

Does how loud you snore matter to your health?

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Snoring is often a sign of a very serious condition known as obstructive sleep apnea, a common disorder marked by loud snoring and stops and restarts in breathing. Until now it was thought that the louder the snore,

the worse the sleep apnea. But current and ongoing research shows paradigms may be shifting in how we think about snoring.

"Snoring is the primary reason people see a sleep doctor, even if there are no other disruptions in their daily lives," said Dan Vena, Ph.D., a researcher in the Division of Sleep and Circadian Disorders at Brigham and Women's Hospital. "I'd argue it's also one of the main reasons people treat their sleep apnea, as snoring can cause issues between bed partners."

But what really causes snoring, and what do snore sounds—especially how loud they are—tell us about the severity of a condition like sleep apnea?

"Our ... researchers have been studying complex questions about sleep apnea for years, and their research is filling critical gaps that one day could help the millions of people who may be living with sleep apnea get a diagnosis and treatment," said Marishka Brown, Ph.D., director of the National Center on Sleep Disorder Research at NHLBI.

In the world of sleep disordered breathing, that would be huge. Huge because sleep apnea can be linked with [high blood pressure](#), increase the risk for cardiovascular disease and diabetes. Left untreated, it can be fatal.

"To properly acknowledge the severity of sleep apnea from snore sounds," Vena said, "we need to understand what causes snoring to the full extent."

A shift in thinking

The prevailing view has been that snoring happens when you transition from a light sleep to a deep sleep. This causes the muscles in the roof of

your mouth, throat, and nose to relax. In snorers, the muscles can relax so much that they partially block the airway. This obstruction results in increased air turbulence when a person breathes in, causing the soft tissues in the upper airways to vibrate and make a snoring sound.

Yet, researchers have been puzzled by an odd thing: snoring seems to increase during [slow wave sleep](#), when the airway is known to be less prone to collapsing, and it seems less frequent during REM sleep, when the airway is most prone to collapsing.

Vena and his colleagues thought there had to be more to the story.

In their study, they enrolled 40 patients with suspected or diagnosed sleep apnea and hooked them up to a mask to measure their airflow during a night's sleep. They recorded ventilatory drive, a measure of the patient's effort to breathe, using a catheter inserted down the throat and into the esophagus to record the muscle activity of the diaphragm. They determined snore loudness by using a high-quality microphone attached over the throat.

The researchers then examined, separately, the effect that airway narrowing and effort to breathe had on snore loudness. In addition, they investigated differences in snore loudness across different forms of sleep disordered breathing, such as apneas, when breathing has completely stopped, and hypopneas, when breathing is greatly reduced. They also looked at the variety of sleep stages experienced nightly to better pinpoint which factors played the bigger role in snore loudness.

"As expected, we found that a mildly collapsible airway generated snoring, and the snores got louder the more the airway became obstructed," said Vena. "But our research also showed that snore loudness has a lot to do with the how much effort a person is making to breathe."

Specifically, the researchers found that snoring is at its loudest when the effort to breathe is high and there's greater obstruction. But it then decreases in the presence of extreme obstruction, such as during sleep apnea.

Increasing the effort to breathe without any airflow obstruction had little impact on snore loudness; nor did worsening obstruction combined with normal breathing effort seem to impact snore loudness.

Surprisingly, the team found that snoring is loudest during periods when a person's breathing effort is stronger, but their levels of airway obstruction are about the same—no matter their sleep stage or form of sleep disordered breathing. This suggests that breathing effort has an equal, if not greater role, than airway obstruction in generating loud snoring.

"The findings ultimately describe a complicated relationship with sleep-disordered breathing in that loudness alone might not be indicative of how severe sleep apnea is," said Vena.

For example, the loudest parts of the night were during periods of mild sleep-disordered breathing—known as stable flow limited breathing—that did not meet the criteria for apnea or hypopnea. On the other hand, the quietest part of the night happened during periods of apnea, which is most concerning because that's when a person isn't breathing.

"In other words, louder snoring in some cases can be indicative of a less severe form of sleep apnea," said Vena.

"This is an important new direction in our understanding of [obstructive sleep apnea](#)," said Brown. "It also highlights the need for continued research into the role sleep health plays in protecting overall health."

Loud snorers among us

The research revealed something else. Even after considering differences in ventilatory drive and airway obstruction, some people just snore louder than others—sometimes twice as loud. This finding alone poses challenges to sound-based diagnostic tools that are being developed to test for sleep-disordered breathing based on a recording of just one night's sleep. Currently there simply isn't a baseline "normal" snore loudness to use for comparison.

Vena said this finding opens more research questions for him and his team to tackle. For example, one future direction is to pursue the mechanisms involved in "why" some patients snore louder. Vena suspects this has to do with differences in the structure of the airways and different sites where the [airway](#) collapses.

"Using this information, we can begin to target the different sites to potentially better treat snoring," Vena said.

"Ultimately, as a bigger picture goal, if we better understand the mechanisms of snoring, we might better explain the still unknown mechanistic link between snoring and adverse cardiovascular outcomes. But on the smaller scale, it might at least save the relationship between snoring and non-snoring bed partners."

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