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**ENT UK Journal of Global Health**

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foreword

“No person is safe until all – everyone, everywhere – are safe, and no country is safe until all countries are safe”

Amina Mohammed, Deputy Secretary General, UN

This quote relates to the pandemic and the roll out of vaccines, but I think this applies to all that the Global Health Committee is doing and “by working together we can build a better world where everyone thrives in dignity and equality on a healthy planet”.

I wish to thank Vijay Pothula who has led the global health group in all their worthy endeavours following on the work of Robin Youngs. I am delighted to see that Nick Eynon-Lewis will be taking on the chairmanship of the group and with the help of the able committee members take the important work forwards. As President of ENT UK, I am pleased that our international collaborations and friendships are cemented by doing this work together and we can all learn from each other in providing high quality care.

Professor B Nirmal Kumar,
President, ENT UK
ENT UK Global Health Committee

Vijay Pothula – Chairman
I was appointed as a consultant ENT and Head and Neck Surgeon in 2001 and work at WWL and Manchester Foundation Trust sites. I have a keen interest in humanitarian work and have conceived, designed and started the Shravana project in Hyderabad, India in 2006. I have assumed the chairmanship of ENTUK Global Health in 2018. It is our endeavour, in collaboration with British Society of Audiolgy, British Charities, Professionals and Industry, would like to help countries where people have no recourse to any help when affected with deafness or any ENT disorders. We intend to help create services and train their ENT, audiology professionals and make them self-sufficient.

Nicholas Eynon-Lewis – Vice Chairman
Nick is a Consultant ENT surgeon at Bart’s Healthcare NHS Trust. He has had a longstanding interest in overseas medicine. He spent a year in Cape Town on a TWJ fellowship and has been involved in various ENT projects in Africa. He is the lead for undergraduate education at Bart’s and organises and lectures on various postgraduate courses. He is the Vice Chair of the Global Health Committee.
Mr Matthew Clark Consultant Otologist, Gloucestershire Royal Hospital and Education & Training lead for ENT UKs Global Health Committee

Matthew was a trainee in Oxford before undertaking a fellowship in Otology & Neurotology in Vancouver, Canada. He was appointed as an Otologist in Gloucester in 2009 where he is a lead in training and education. This role now extends to ENT UKs Global Health Committee. He has worked in Nepal and Uganda on ear camps and courses, whilst also helping to establish and mentor a post-CCT fellowship programme in Cambodia. Research includes the development of an ear surgery simulator designed for low-resource settings and he is currently co-authoring a guide on delivering and developing Otology in remote or resource-poor countries.

Mr. Sanjiv Kumar MS, DM, FRCSI, FRCS (Glasg), FRCS(ORL-HNS)

I have been a consultant at University Hospital of North Midlands NHS trust since 2012, where I specialise in adult and paediatric otology and have been active role in education and training. I am interested in global health and equality of access to medical care and training across the world. I have been involved in humanitarian care doing ear camps in Uganda. I have been active in setting up and teaching primary care ENT to clinical officers in Uganda. As a member of the ENT UK’s Global committee, I am keen on co-ordinating and helping global charity work undertaken by UK surgeons abroad.

Cheka Spencer

Cheka is a Consultant ENT Surgeon with a special interest in Rhinology, Facial Plastics and Paediatric ENT. He is the Clinical Lead for ENT and Audiology at the Royal Free London NHS Foundation Trust. He is the Global Health editor for the international magazine ENT and Audiology News. He is committed to humanitarianism and has developed many links around the world.
**Mr Misha Verkerk MA (Cantab.) FRCS (ORL-HNS)**

Misha is a senior ENT Registrar in South London and since 2016 has been the UK Director of Global ENT Outreach, a charity that aims to improve the lives of people with hearing loss and ear disease through surgical training and education. His main global health activities have been focussed in Ukraine and Ethiopia. Since 2017, he has led biannual Otology training camps to Mekelle, Ethiopia and established the first temporal bone lab in the region to train local ENT surgeons and prevent the so-called “brain drain” of African-trained surgeons to the West.

Misha is a member of the WHO’s World Hearing Forum and the recipient of grants and awards from the Royal College of Surgeons, Association of Surgeons in Training and the British Medical Association to support his global health work. Misha was the inaugural recipient of the Rising Star Award at the British Academic Conference in Otolaryngology (BACO 2020) and in 2021 he was awarded the Gold Medal for top performance in the FRCS (ORL-HNS) exam. He is proud to represent trainees on the ENT-UK Global Health committee.

