

DEVICES	CLEAR HEARING		
	WORDS PAYAL KHANDELWAL	PHOTOS RISHIKESH KUMAR	ILLUSTRATIONS EVGENIA BARINOVA
INDIA	HEARING IMPAIRED 1.3 MILLION	RURAL POPULATION 852 MILLION	

Mobile phone parts and rubbery earbuds serve as low-cost hearing aids for India's rural residents —Clear Hearing

At 15 years old, Mantu Kumar could hardly register sounds in his right ear, and he constantly had to ask people to speak up. Mantu, who lives in a rural village in northeastern Bihar state, couldn't afford a conventional hearing aid. So he learned to adjust to the physical quiet and a sense of isolation in daily life. That is until late 2013, when a young inventor handed him a device made from recycled mobile phone parts.

Mantu slipped into his deaf ear a round, rubbery earbud, which connected to a small plastic box. Inside the tiny case was a handmade electro-acoustic system, made of a microphone, four resistors, three transistors, and two capacitors that all worked to receive, amplify and regulate sound waves directly into Mantu's ear. A small rechargeable battery allowed him to power the device for up to 13 hours on a single charge.

"After so many years, I was able to clearly hear all the voices around me," Mantu, now 25, recalls. "It was a great experience."

The device came from Rishikesh Kumar, a university student who lived close by in the Madhubani district in Bihar. Rishikesh was field-testing his design on a dozen adults and children in Rahika and other villages, where low-cost options for hearing aids were not available, though needed by many.

The project began nearly two years ago, when Rishikesh began his Bachelor of Science program and a teacher made a casual comment that sparked the idea. The teacher runs a wood-cutting shop on the side, and he told Rishikesh that one of his staff members, who is hard of hearing, regularly made mistakes at work because he couldn't hear the instructions properly. The teacher half-jokingly told Rishikesh to find a solution for the man's problem.

Rishikesh took up the challenge. The wood-cutter's situation, after all, wasn't rare. Many people in India, especially the elderly, suffer from hearing impairments yet can't pay for

Rishikesh's low-cost hearing aid borrows from old mobile phones and basic ear buds.



hearing aids. Devices in India can cost between INR 1,000 (USD 16) and INR 4,000 (USD 63), a price often too steep for the majority of India's rural residents— 60 percent of whom live on less than INR 35 (USD 0.52) a day.

"It's not like I had an immediate solution to the problem," says Rishikesh, 18. "But I knew that there was a huge gap in the hearing device market, which I could fill up if I put my mind to it." After about seven months of thinking and experimenting with technology, he developed a prototype for an extremely low cost: Just INR 75 (USD 1.20).



Rishikesh Kumar, second from right, won an award for his hearing aid design at the 2014 Bihar Innovation Forum's Innovation Expo.



Amelia Marzec, a Brooklyn-based artist, lost hearing in one ear due to a tumor. The conventional solution involved screwing an implant directly into the skull and snapping on a hearing aid, which vibrates and conducts sound. Surgery can cost tens of thousands of US dollars, and the expensive hearing aids need frequent replacement. "I realized it sounded like something I could build in my living room," Marzec told *The Magazine*. After a stop at RadioShack, she connected microphones and signal amplifiers to a vibration

component and effects circuit, then slipped everything inside a slick black construction hardhat. Her Re-wired helmet adjusts to any head shape, and dials mounted on the sides can tweak the sound and volume. It can't quite match the sound supplied by a true bone-anchored hearing aid, but Marzec's device "leaves the wearer free to roam their environment and experience a physical sensitivity to sound," she explains.



ameliamarzec.com/rewired/

Rishikesh cracked the cost barrier by building with old electronic parts, and by designing a system with fewer parts than a conventional hearing aid. Last year, he presented his device at the Bihar Innovation Forum's Innovation Expo, which is organized by Jeevika, a government initiative to improve the quality of life for India's rural poor. Rishikesh won the Best Grassroots Innovator Award and a check for INR 100,000 (USD 1,570), presented by the chief minister of Bihar.

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Since then, however, his progress has stalled as he navigates India's patenting system. He says that even though the government recognized the importance of his invention, officials have done little to help speed up the bureaucratic process.

Rishikesh, who lives in Madhubani with his parents and two older siblings, is in the second year of his bachelor's program. He says he's hopeful his hearing aid will continue to become more accessible across rural India. Once his patent is finalized, he plans to hand over the design to a company that can mass-produce the device. "I'm still in college, and I want to concentrate on creating more innovative solutions that can help the poor, so I don't want to be involved in the production part," he explains.

In the meantime, Rishikesh continues to showcase his prototype at various events. At a recent forum, an attendee advised using a longer-lasting battery. He's taken that tip as yet another problem to solve. Which means constantly tinkering with new parts and designs as he works toward patenting his handmade hearing aid. ☒