



Annual impact report



2021



National Acoustic Laboratories' mission is to lead the world in hearing research and evidence-based innovation to improve hearing health and transform the lives of people with hearing difficulties.

As one of the longest established hearing research institutes in the world, NAL's work has delivered significant advancement in knowledge and practical tools for the hearing community since 1947.

Our team of world-class researchers and innovators focuses on projects that deliver impact and address unmet needs through truly translational research.

NAL's contemporary methodologies overcome traditional barriers to deliver research that benefits researchers, clinicians, industry experts, product developers and, most importantly, people with hearing difficulties.

ACKNOWLEDGEMENT OF COUNTRY

NAL acknowledges the Aboriginal and Torres Strait Islander peoples – the traditional custodians of the lands across Australia on which we work, live and learn. We pay our respects to ancestors and Elders past, present and emerging.

NAL is committed to honouring Aboriginal and Torres Strait Islander peoples' unique cultural and spiritual relationships to the land, waters and seas and their rich contribution to society.

We are committed to a future in which Aboriginal and Torres Strait Islander people take up their rightful opportunities; grow strong in their identity, culture and language; and in which ear and hearing problems do not alter the trajectory of Aboriginal and Torres Strait Islander peoples' lives.

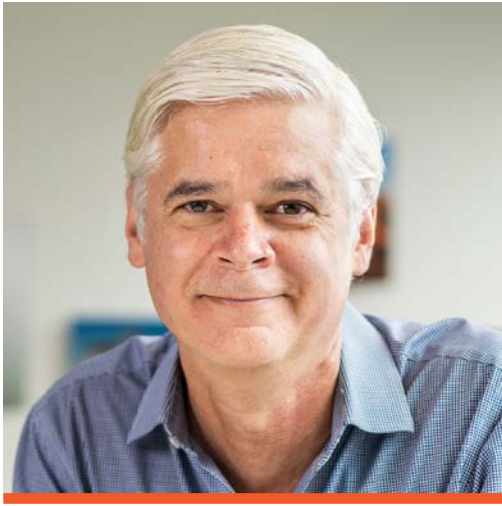
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Message from Dr. Brent Edwards

NAL Director

2021 was a challenging year for the National Acoustic Laboratories, as it was for every organisation around the world. I am proud of how our team pivoted throughout the year, adjusting the way we work as restrictions changed, while still making progress on our mission to improve the lives of those with hearing loss.

NAL continued to support the Australian Government's Department of Health with its research to gather evidence for specific policy initiatives, with work investigating how best to identify the need for hearing healthcare and leading a multisite study on the benefit of cochlear implant processor upgrades. We were pleased to receive from the Department of Health continued funding for our 10+ year Longitudinal Outcomes for Children with Hearing Impairment (LOCHI) study. Additionally, we were pleased to receive new funding from the Department of Health to initiate an Aboriginal and Torres Strait Islander longitudinal study on paediatric hearing healthcare outcomes.

In 2021, we introduced our new strategic priorities in the form of Research Challenges, focusing on the development of solutions in emerging hearing healthcare areas. These include Connected Health applications across the patient journey, the application of Artificial Intelligence to hearing healthcare services, improving speech-in-noise understanding for specific populations or situations, and improving access to hearing healthcare among Aboriginal and Torres Strait Islander children.

NAL partners with many different organisations to help with our mission to improve the lives of people with hearing difficulties. We initiated several new projects in partnership with both small emerging start-ups and large established companies. One exciting initiative is a three-way research alliance between NAL, Macquarie University and Phonak that uses an agile approach to research, and leverages the value of the Australian Hearing Hub and its members, of which we are a part. With Hearing Australia, we have worked on several transformative projects to advance hearing healthcare, including the Hearing Loss Prevention Program focused on improving hearing healthcare for Aboriginal and Torres Strait Islander children in Australia.

Finally, in 2021 we continued to provide new hearing healthcare insights through research, and develop innovative technology solutions to transform the lives of people with hearing difficulties, both with and without a diagnosed hearing loss.



Message from Kim Terrell

Hearing Australia Managing Director

National Acoustics Laboratories is the research division of Hearing Australia

Hearing Australia is proud of the impact of NAL's work over many decades.

NAL works with partners and collaborators around the world to deliver evidence-based innovation and research to improve the lives of people with hearing loss.

