



Sounds Only You Can Hear

TINNITUS & BRAIN HEALTH

Barbra Streisand, the famous singer, has heard phantom sounds since childhood. In grade six, she feared the strange noises and tried to block them with scarves around her head.

Millions of people in North America hear sounds that have no external source. This condition, called tinnitus, comes from the Latin verb “tinnire,” which means “to ring.” Experts pronounce it as TINN-it-is, but you may also hear tin-AYE-tis.

People living with tinnitus describe the noises they perceive as ringing, buzzing, grinding, roaring, hissing, whooshing, or similar to the sounds cicadas or crickets make or a kettle releasing steam.

These phantom sounds may last a short time or become constant. They may be barely noticeable or bothersome enough to disrupt daily life and sleep and cause stress, anxiety, and depression. Severe tinnitus can be debilitating and lead to suicidal ideation, although additional mental health issues may be involved with the latter.

Streisand is one of several celebrities who shared how tinnitus affects them in an awareness campaign by the Hearing Health Foundation. Others included actors William Shatner and Halle Berry, and Chris Martin, the lead singer of the band Coldplay.

Mind Over Matter® spoke with leading North American experts to learn more about tinnitus, how it affects brain health, current treatment options, and an innovative treatment strategy on the horizon.

TINNITUS CAUSES

Is tinnitus all in your head? Yes, but you’re not imagining things. Your auditory system is producing sounds only you can hear.

Tinnitus is a symptom of a problem in the auditory system, which includes the ear, the auditory nerve that connects the inner ear to the brain, and the parts of the brain that process sound, according to the National Institute on Deafness and Other Communication Disorders (NIDCD).

“Most tinnitus is associated with damage to sensory cells in the inner-ear structure called the cochlea,” explained Dr. Susan Shore, professor emerita of the Department of Otolaryngology-Head and Neck Surgery at Michigan Medicine’s Kresge Hearing Research Institute.

“When the damaged cells send less input to the brain, certain cells in an area of the brain called the cochlear nucleus become hyperactive and fire, trying to compensate for the missing input.”

“Tinnitus is almost always experienced alongside some level of hearing loss and frequently triggered by age-related or

noise-induced hearing loss,” said Dany Pineault, Doctor of Audiology, research advisor for Statistics Canada and adjunct assistant professor of the Post-Professional Doctor of Audiology Program at the A.T. Still University-Arizona School of Health Sciences.

“ I EXPLAIN TO MY PATIENTS THAT THE RINGING OR BUZZING INDICATES THE BRAIN IS WORKING HARDER IN AN EFFORT TO COMPENSATE FOR MISSING SOUNDS. THE INCREASED EFFORT IS PERCEIVED AS NOISE, LIKE A CAR’S ENGINE GROWING LOUDER AS IT ACCELERATES.

An estimated 15% of adults experience tinnitus, and only 10% of that group report it as debilitating. William Shatner’s severe tinnitus was caused by noise-induced hearing loss: He was standing too close to a special effects explosion while filming a Star Trek episode. “There were days when I didn’t know whether I would survive the agony; I was so tormented by the screeching in my head,” he told the American Tinnitus Association.

Some people with tinnitus have normal hearing. However, a recent study by investigators from Massachusetts Eye and Ear, a treatment and research centre and teaching hospital of Harvard Medical School, found that despite having normal hearing, these individuals still had some degree of damage to their auditory nerve and hyperactivity in the brainstem. About half of the study participants were women. Their study was published in *Scientific Reports* in November 2023.

Certain medications have been linked to a higher risk of tinnitus, according to a longitudinal study by researchers at Brigham and Women’s Hospital published in February 2022 in *Journal of General Internal Medicine*.

The investigators found that women who frequently used non-steroidal anti-inflammatory drugs, such as ibuprofen or naproxen, had an almost 20% higher risk of developing persistent tinnitus.

Those who regularly used COX-2 inhibitors had a 21% higher risk of developing this condition. The study also revealed that frequent use of moderate-dose aspirin was associated →

with a 16% higher risk of tinnitus in women under 60, but frequent use of low-dose aspirin did not affect risk.

Other medications linked to an increased risk of developing tinnitus include some antibiotics, antidepressants, and anti-cancer and anti-malaria drugs, according to the NIDCD.