**Emma Stapleton**

Emma has been a Consultant Otolaryngologist at Manchester Royal Infirmary since 2018. She is Clinical Lead for the Manchester Cochlear Implant Programme and Undergraduate Lead in ENT. Her other roles include President Elect of the North of England Otolaryngology Society, Editor of ENT UK Newsletter, and Associate Editor of ENT and Audiology News magazine where she introduced a responsible policy for coverage of Global Health initiatives.

Emma has been a volunteer surgeon at the BRINOS Hospital, Nepal, she is a Trustee of Helping Uganda Schools (HUGS) Charity and a Trustee of the TWJ Foundation. She is married with two sons.

**Baveena Heer**

Baveena is currently a medical student at GKT School of Medical Education, King’s College London, and an aspiring ENT surgeon with an interest in Global Health. She leads a multi-disciplinary research group at King’s College London that is focused on developing sustainable technological interventions for current ENT problems in low-resource settings. She is a member of the Global OHNS Initiative, where she works within the Racial Disparities and Gender Disparities research groups. She is also the InciSioN UK representative for King’s College London, where she works to promote safer access to surgery for all through research, education and advocacy. She has previously been a part of Global Brigades at King’s College London, during which she made several brigades to Central America.
Ms Dulani Mendis, B.Sc. DO-HNS, MBA, FRCS (ORL-HNS)
Dulani is a fellowship trained Otolaryngology Consultant specialising in Laryngology, Rhinology and Facial Plastics. She has completed a Royal College interface fellowship in Cosmetic and Reconstructive Surgery and a Canadian fellowship in Benign Head and Neck and Laryngology. She has an interest in health policy, clinical leadership, safety and governance having completed an MBA at Keele University. She is currently completing a Global Health Postgraduate certificate due to an interest in Global Health and an inherent desire to tackle health inequality. Dulani is also an ENT-UK Global Health committee member and treasurer.

Mahmood Bhutta DPhil FRCS (ORL-HNS)
Mr Mahmood Bhutta is academic lead in ENT Surgery at Brighton & Sussex University Hospitals (UK) and founder of the BMA Medical Fair and Ethical Trade Group. He is a consultant ENT surgeon with diverse interests, particularly relating to global inequity. He was formally Phizackerley Senior scholar at Balliol College Oxford where his DPhil was in genetic susceptibility to otitis media. He works with national and international partners on labour rights concerns in healthcare supply chains. He also works on global ear disease, and has delivered training to health workers in Cambodia, Nepal and Uganda, and is a consultant to the WHO program on prevention of deafness and hearing loss.

Mr Sanjay Verma MB, BCh, MA, FRCS(ORL-HNS), PhD (Cantab)
Mr Sanjay Verma is an experienced Consultant ENT surgeon at the Leeds Teaching Hospitals NHS Trust and Nuffield Leeds Hospital, where he has a dedicated adult and children’s ENT practise. He specialises in ear, nose and sinus problems. Over the last decade he has been instrumental in developing laser ear surgery, endoscopic sinus surgery and coblation tonsillectomy techniques in the region.
Ms. Kate Stephenson FRCS ORL-HNS(Eng.),
FC ORL (SA), MMed Consultant Paediatric
Otorhinolaryngologist, Head and Neck
Surgeon Birmingham Children’s Hospital
Kate is a Paediatric Otorhinolaryngologist at Birmingham
Children’s Hospital. Her interests include paediatric head
and neck, airway and voice. She trained in both the UK
and South Africa and completed a fellowship at Great
Ormond Street Hospital.
Kate is the Networking Chairperson for the Young
Otolaryngologists of IFOS and has reviewed for a
number of ENT journals. She has also created Open Access educational materials
in collaboration with the University of Cape Town. Kate is currently developing a
global health section for the ENT UK e-lefENT website with Maha Khan.

Ms Maha Khan
Maha currently trains in Manchester. Her
clinical interests are neurotology and skull
base surgery, and translational and applied
research. She has raised funds for and
volunteered with ENT charities in both the UK
and abroad, and has an interest in the diagnosis
and management of paediatric hearing loss in
a Global Health setting. Maha is a member
of the ENT-INTEGRATE committee, and
President of the North West Trainee Research
Collaborative. She works to promote research and Global Health to students and
Foundation doctors through her work with the ENT-UK’s Student & Foundation
Doctors in Otolaryngology group. She lives in Cheshire with her husband and baby
boy, and when not working, is happiest outdoors.