At Hearing Australia, our clients are at the heart of everything we do, and we have a clear responsibility to deliver the best possible hearing care, particularly in times of crisis when staying connected is so important.

NAL plays an important role in making this happen.

During COVID-19, NAL acted rapidly to address specific problems faced by people with hearing loss. This work demonstrates NAL's core value – not only developing world-leading insights, practices and technologies, but crafting them to be easily adopted in real-world settings.

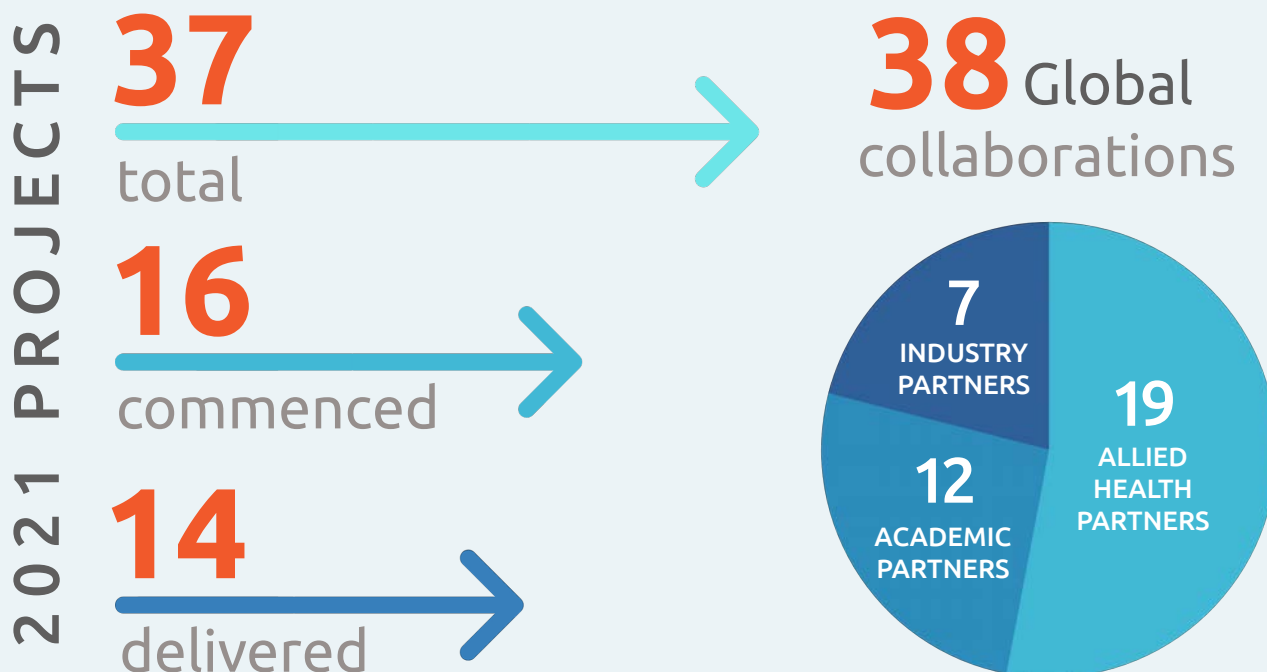
In 2021, NAL also made significant contributions to policy making and a review of the Australian Government's Hearing Services Program. In addition, NAL completed several research projects funded by the Australian Government, including research on Defining Outcomes for the Hearing Services Program and two reports related to key priorities in the 2019 Roadmap for Hearing Health.

This year, the Australian Government also committed to a five-year continuation of NAL's Longitudinal Outcomes of Children with Hearing Impairment (LOCHI), which also marks the beginning of an exciting Aboriginal and Torres Strait Islander LOCHI study. NAL will also continue to support Hearing Australia's initiative to prevent avoidable hearing loss in high risk communities, including reducing the rate of hearing loss in Aboriginal and Torres Strait Islander children.

Hearing Australia is proud that NAL is a global leader in hearing research. NAL's strategic focus on innovation to deliver real world outcomes, its strong network of partners, and its talented team places it in a unique position to help transform the lives of people with hearing difficulties.

