DRUMBEAT.AI

AN AMBITIOUS PROGRAM TO BEAT EAR-DRUM DISEASE IN RURAL AND REMOTE INDIGENOUS CHILDREN

WHAT IF YOU COULD FIND a solution to help address one of our most shameful health figures? That's the aim of an ambitious team using artificial intelligence (AI) to try to solve problems before they begin.

Associate Professor Narinder Singh is a curious mix of farm-raised country-boy and self-confessed computer-geek who has combined a lifelong fascination with technology with his skills as a University of Sydney Professor of Otolaryngology (ear, nose & throat, head and neck surgery) to lead the project dubbed DrumBeat.ai. He and his team have created an AI algorithm that can accurately detect ear disease, or the potential for it, from a simple image, so that rural and remote Indigenous children can be diagnosed and treated before lifelong damage is done.

"Aboriginal children have the highest rates of chronic middle ear disease, with associated hearing loss, in the world." Associate Professor Narinder Singh explained.

"Long term ear disease in childhood can have a devastating impact on hearing which results in issues with speech and language development and has lifelong impacts on behaviour, social isolation, poor school performance, reduced job prospects and interaction with the criminal justice system, along with the need for repeated and complex surgical intervention–if that person ever receives a diagnosis or treatment.

"Unfortunately, despite many programs and hundreds of millions of dollars spent on tackling the issue, there has been little progress. One of the key issues is the lack of access to ENT specialists."

A seemingly intractable problem, which Associate Professor Singh felt his particular skill set might have a chance at tackling. He said "I grew up driving tractors and picking fruit after-school and on weekends on our family's farm near Griffith, in country NSW, with the nearest ENT specialist being a 400km round-trip away in Wagga".

"When I was 12, I convinced my parents to buy my first computer, a Commodore Vic 20. The entire computer ran on 3.5kb of RAM. It was 15 years before the internet was developed so I had to learn how to program the computer using library books and magazines. So, you can see how I gained a very strong personal conviction for using computer technology to solve critical health problems for underserved rural communities."

Associate Professor Singh maintained that passion as he progressed through his medical career and in 2018 began work on melding the two in a bid to make radical change.

"It was a combination of being aware of Indigenous ear disease as a critical problem through ENT, having grown up in the country and knowing the issues facing rural and remote healthcare and then having that background in technology and computers."

ENT specialists simply aren't available in rural and remote areas. Instead, telemedicine has been utilised for Indigenous children in such communities. Local health workers check the ears, capture otoscope images, perform hearing tests and then store and forward the data for metropolitan ENTs to review.

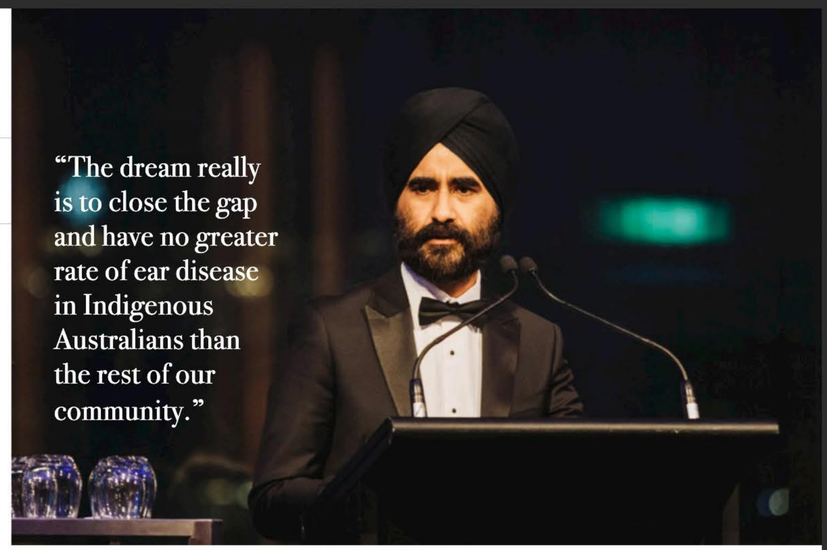
"While telemedicine has improved outcomes, it has several limitations. The metropolitan specialist must waste a lot of time looking at normal ear images. There are significant delays between image capture, review and intervention which can result in complications. Just as importantly there's a missed opportunity for intervention at the crucial point of contact with the patient and data capture."

Associate Professor Singh's group collected a database of images from rural and remote Indigenous children in Queensland and the Northern Territory.

"Our dataset is unique. We have collected 10,000 images, all of them with the associated data—hearing tests, tympanometry and nurse impressions—that have been gathered over a 10 year period, from 93 Indigenous communities. It's the exact data set from the actual patient population we plan on treating."

Associate Professor Singh and his team, including a group of computer engineers and data scientists provided by Microsoft's "AI for Good" program, have refined their AI algorithm through multiple iterations over the last few years.

Pre-teen Narinder with his first computer



Associate Professor Narinder Singh, Head of Otolaryngology, Head and Neck Surgery at Westmead Hospital addressing AMA (NSW)'s Night For The Profession.

The algorithm has reached a level of sophistication where, when presented with a random otoscopic image, it is able to make a diagnosis with over 90% accuracy, outperforming individual human ENT specialists.

Additionally, AI allows Associate Professor Singh's team to undertake novel tasks that even human ENTs are incapable of performing.

"In the latest version of the algorithm we are able to accurately predict the actual level of hearing loss just by looking at the otoscopic image alone. Even more exciting, in the next version of the algorithm, we expect to take completely normal-looking ear drum images and predict which children will go on to develop ear disease, despite having an ear that appears totally normal at the time of review. This will allow us to flag these children for extra attention to prevent such ear disease from developing."

"So now the next big step is to actually test the AI algorithm in the field. By putting it in the hands of local health care workers we will assess usage and acceptance by nurses, audiologists, patients, their families and their communities."

"That'll be about a two-year process in Queensland, the NT and Western Australia, courtesy of a $400,000 grant generously awarded by the Ramsay Hospital Research Foundation. If we find that the AI algorithm actually changes outcomes in the real world, then it is "Go-Time" to roll it out across Australia."

"The dream scenario is a smartphone app that can link to a video-otoscope so that end users can put the otoscope into a child's ear and get an instant, accurate diagnosis. After deploying throughout Australia, stage two would be to use the same technology in underserved communities around the world; Sub-Saharan Africa, rural India, etc."

"Equally, the same technology could be used in developed countries, in general practice, hospitals and emergency departments. If we were able to secure a commercial partner/sponsor we could develop a product with a philanthropic model such that for every device that is bought, we donate another device to an underserved community."

"The dream really is to close the gap and have no greater rate of ear disease in Indigenous Australians than the rest of our community." dr.

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