Robin Youngs MD FRCS
Robin is an ENT Consultant Surgeon in Gloucestershire
who has an interest in the treatment of deafness. He has
been involved with deafness in developing countries for
25 years and is a Director of The Britain Nepal Otology
Service. In addition, he established the Mandalay School
for the Deaf Charity, which supports deaf children in
Myanmar. He has close connections with ENT surgeons
in Myanmar and Nepal, having organized numerous
educational activities.
He was the first Lead for Global Health for ENTUK and is a Past President of the
Otology Section of The Royal Society of Medicine. He is also Emeritus Editor of The
Journal of Laryngology and Otology, an international publication. His MD degree
from the University of London was awarded for research into chronic ear disease.
He has a Postgraduate Certificate in Global Health Policy from the London School
of Hygiene and Tropical Medicine.
GAVISCON ADVANCE PROVIDES EFFECTIVE RELIEF FOR PATIENTS WITH LPR SYMPTOMS

Laryngopharyngeal Reflux (LPR)

References

Prescribing information
Gaviscon Advance Aniseed Suspension PL 00063/0108 Active substances: Each 10 ml dose contains sodium alginate 1000 mg and potassium bicarbonate 200 mg. Indications: Treatment of symptoms resulting from the reflux of acid, bile and pepsin into the oesophagus such as acid regurgitation, heartburn, indigestion (occurring due to the reflux of stomach contents), for instance, after gastric surgery, as a result of hiatus hernia, during pregnancy, accompanying reflux oesophagitis, including symptoms of laryngopharyngeal reflux such as hoarseness and other voice disorders, sore throats and cough. Can also be used to treat the symptoms of gastro-oesophageal reflux during concomitant treatment with or following withdrawal of acid suppressing therapy. Dosage and administration: Adults and children 12 years and over: 5–10 ml after meals and at bedtime. Children under 12 years: Should be given only on medical advice. Elderly: No dose modification is required for this age group. Hepatic Impairment: No dose modification necessary. Renal Insufficiency: Caution if highly restricted salt diet is necessary. Contraindications: This medicinal product is contraindicated in patients with known or suspected hypersensitivity to any of the ingredients, or any of the excipients listed in section 6.1, including methyl parahydroxybenzoate (E218) and propyl parahydroxybenzoate (E216). Special warnings and precautions for use: If symptoms do not improve after 7 days, the clinical situation should be reviewed. This medicinal product contains 106 mg (5.0 mmol) sodium per 10 ml dose, equivalent to 5.3% of the WHO recommended maximum daily intake for sodium. The maximum daily dose of this product is equivalent to 21% of the WHO recommended maximum daily intake for sodium. This product is considered high in sodium. This should be particularly taken into account for those on a low salt diet (e.g. in some cases of congestive heart failure and renal impairment). Potassium: This medicine contains 78 mg (2.0 mmol) potassium per 10 ml dose. To be taken into consideration by patients with reduced kidney function or patients on a controlled potassium diet. Each 10 ml contains 200 mg (2.0 mmol) of calcium carbonate. Care needs to be taken in treating patients with hypercalcaemia.
Each 10 ml contains 200 mg (2.0 mmol) of calcium carbonate. Care needs to be taken in treating patients with hypercalcaemia.

- This medicinal product contains 106 mg (5.0 mmol) sodium per 10 ml dose, equivalent to 5.3% of the WHO recommended maximum daily intake for sodium.

Special warnings and precautions for use:

- Hepatic Impairment: No dose modification necessary.

Dosage and administration:

- Breast feeding: No known effect on breast fed infants. Gaviscon can be used during breast feeding.
- Fertility: No known effect on human fertility. Side effects: Adverse reactions have been ranked under headings of frequency using the following convention: very common (1/10), common (1/100 and <1/10), uncommon (1/1000 and <1/100), rare (1/10,000 and <1/1000), very rare (< 1/10,000) and not known (cannot be estimated from the available data).