2021: A year of global impact

TRANSLATIONAL RESEARCH



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OUTCOMES



6,144 downloads of NALscribe globally in the first three months of release

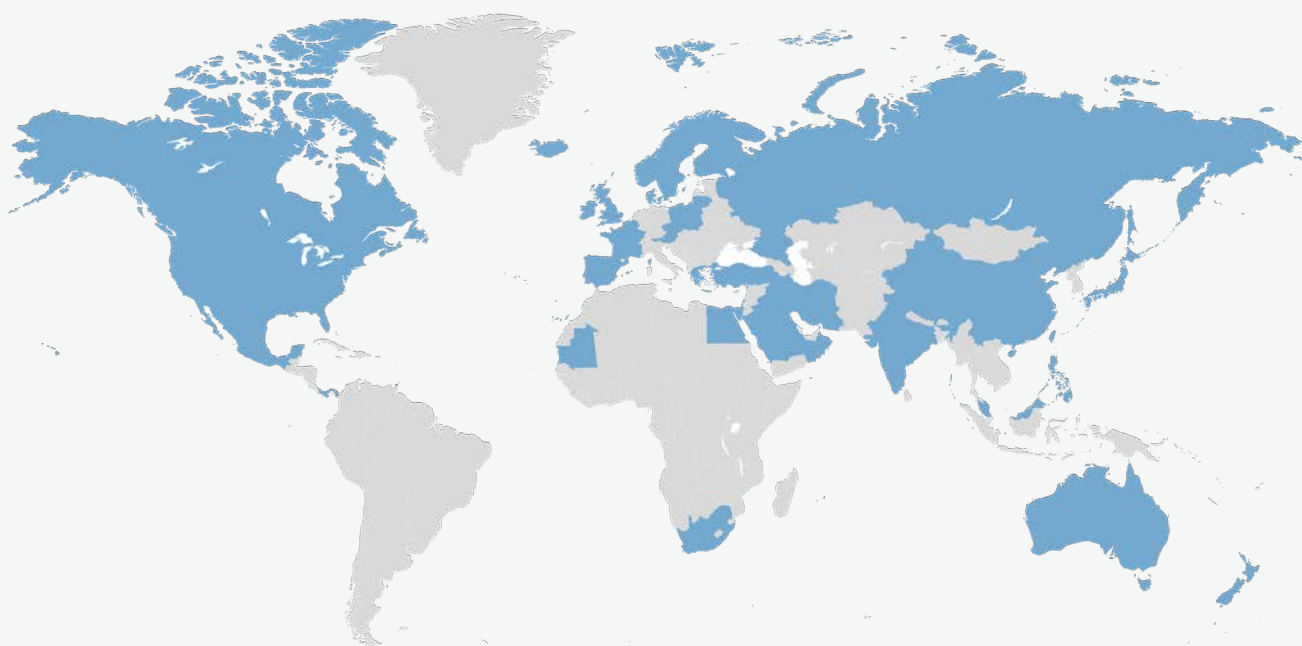


More NAL–NL2 licences increasing year-on-year: the most used prescription software by clinicians worldwide

KNOWLEDGE DISSEMINATION

44 webinars and presentations across
39 countries with **2,487** live attendees

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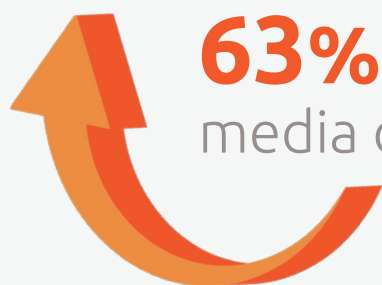


31 publications in **19** journals

1,438 new citations of
NAL publications in one year



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63% increase in social
media connections globally

Outlook to future trends: Accelerating innovation in hearing healthcare

Innovation is driving technology development, new approaches to service delivery, and reinventing how people receive hearing care. The net result is that new consumers are emerging in hearing healthcare and there is a growing investment in innovation that challenges the status quo.

INNOVATION IN HEARING TECHNOLOGY

Incremental innovation continues to improve speech understanding, sound quality, and the user experience of traditional hearing aid users. New alternatives to traditional hearing aids are emerging: from ear-level devices to apps and accessories.