Tinnitus may also be caused by other health issues, including Ménière's disease, acoustic neuroma, head and neck injury, jaw joint problems, high blood pressure, atherosclerosis, chronic diabetes, migraines, thyroid disorders, lupus, and multiple sclerosis.

SEX DIFFERENCES

"The evidence is mixed on whether more women or men experience tinnitus. It depends on what study you read," advised Dr. Shore. "Some say men are likelier to develop tinnitus since they work more often in noisy environments. Others say women are more likely to experience stress and anxiety, which can be contributing factors, but that's a chicken-or-egg situation. We don't know which issue arises first and contributes to the others."

According to a recent study by researchers in Europe, there were no differences in reported loudness, duration, or location of the tinnitus between women and men.

Women, however, more often reported sudden onset tinnitus, headache, dizziness, and a lower tolerance for sounds, called hyperacusis, as well as experiencing depression, anxiety, and worries.

Men, on the other hand, more often reported a higher need to control their thoughts and more trouble coping with increasing distress related to tinnitus. The study was published in the journal *Frontiers in Neuroscience* in July 2020.

LINK TO BRAIN DISEASES?

The evidence is also mixed on whether individuals with tinnitus have a higher risk of developing neurodegenerative diseases.

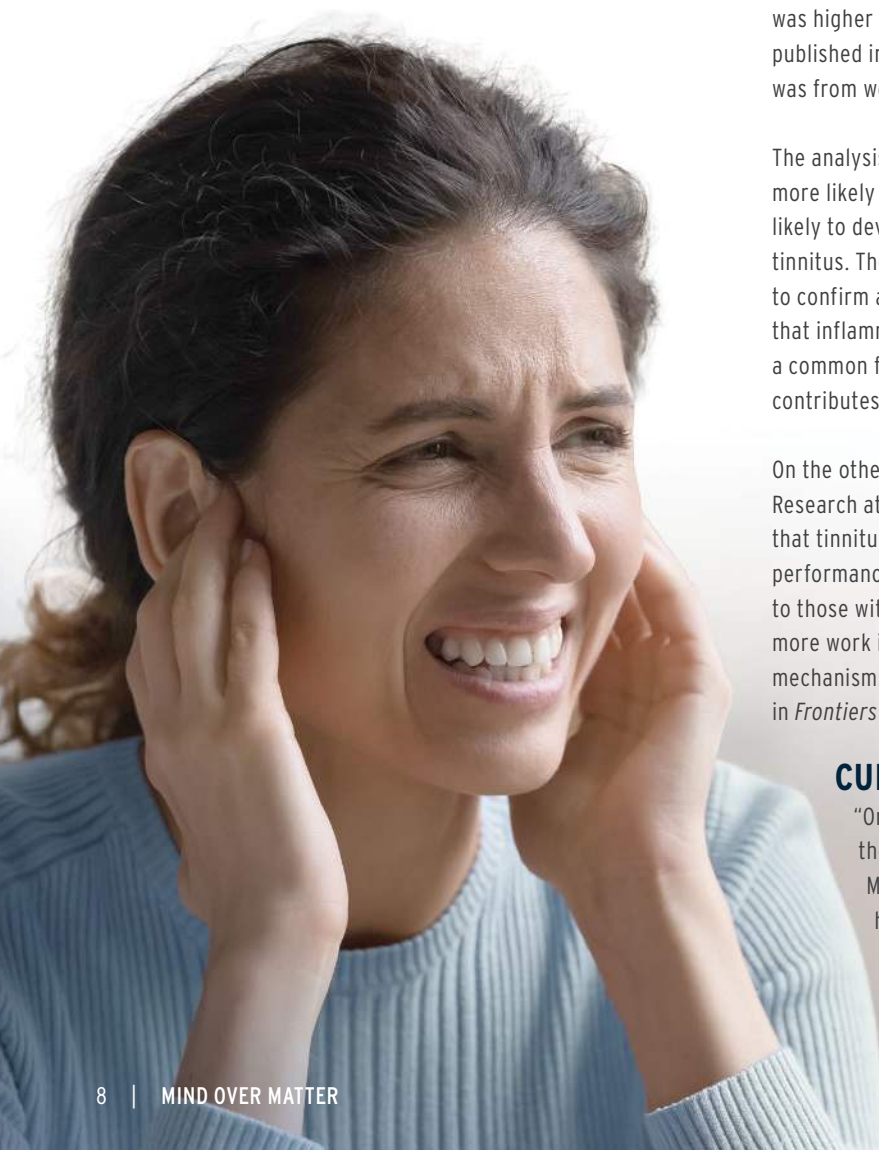
Investigators in Taiwan recently analyzed ten years of data from their country's medical claims database to see if the risk of Alzheimer's disease and Parkinson's disease was higher in adults who developed tinnitus. In this study, published in July 2020 in *Scientific Reports*, 52% of the data was from women.

