**The New York Times, Tuesday, December 6, 2016, D1 &3**

**By Catherine Louis**

# NOISE MACHINES

Despite claims, **many volume-limiting headphones for children aren't safe**, an analysis finds. These days, even 3-year-olds wear headphones, and as the holidays approach, retailers are well stocked with brands that claim to be "safe for young ears" or to deliver "100 percent safe listening." The devices limit the volume at which sound can be played; parents rely on them to prevent children from blasting, say, Rihanna at hazardous levels that could lead to hearing loss. But a new analysis by The Wirecutter, a product recommendations website owned by The New York Times, has found that **half of 30 sets of children's headphones** tested **did not restrict volume to the promised limit**. The **worst headphones produced sound so loud that it could be hazardous to ears in minutes**.

"These are terribly important findings," said Cory Portnuff, a pediatric audiologist at the University of Colorado Hospital, who was not involved in the analysis. **"Manufacturers are making claims that aren't accurate."**

The new analysis should be a wake-up call to parents who thought volume-limiting technology offered adequate protection, said Dr. Blake Papsin, the chief otolaryngologist at the Hospital for Sick Children in Toronto.

**"Headphone manufacturers aren't interested in the health of your child's ears:'** he said. "They are interested in selling products, and some of them are not good for you."

Half of 8- to 12-year-olds listen to music daily, and nearly two-thirds of. teenagers do, according to a 2015 report with more than 2,600 participants. Safe listening is a function of both volume and duration: The louder a sound, the less time you should listen to it.

It's not a linear relationship. **Eighty decibels is twice as loud as 70 decibels, and 90 decibels is four times louder.**

Exposure to **100 decibels, about the volume of noise caused by a power lawn mower, is safe for just 15 minutes; noise at 108 decibels, however, is safe for less than three minutes**.

The workplace safety limit for adults, set by the National Institute for Occupational Safety and Health in 1998, is 85 decibels for no more than eight hours. But there is no mandatory standard that restricts the maximum sound output for listening devices or headphones sold in the United States.

When cranked all the way up, modern portable devices can produce sound levels from 97 to 107 decibels, a 2011 study found.

A team at The Wirecutter used two types of sound to test 30 sets of headphones and earbuds with an iPod Touch. First, they played a snippet of Major Lazer's hit "Cold Water" as a real-world example of the kind of thumping music children listen to all the time.

Second, the testers played **pink noise**, usually used to test the output levels of equipment, to see whether the headphones actually limited volume to 85 decibels.

Playing 21 seconds of "Cold Water" at maximum volume, half of the 30 headphones exceeded 85 decibels. **The loudest headphones went to 114 decibels.** .

With pink noise, **roughly one-third exceeded 85 decibels; the loudest was recorded at 108 decibels.** Complete results are available at thewirecutter.com.

To pinpoint the earbuds that did reduce volume the Wirecutter team hooked up a computer to a simulated ear with a microphone inside and a coupler that models the acoustics of an ear canal.

Brian Fligor, an audiologist who is a member of the World Health Organization's working group on safe listening devices, advised the team on how to compare its results to data on the

85-decibel workplace limit. (Headphones and earbuds are much closer to the ear, obviously; the workplace limit was devised with open areas in mind.)

Lauren Dragan, an editor at The Wirecutter, also corralled a half-dozen children, 3 to 11 years old, to try on each model, choose favorites and compile a "hate list" of ones they would never use.

In the end, the overall pick for the children was a Bluetooth model called the Puro BT2200 ($99.99). The headphones were well-liked by both toddlers and tweens, had excellent sound quality, offered some noise cancellation features and adequately restricted volume **as long as the cord wasn't used**.

The battery lasts an impressive 18 to 22 hours, and the wired connection is used only as a backup. But that cord must be plugged in as labeled, with one particular end to the headphones and the other to the music device. If inserted the wrong way, "it'll play really loud," said Brent Butterworth, an audio expert who helped test all the headphones.

"If they are using it in Bluetooth mode, it's impossible to make too loud," he added.

Most of the other models relied on resistors, which impede electrical currents, inside the cord to reduce volume, but they sometimes failed to work. Both of the overall runners-up were not Bluetooth, however; despite the cords, their maximum volumes did not exceed 85 decibels.

Toddlers liked the fit of Onanoff Buddyphones Explore ($29.99) but will most likely outgrow them, the analysis found, and the sound quality didn't compare to that of the Puro. The corded pick for older children, ages 4 to 11, was JLab JBuddies Studio ($29.99).

The Wirecutter team also assessed the headphones' ability to reduce ambient noise. Children often wear headphones in noisy places, like car back seats and planes. Without noise cancellation, the natural tendency is to pump up the volume to hear over the background noise.

**Only four of the 30 sets of headphones tested blocked a significant amount of low frequency sound similar to that in a car or an airplane cabin**. A pair of earbuds - Etymotic ETY Kids 3 ($49) and Puro IEM200 ($29.99) - did the best job at blocking outside sounds. (The other two were Direct Sound YourTones ($119.95) and Nabi ($69.99).)

Dr. Papsin recommended buying headphones that both limit volume and cancel outside noise. "It's worth the money," he said. .

But the analysis based its top three on their volume-limiting capacity. "Unless you're on a plane or in a car, you don't need to worry as much about isolation:' Ms. Dragan said.

**No Substitute for Supervision**

Even with headphones that effectively limit maximum sound, supervision is crucial. "**Eighty-five decibels isn't some magic threshold below which you're perfectly safe and above which your ears bleed**," Dr. Fligor said.

Audiologists offered some tips for listening: First, **keep the volume at 60 percent**. Second, encourage your child to **take breaks every hour** to allow the hair cells in the inner ear to rest. **Nonstop listening can eventually damage them**.

Finally, Dr. Jim Battey, the director of the National Institute on Deafness and Other Communication Disorders, offered this practical rule: **If a parent is an arm's length away, a child wearing headphones should still be able to hear when asked a question.**

Let that sink in: **If they can't hear you, "that level of noise is unsafe and potentially damaging,"** Dr. Battey said.

Whether this generation of children suffers greater hearing loss than previous ones is the subject of scientific debate. Studies have shown mixed results.

In 2010, a nationally representative study suggested that hearing loss among adolescents

had increased to 19.5 percent in 2005- 2006 from 14.9 percent in 1988-1994.

But those figures included both **high-frequency loss usually associated with noise** and **low-frequency loss linked to ear infections or even impacted earwax**. Most of the hearing loss found in that study was minor, and in one ear.

In 2011, a study that used the same data but excluded more adolescents found no statistically significant increases in hearing loss overall. But there was an increase in hearing loss among girls.

**"Boys and men have always had worse hearing,"** Dr. Fligor explained, partly because historically they have been more likely to engage in extremely loud activities. The 2011 study in Pediatrics suggested that **girls were catching up.**

Even if there were an indisputable increase in hearing loss among adolescents, it is not at all clear that the main culprit is cranking at full blast. Children are exposed to other hazardous noise: lawn mowers, rock concerts, firearms, sporting events and police sirens.

"It may be premature to blame music players," Dr. Portnuff said. Still, he added, "we know that a substantial segment of the population choose hearing levels that put them at risk for hearing loss."

Dr. Papsin, a father of five, argued that it was too late to put the horse back in the barn - adults are going to let children wear headphones to watch the in-flight movie and to stay entertained in a dozen other ways.

"I'm not going to get on a high horse as an old man and say, 'Don't do this.' Every parent should have a three-hour flight to themselves."

Still, he said, "you have to know your free time isn't costing your child lifelong hearing problems."