Hearing tech start-ups

2021 saw many start-up companies emerge and mature, developing new solutions for those with hearing difficulties as alternatives to traditional hearing aids. One example is Noopl, who launched an accessory using NAL-developed beamforming technology that can steer a directional microphone system to improve the ability to hear and understand someone in a crowded environment. Innovation from hearing start-ups often highlights where there is opportunity and challenges for the industry to consider different ways to address those unmet needs.



Sound personalisation

Popular smartphone apps, such as SonicCloud, are providing functionality similar to hearing aids, albeit in a very different form factor and user experience. New applications of machine learning are emerging, whether it is to provide improved speech understanding, a better adaptive feature experience or even to provide automated counselling on an app. Such acceleration in innovation to 'personalise' sound has the potential to play a big role in self-fitting and fine-tuning procedures as well as consumer technology.



Speech-in-noise solutions

There is a large population of people with no clinically diagnosed hearing loss who are actively seeking help for difficulties understanding speech-in-noise. NAL is exploring innovative solutions for this population, whether that be smartphone apps, hearables, hearing aids or earpieces for streaming audio with environmental sound pickup.

One surprising finding from our work so far was that people with normal audiograms but difficulty with speech-in-noise can benefit from, and be satisfied with, traditional hearing aids as a solution. Clearly, there is a segment of people underserved by traditional hearing healthcare and NAL is helping to understand the needs and opportunities for this population.



INNOVATION IN HEARING HEALTHCARE SERVICE

The emerging popularity of hearing apps, direct-to-consumer devices, self-fitting solutions and Artificial Intelligence applications will drive further changes in hearing services and their delivery.



Remote service delivery

COVID-19 has accelerated the adoption of teleaudiology services. NAL compared results from our comprehensive teleaudiology survey in 2018 with a repeated survey at the end of 2021 which showed increased acceptance and use by both clinicians and consumers – but will this continue? Policymakers, clinicians and consumers will need evidence that remote services and teleaudiology tools do not disadvantage people with hearing loss compared with in-person service.



Over-the-counter and self-fit solutions

The U.S. Food and Drug Administration's 2021 release of draft regulations for over-the-counter hearing aids was an important milestone around the world: whatever happens in the US will eventually influence hearing healthcare globally. Regardless of the final regulations, innovations in service delivery to include self-assessment and fitting will encourage more people to engage with hearing healthcare, including many who currently do not.

These solutions and services will all require evidence-based validation for the effectiveness of the devices; and a demonstration of the feasibility of the self-fitting tool and the value of adding a direct-to-consumer model to the current established services provided by hearing healthcare professionals.



Artificial Intelligence (AI) solutions

AI is both a tool for clinical services and a replacement. As a tool, AI can facilitate clinical diagnosis, such as DrumBeat.ai, and individualised treatment. AI can also be used to make adjustments to hearing aids – replacing fine-tuning by clinicians. As with applications of AI across all fields of healthcare, in hearing healthcare AI has the potential to provide hearing care to those who can't see a professional and will become a critical tool for clinicians for precision in diagnosis and treatment strategies.

Translational research and innovation

CHALLENGE: UNMET NEEDS

COVID-19 changed the world in many unexpected ways. For people who are hard of hearing, health control measures like social distancing, mask wearing and plexiglass barriers created additional communication challenges. These additional barriers to communication increase stress levels and reduce speech understanding.

NAL's team took on the challenge: How might we improve speech understanding while masks are worn?



PROCESS: IDEATE, CO-DESIGN AND ITERATE

The team explored the unmet needs of communicating with someone wearing a mask to really understand the problem: how people felt and where the problem occurred. This helped to ideate potential solutions. At one stage, the team was pivoting every week.

After creating a detailed picture of user experiences and their needs, NAL rapidly developed a minimum viable product to test whether a speech-to-text app would improve communication with mask-wearers for people with hearing loss. The team determined that people with hearing loss seeking help in hearing clinics experienced the biggest unmet need, so they tested the prototype in functioning clinics across Australia.

The app proved to be useful in busy reception areas and clinicians found it enhanced their ability to communicate effectively with patients in appointments.

Based on user feedback, the team iterated the app to include features for enhanced data privacy, easy readability of captions, the ability to save and share transcripts, and translation to different languages.

“My father-in-law has been profoundly deaf now for many years and we have been searching for any way we can use technology to assist us in communicating, especially with family get togethers... even around his home. It has been a largely frustrating journey of trying all sorts of things... We just came across your app yesterday and just want to say a huge Thank You... it will transform his life and give us all more interaction and access to our father and grandfather.”