The analysis found that people with tinnitus were 1.54 times more likely to develop Alzheimer's and 1.56 times more likely to develop Parkinson's than people who did not have tinnitus. The authors concluded further studies are needed to confirm any biological connection. Still, they speculated that inflammation might explain these results since it is a common factor that triggers ringing in the ears and contributes to neurodegeneration.

On the other hand, researchers at the Center for Hearing Research at the University of California, Irvine, found that tinnitus was associated with improved cognitive performance in adults over 60 with hearing loss compared to those without hearing loss. The authors also said more work is needed to understand the underlying mechanisms. Their paper was published in October 2021 in *Frontiers in Neuroscience*.

CURRENT TREATMENTS

"One of the biggest myths about tinnitus is that there are no effective treatment options," said Mr. Pineault. "The technologies for hearing aids have advanced greatly in the past ten years. We have many options for providing people with relief from tinnitus and improving their quality of life."



The primary treatment for tinnitus is treating the associated hearing loss.

"It's important for people to know that's the case so they're not surprised when their audiologist recommends hearing aids," he said.

According to the NIDCD, only about 16% of adults aged 20 to 69 and about 30% of adults over 70 who could benefit from hearing aids have never used them. By contrast, the Vision Council reports that 64% of adults requiring vision correction choose corrective eyeglasses. "Awareness of the importance of good hearing health is slowly increasing, but there's still much room for improvement," Mr. Pineault said.

Hearing aids can be programmed to address each individual's hearing issues. "Patients with high-pitched tinnitus likely have hearing loss in that specific frequency," Mr. Pineault advised. "Many hearing aids come with tinnitus relief features, including a programmable app that an audiologist can calibrate to match a patient's tinnitus frequency. They also include sound therapy apps that provide relaxing sounds, such as ocean waves or rain."

A SOUND-ENRICHED ENVIRONMENT CAN GIVE AN OVEREXCITED AUDITORY SYSTEM SOMETHING ELSE TO FOCUS ON.

"Silence is not golden," Mr. Pineault said. "I can't start working on my computer until I have some low-level background music playing to support my hearing." He prefers jazz but says the type of music doesn't matter as long as you find it soothing.

If you or a loved one are bothered by tinnitus lasting longer than six months, Mr. Pineault advised it's best to consult an audiologist for an accurate diagnosis and discuss the best treatment options. He notes that accredited audiologists use evidence-based methods for diagnosing and treating tinnitus according to the American Academy of Otolaryngology-Head and Neck Surgery Foundation's clinical practice guidelines.

William Shatner found significant relief when an audiologist matched the tone of his tinnitus. He reported he's no longer bothered by it and doesn't think about it unless asked.

Cognitive behavioural therapy (CBT) teaches individuals how to identify negative thoughts about tinnitus that cause distress, change their responses, and focus on positive ways to reduce the impact of tinnitus on daily life. Mr. Pineault

TINNITUS & MEDICATIONS

There are no FDA-approved drugs for treating tinnitus, according to the American Tinnitus Association (ATA).


The National Institute on Deafness and Other Communication Disorders advises, "There are no medications specifically for treating tinnitus, but your doctor may prescribe antidepressants or anti-anxiety medications to improve your mood or help you sleep. While certain vitamins, herbal extracts, and dietary supplements are commonly advertised as cures for the condition, none of these has proven to be effective."

A recent survey by investigators at the University of Iowa found that almost one-quarter of individuals with tinnitus reported taking a dietary supplement to address it – and none said they were effective. The most common supplements were ginkgo biloba, zinc, vitamin B12, melatonin, magnesium, and lipoflavinoid, a combination of vitamins and a phytonutrient found in lemon peels. The study authors concluded some of these supplements may help improve sleep, but they should not be recommended for treating tinnitus.

