate, as it contains larger amounts of key minerals, such as iron, magnesium, and zinc, as well as [antioxidants](#).

Research has suggested that [magnesium supplementation](#) can sometimes help improve symptoms of depression, and the antioxidants could help fight the oxidative stress that Dr. Amin believes could play a role in depression.

Kelly shared some other easy dietary recommendations with us:

1. first, “avoiding the crap,” that is, unhealthy food and drinks that are [ultra-processed](#) and contain [added sugars](#), which studies have repeatedly shown are an important risk factor for health
2. second, adding variety — “go to the supermarket and if you always buy one kind of bean, buy six kinds of beans, if you always buy one kind of flour, buy six kinds of flour,” Kelly advised
3. third would be to add more [probiotic foods](#), such as yogurt and kimchi, as well as [prebiotic foods](#), such as leafy greens, which can help improve bacterial diversity in the gut
4. fourth, eat more [omega-3-rich foods](#), such as oily fish or walnuts, which can have an [anti-inflammatory effect](#) and may help relieve depression symptoms.

At the same time, she emphasized, diet should only be one of several approaches when it comes to fighting depression symptoms. There are many other things that people can do in a bid to feel more themselves, she pointed out.

“We talked a bit about stress, and stress has an impact in terms of our microbiome, how well we’re digesting. So you’ve got to

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effective.”

– Rachel Kelly

Dr. Amin also acknowledged that opting for a healthier diet does not have to be an act of self-sacrifice. “If you want to indulge in your piece of donut go ahead, eat it,” she said.

“But do compensate it with fruits, healthy foods, [a] healthy diet, vegetables, green leafy vegetables, and whole grains (wholemeal). And yeah, just balance it [out].”

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Ongoing stress not only takes an emotional and psychological toll, it can produce physical symptoms. Those may include headaches, an upset stomach, tense and aching muscles, insomnia and low energy.

Heart disease is another potential stress-related problem.

Stress may lead to high blood pressure, which can pose a risk for heart attack and stroke. Stress also may contribute to such cardiovascular disease risks as smoking, overeating and lack of physical activity.

"Chronic stress has been shown to be associated with increased cardiovascular events," Schiffrin said. He pointed to a [2017 study in *The Lancet*](#) that used images of part of the brain involved with fear and stress and found links between stress and cardiovascular disease episodes. Brain activity was studied along with bone marrow activity and artery inflammation.

"These findings illustrate mechanisms through which emotional stressors can lead to cardiovascular disease in human beings," Schiffrin said.

Constant stress can impact creativity and productivity. For many people, the workplace is a source of stress.

About 2 in 3 employees say work is a significant source of stress, according to a recent report from the [American Heart Association Center for Workplace Health Research & Evaluation](#). Job stress can stem from long hours, physical strain, high demand or job insecurity.

Annual expenditures on work-related stress has been estimated at \$190 billion, while the cost of poor mental health, including depression and anxiety, has been pegged at \$211 billion annually. The estimates encompass lost productivity and work absenteeism.

To minimize continual stress, set priorities for what is most important to you and aim for a life-work balance, Schiffrin said.

Make time for friends, family and laughter. Ease stress and improve mood through physical activity. Regular exercise helps to lower blood pressure and combat other cardiovascular disease risk factors. Mindful meditation and deep breathing can help manage stress. Consider yoga, which combines movement, controlled breathing and relaxation.

Sleep and stress are interconnected. Stress can affect sleep, and lack of sleep can, in turn, lead to more stress. Seven to eight hours of sleep per night is ideal, Schiffrin said.

"Better sleep hygiene is critical in management of stress and promotion of heart health," he said.

Sleep in a cool, dark and quiet room; don't exercise close to bedtime; and avoid eating or drinking in the hours before bedtime, especially alcohol and foods high in fat or sugar, he said.

For unending stress or symptoms of depression, talk with a health care provider about getting help.

Attempting to see a "silver lining" and adopting a positive attitude toward life may help reduce stress, Schiffrin said.

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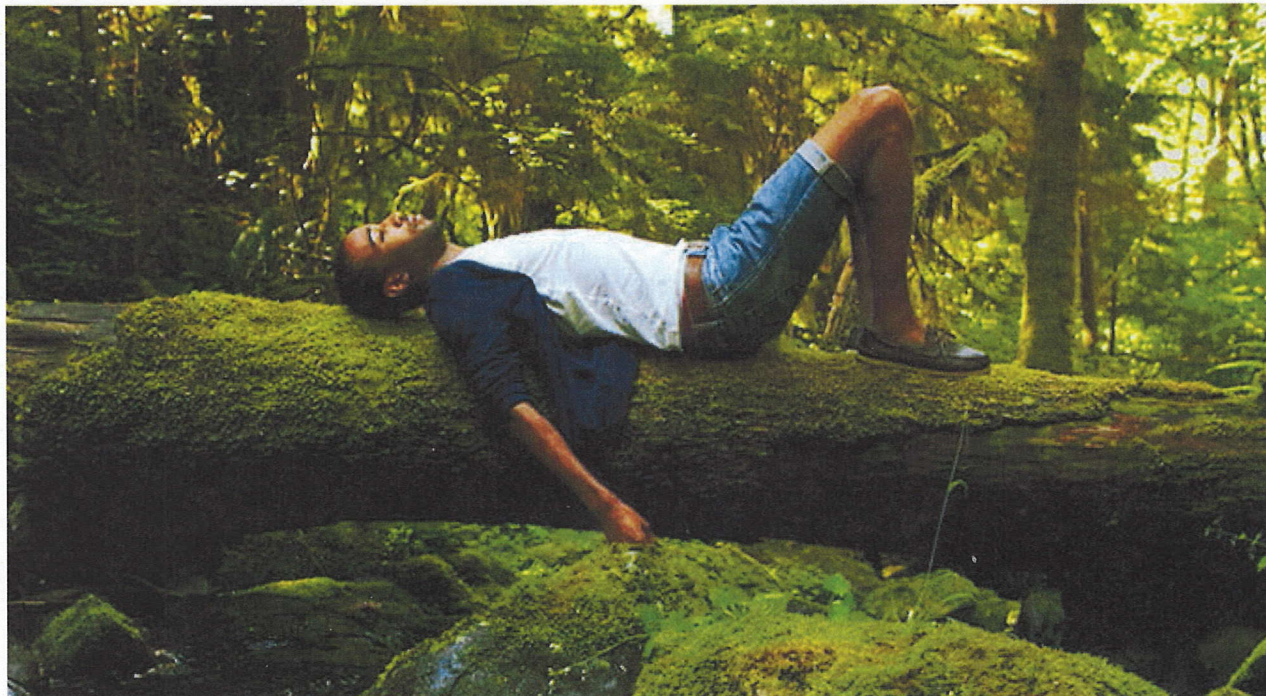
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Stress linked to behaviors that increase heart disease, stroke risk in African-Americans



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