— R.W, NALscribe user

IMPACT: SOLUTIONS DELIVERED

In October 2021, the NALscribe app was launched and had over 1,000 downloads in the first week. Since then, NALscribe has had over 100 pieces of coverage across online, print and radio.

Feedback from staff, clinicians and patients has been overwhelmingly positive and the app is being adopted by clinics and hospitals around the world. Additional feedback from users, organisations and the Apple user experience team will be used for future developments.

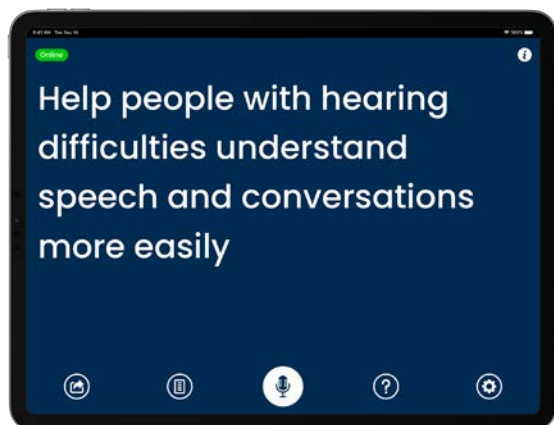
After the success of the NALscribe app, NAL will be working on more hearing health apps that will benefit people around the world with hearing difficulties.

“Through the app, they found reassurance by being able to confirm what they think they heard, and it eliminated any miscommunication. The captioning improved the flow of conversations and, as a result, the overall appointment experience was better for clients. For those who may not speak English as their first language, the app has been useful in helping them to better understand what we’re asking them.”

— E Church, Audiologist, NALscribe user

“I have resorted to pen and paper many times when verbal communication has been impossible. This app facilitates easier communication in so many settings... where accurate communication is important.”

— K Symes, Clinic Manager, NALscribe user



Download
NALscribe

Other rapid solutions during the pandemic

Communication needs caused by the pandemic also inspired projects resulting in:

- NAL mask-adjust: a prescription adjustment table for fitting hearing devices tailored for listening to speakers wearing masks
- The evaluation of patient outcomes and provision of evidence-based advice to clinicians on remote vs in-person appointments

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New leadership team members



Pádraig Kitterick

Head of Audiological Science

NAL welcomed Pádraig to its leadership team as Head of Audiological Science and the adult hearing loss research program. Pádraig was formerly Head of Hearing Science at the School of Medicine, University of Nottingham where he also led the hearing department of the NIHR Nottingham Biomedical Research Centre. He has extensive experience leading hearing aid and cochlear implant research programs with a strong publication record.

Pádraig sees hearing technology following the same path taken by technology in other areas of personal health: smart and adaptive to the user's needs, customisable to the user's preferences, connected to other devices and services, and providing the user with data and data-driven insights. With his scientific rigour and creative mindset, Pádraig's arrival at NAL will bolster NAL's adult hearing loss research program and the NAL innovation agenda.