"The internet is rife with promises of a quick fix for tinnitus, but there's no proven cure yet," Mr. Pineault said. "I've seen many patients who spent a lot of money on unproven treatments and became even more distressed when they didn't work."

The ATA also points out that dietary supplements are regulated as food, not drugs, so manufacturers do not have to prove the products are safe or effective before selling them. Many contain powerful active ingredients that can result in unwanted side effects, depending on what other medications you're taking and your health history.

said CBT is a proven and highly effective treatment option, especially for those who experience unhelpful thinking patterns, heightened anxiety, or who avoid social situations to minimize noise exposure.

Tinnitus retraining therapy (TRT) combines psychological counselling with sound therapy. Counselling helps change 

negative thinking patterns, emotional reactions, and sound hypersensitivity. Sound therapy decreases the contrast between the tinnitus and external sounds to get the brain more used to the tinnitus sounds. According to Hear Canada, more than 100 studies have shown that 80% of people have improved their tinnitus with TRT.

A PROMISING NEW TREATMENT ON THE HORIZON

A new device for treating tinnitus may soon be available for individuals who have tinnitus they can modulate with head or neck movements, such as tilting their head or moving their jawbone. About 70% of people with tinnitus have this type of tinnitus, called somatic tinnitus.

Several years ago, Dr. Shore and members of her lab made a critical discovery using guinea pigs.

“We found that in addition to auditory nerves, other nerves from touch-sensitive places in the body, called somatosensory nerves, provide input into the cochlear nucleus in the brain,” said Dr. Shore. “We also discovered we could turn down the excitability of tinnitus-creating cells in the cochlear nucleus by combining input from the somatosensory and the auditory systems with a precise order and timing.”

To translate this insight to human studies, they developed a prototype device that delivers both types of stimulation via an in-ear headphone and two electrodes that attach to the skin on the neck or cheek. The level of stimulation is calibrated for each user’s tinnitus. The ground-breaking results of their first clinical trial were published in *Science Translational Medicine* in 2018, followed by a larger study published in *JAMA Network Open* in June 2023.

In the larger trial, 99 people with bothersome tinnitus used the device at home for 30 minutes daily for six weeks. Half of the participants received the bi-sensory treatment, and the other half received sound treatment only. None of the participants knew which treatment they received since the electrical stimulation from the active device was not noticeable.

MORE THAN 60% OF PEOPLE IN THE BI-SENSORY TREATMENT GROUP EXPERIENCED SIGNIFICANT DECREASES IN TINNITUS SYMPTOMS, YET THE SOUND-ONLY GROUP EXPERIENCED ONLY SMALL CHANGES.

Even during a following six-week break, people in the bi-sensory group continued to report improvements that lasted up to 36 weeks. They consistently reported an improved quality of life, handicap scores, and lower tinnitus volume.

PROTECT YOUR HEARING

Sound is measured in decibels (dB). A whisper is about 30 dB, and everyday conversation is about 60 dB. But noise that’s 70 dB or louder over a prolonged period can damage your hearing.

According to the U.S. Centers for Disease Control and Prevention:

- ▶ two hours of exposure to gas-powered lawnmowers or leaf blowers (80 to 85 dB) may cause hearing damage;
- ▶ 15 minutes of exposure to noise at a football game (100 dB) may cause hearing loss; and
- ▶ less than five minutes of loud music on personal headphones at maximum volume or a rock concert (105-110 dB) may cause hearing loss.

Learn more about tinnitus from these reputable organizations:

- ▶ HearCANADA
hearcanada.com/en-ca/hearing-services/tinnitus-management
- ▶ The National Institute on Deafness and Other Communication Disorders
nidcd.nih.gov/health/tinnitus
- ▶ The American Tinnitus Association
ata.org

“Our results were very encouraging,” said Dr. Shore, who has formed the company Auricle with two colleagues. “We are now working toward gaining regulatory clearance for the device. If our submissions are successful, we plan to commercialize the device as soon as possible so that it may be available to help the many people who struggle with tinnitus.”

In the meantime, if you suffer from ringing, buzzing, or screeching noises that aren’t really there, know that you’re not alone. Your best bet for finding relief is to consult an audiologist about proven effective treatment options and speak to your healthcare provider to learn whether medications for improving mood or sleep are right for you. 🧠