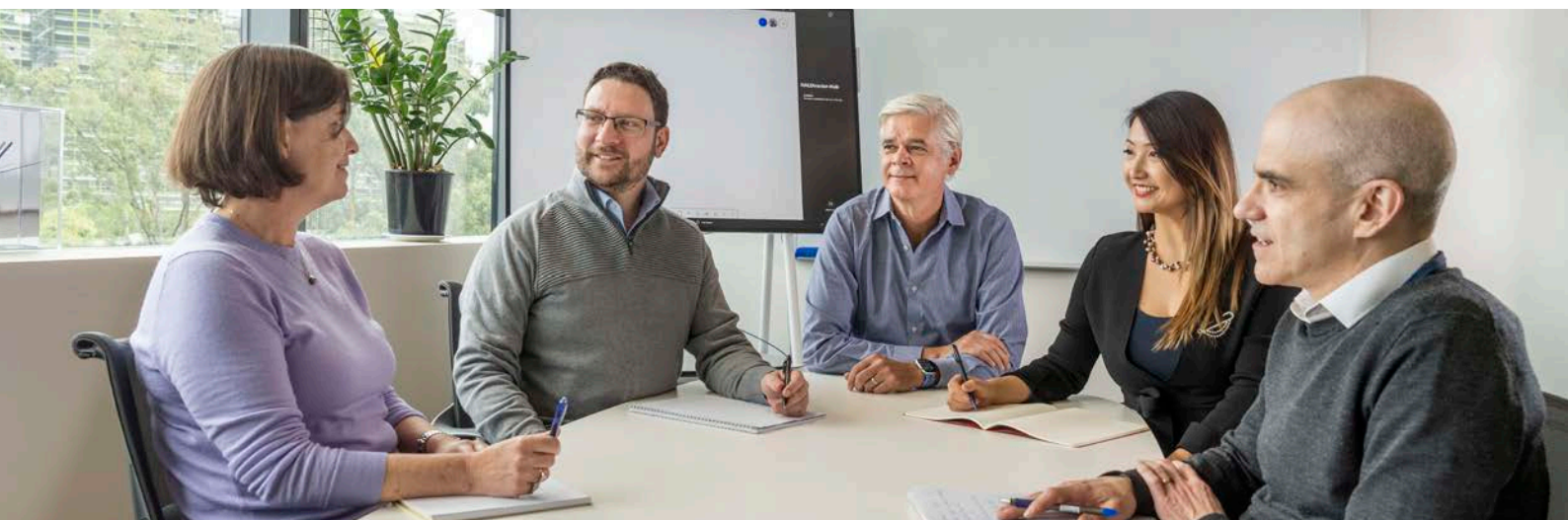


Catherine Morgan

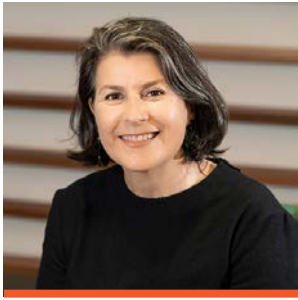
Head of Clinical Trials

In 2021, Catherine joined NAL's Leadership Team to head NAL's new Clinical Trials initiative. Catherine has a proven track record of working in international healthcare and medical devices industries contributing to clinical strategy, structural development, change management, clinical governance, quality management and risk management.

Leveraging NAL's multidisciplinary expertise, emerging technologies and access to over 600 audiology clinics, Catherine will lead a Clinical Trials unit that offers independent, robust and globally compliant clinical data for pre-market product registration, marketing claims or post-market clinical follow-up (PMCF). Catherine believes that the hearing healthcare delivery system will evolve into person-centred care, with readily accessible wearable technologies and portable clinical software apps linking hearing to other health concerns.



Featured researchers



Paola Incerti

Senior Research Audiologist

In 2009, Paola chose to work at NAL because it's "simply the best place to work – with the opportunity to research, ideate, discover, learn, follow our passions, and help people all at the same time".

Paola currently leads a large, multi-centre study funded by the Australian Government Department of Health evaluating the clinical- and cost-effectiveness of upgrading cochlear implant sound processors in older adults.

Paola believes that COVID-19 and related (yet unknown) challenges will continue to drive innovation over the next 5 years, and that NAL is perfectly placed to continue to drive understanding through rigorous, inclusive, evidence-based research.

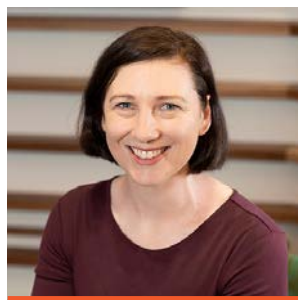


Joaquin Valderrama-Valenzuela

Senior Research Scientist

Joaquin's desire to make an impact on society and his focus on applied research drove his choice to work at NAL. He credits his success to his strong work ethic, a highly critical (or even sceptical!) mind when interpreting results, and his ability to communicate the research outcomes effectively.

Recipient of the 2020 NAL Research Excellence Award, Joaquin is currently leading the electrophysiology competency at NAL – objective diagnostic tools to understand the underlying hearing mechanism in normal and abnormal auditory systems. Joaquin is most proud of the work conducted at NAL to deeply understand the unmet needs of people with hearing difficulties despite having a normal audiogram.



Viv Marnane

Research Speech Pathologist and Research Project Coordinator

On the brink of applying to study audiology, the opportunity to work at NAL changed the trajectory of Viv's life. Now an integral part of the Communication Sciences Department, in 2021 Viv was awarded NAL's highest honour – the NAL Research Excellence Award.

A fervent believer that multidisciplinary teams deliver successful projects, Viv's passion for impact fuels translational research outcomes in paediatric hearing – including investigating the efficacy of early intervention and amplification, identifying the factors that affect short- and long-term outcomes for paediatric populations, and addressing barriers in hearing healthcare for Aboriginal and Torres Strait Islander children.

[LEARN MORE](#)

Speech-in-noise difficulties beyond the audiogram

IMPACT
PROJECT



THE CHALLENGE

A large percentage of adults experience abnormal difficulty understanding speech in noisy environments despite having clinically normal audiograms. Many within this population seek help from hearing healthcare professionals who report feelings of frustration and disempowerment because there is no validated best practice intervention for this group.



OUR APPROACH

A NAL team postulated that low-gain hearing aids with directionality, beamforming and noise reduction might mitigate the hearing difficulties of this population with no clinical hearing loss. Evidence of hearing aid benefit could guide clinicians in recommending solutions for this difficult-to-treat population and demonstrate that this group of people are a viable market for hearing devices.

Objective and subjective measures were obtained both in the laboratory and in real-world situations using a smartphone app. Measures included speech understanding, listening effort, satisfaction and a variety of standardised questionnaires.



OUTCOMES AND IMPACT

The research showed that while low-gain hearing aids are not a panacea, they do improve the ability of this population to comprehend speech within noisy environments. Surprisingly, many participants said that they wanted to continue wearing their hearing aids after the study concluded because of the benefit they received for speech understanding in noise, even though they did not have a measurable hearing loss and would not normally be considered hearing aid candidates.

Importantly, insights from this study will help audiologists provide more informed recommendations for this challenging and underserved population, and also inform and empower this population to manage their hearing difficulties more effectively.

Applying behavioural economics to empower hearing health decisions

IMPACT
PROJECT



THE CHALLENGE

Approximately one third of people who have been diagnosed with a hearing loss and had hearing aids recommended by an audiologist choose not to get them fitted.

Since it is well established that hearing aids can improve quality of life and reduce the psychological, social, and emotional effects of hearing loss, people rejecting hearing aids may be missing out on these benefits.

The NAL Behavioural Insights team wanted to understand what drives the decisions of people who have received a hearing aid recommendation and whether audiologists can better support informed choices by those with hearing loss about proceeding with hearing aid fitting.



OUR APPROACH

Through observations, surveys, focus groups and interviews with both clinicians and those with hearing loss, the team identified common barriers and cognitive biases that influence decisions on whether to proceed with hearing aids. An additional roadblock was a lack of clarity around the diagnostic results and treatment recommendations reported by the person with hearing loss.



Using behavioural economics principles, the team developed and piloted three simple and low-cost tools that a clinic could use to provide more information to clients and a clear conversation guide for clinicians.



OUTCOMES AND IMPACT

There was a significant increase in clarity of treatment recommendations and acceptance of prescribed hearing aids during the study period, demonstrating that the tools were effective in addressing the blockers to hearing aid acceptance.

The recommendations from the NAL Behavioural Insights team were taken up and implemented nationally by the sponsoring hearing health service provider.

Early identification of hearing difficulties in Aboriginal and Torres Strait Islander children

IMPACT
PROJECT



THE CHALLENGE

Ear and hearing troubles are commonly experienced by many Aboriginal and Torres Strait Islander children during their first few years of life – a critical period when children learn to listen, speak and communicate. This can have a lifelong impact on education, employment and social inclusion.

Together with several Aboriginal and Torres Strait Islander communities, NAL co-designed two tools, Parent-evaluated Listening and Understanding Measure (PLUM) and the Hearing and Talking Scale (HATS), to help identify young children with potential hearing or communication difficulties for earlier intervention

The task now is to embed the use of PLUM and HATS into primary health and early childhood education settings.



OUR APPROACH

Consultation was conducted with over 30 nation-, state- and territory-based service providers, including the National Aboriginal Controlled Health Organisation, to understand what would enable the uptake of the PLUM and HATS tools.

The team co-designed resources with an Aboriginal Advisory Group and trained health and early childhood workers in online and face-to-face workshops, including a training module now available for all primary health workers, and videos accessible from a dedicated PLUM and HATS website.



OUTCOMES AND IMPACT

PLUM and HATS has been incorporated in the referral pathway in Hearing Australia. Other agencies, including Deadly Ears (Queensland Health) and Telethon Kids Institute (Perth) have adopted the tools in clinical care, standard tele-consultations, and research.

Featured on SBS radio and various media shares, PLUM and HATS has facilitated earlier referrals and intervention for young Aboriginal and Torres Strait Islander children with hearing difficulties.

LEARN MORE

PLUM and HATS in action



Sherilee McManus
Community Engagement
Officer NSW,
Hearing Australia

SHERILEE MCMANUS TALKS ABOUT PLUM AND HATS IN ACTION

“ I fell in love with PLUM and HATS at first sight. The resources are easy to use, but still provide us with the answers we need about how the child is hearing and communicating at home. Everyone I have spoken with really likes how PLUM and HATS help the parents and carers answer the questions about how the child is hearing. The questions help the parents and carers think about particular situations which they may not normally think about when asked about their child’s hearing.

“ Early Educators tell me that PLUM and HATS helps them start conversations with parents that may otherwise be tricky, and it helps them think differently about how the children are interacting in the school environment. ”

Sherilee believes that it is PLUM and HATS’ simplicity that means it can be administered to find answers which may otherwise be difficult for the parents to provide. This assists the audiologists in assessing the child’s ability to hear and communicate over time.

“ These resources are a great help in creating community engagement with growing hearing health awareness and prevention. ”



Children with mild hearing loss

IMPACT
PROJECT



THE CHALLENGE

Mild hearing loss is the most prevalent type of childhood hearing loss in Australia and there is a long-standing need for evidence-based recommendations on the management and effectiveness of hearing aids for children with mild hearing loss.

In 2018, NAL and Murdoch Children's Research Institute explored the feasibility of a randomised control trial to produce evidence-based recommendations. However, many parents were understandably reluctant to include their child in studies where their child might randomly be placed in the group receiving an inferior treatment plan.



In light of these challenges, the team pivoted the approach to create a feasible study design that allows us to obtain high-quality evidence while addressing parents' hesitation to participate.



OUR APPROACH

The team conducted semi-structured interviews with clinicians and caregivers, and a thematic analysis to identify factors that would influence involvement in a randomised control trial. Three clear overarching themes emerged – timing, impact of the study design, and attitude towards research.



OUTCOMES AND IMPACT

The findings demonstrated that caregivers and audiologists both desire quality evidence to inform decisions around hearing aid fitting, and also highlighted potential gaps in this evidence. There is a need for a more effective approach to inform and prepare caregivers about participating in their child's hearing rehabilitation that leverages audiologists as recruiters of participants. In addition, careful consideration must be given to the study methodology to facilitate choice and control to empower the decision makers.

Our collaboration led to a further study looking at factors predicting the outcomes of children with mild hearing loss to further improve the management and outcomes of these children.

Thank you

Our global connection of collaborators enables translational outcomes and allows us to pursue our mission of improving hearing health and transforming the lives of people with hearing difficulties.

COLLEAGUES



Australian Government
Department of Health



COLLABORATORS

Australasian Newborn Hearing Screening Committee
Awabakal Community Controlled Health Service
Cochlear ANZ and Global
Curtin University
Deafness Foundation
Ear Science Institute, WA
Ida Institute

MedRx
Macquarie University
Murdoch Children's Research Institute
Noopl
Nuheara
Phonak
University of Birmingham, UK
WS Audiology

VALUED CONTRIBUTORS TO NAL RESEARCH

408 participant volunteers

Amplify Hearing and Diagnostics, NSW
Clarity Hearing and Balance, QLD
Cochlear Care Centre
Ear Science Institute, WA
Fiona Stanley Hospital
HEARnet Clinical Studies
Melbourne University
Mater Health Services, QLD
NextSense

56 professional volunteers

North Queensland Cochlear Implant Centre
Quality Home Health
Royal Brisbane Hospital, QLD
Royal Hobart Hospital, TAS
Royal Perth Hospital, WA
Royal Sir Charles Gairdner Hospital, WA
Royal Victorian Eye and Ear Hospital, VIC
South Australia Cochlear Implant Centre, SA



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