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<th>System Organ Class</th>
<th>Frequency</th>
<th>Adverse Event</th>
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<td>Immune System Disorders</td>
<td>Very rare</td>
<td>Anaphylactic and anaphylactoid reactions. Hypersensitivity reactions such as urticaria.</td>
</tr>
<tr>
<td>Respiratory, Thoracic and Mediastinal Disorders</td>
<td>Very rare</td>
<td>Respiratory effects such as bronchospasm.</td>
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Global Hearing Health: Progressing the goal of hearing care for all

Shelly Chadha
Technical lead, Ear and hearing care, World Health Organization

Even as the world battles a prolonged pandemic, hearing loss must be included among and addressed as a public health priority. This is so because:

Hearing loss is rising

It is anticipated that by 2050 there could be nearly 2.5 billion people with some degree of hearing loss, at least 700 million of whom will need rehabilitation services to ensure that they do not face its adverse consequences.

Inaction is expensive

The human cost of unaddressed hearing loss is huge for those living with it and their families. At the same time, a heavy price is also levied on the society at large. National economies are losing close to one trillion dollars each year, due to our collective failure to adequately address hearing loss.

It is possible to address hearing loss

Many cases of hearing loss can be prevented through effective and available measures. For example, hearing loss resulting from infections, birth complications, ear diseases, exposure to noise or ototoxic medicines. In children, nearly 60% of hearing loss is preventable.

Hearing loss is on the rise

Countries must act now to provide access to ear and hearing care for all

#hearingcare
Innovative, cost-effective technological and clinical solutions are available that can benefit nearly everyone who has a hearing loss. Millions are already benefitting from these developments. However, nearly 80% of people with hearing loss live in low- and middle-income countries where services and resources for ear and hearing care remain elusive.\(^2\),\(^5\)

**An additional annual investment of $1.40 per capita can: benefit 1.4 billion people bring a return of $16 for every $ invested over 10 years**

Ear and hearing care is a sound investment

Combining the power of technology with sound public health strategies can ensure that its benefits can reach all those in need. Moreover, investment in hearing care is a financially viable option, as governments can expect a return of nearly $16 for every dollar invested in ear and hearing care.\(^6\)

WHO’s public health framework for ear and hearing care

In it’s recently launched *World report on hearing*, WHO outlines the need and means for hearing across the life course. It acknowledges the challenges faced in making ear and hearing care accessible for all and proposes strategies to address these. Examples of strategies elaborated within the report include: task sharing among highly trained professionals and other health workers that have lesser training requirements, use of digital technologies, and telehealth solutions, among others. Most importantly, the *World report on hearing* provides a public health framework for making ear and hearing care accessible as part of universal health coverage.
**Integrated people-centered ear and hearing care (IPC-EHC)**

IPC-EHC envisions all people having equal access to quality ear and hearing care as part of health services that meet their needs across their life course. Countries can deliver IPC-EHC by ensuring access to evidence-based interventions that are delivered through a strengthened health system.

**Key public health interventions**

Provision of EHC services across the life course are summarized in the acronym ‘H.E.A.R.I.N.G.’. This refers to: Hearing screening and intervention; Ear disease prevention and management; Access to technologies; Rehabilitation services; Improved communication; Noise reduction; and Greater community engagement. Each country must determine which of the H.E.A.R.I.N.G. interventions best suit its needs. This can be achieved through an evidence-based consultative prioritization exercise that considers, among other things, cost–effectiveness, equity and financial risk protection.

Implementation of identified interventions through the IPCEHC approach requires actions at all levels of the health system through:

- Policy guidance and planning with a collaborative approach, including the setting of realistic and time-bound targets.
- Sustainable financing and health protection to ensure that people can access quality EHC services without impoverishment.
- Workforce capacity development by scaling up education programmes for relevant EHC workforce; task sharing with and training of non-EHC cadres.
- Health information and data that helps determine population needs and priorities, identify gaps and tracking progress towards the targets set.
- Equitable access to high-quality hearing technologies, which could be furthered by their inclusion in governments’ lists of essential devices.
- Access to safe and quality diagnostic and surgical equipment as well as the medicines required for EHC.
- Relevant and impact-oriented research that supports implementation of integrated people centered EHC across the life course.
Given the importance and benefits of investing in a systematic scale-up of EHC services, the *World report on hearing* calls for countries to strive for a minimum of a 20% relative increase in the effective coverage of EHC services from by 2030 and identifies three tracer indicators to monitor progress towards this goal.

Achieving this target requires concerted action by all stakeholders in the field of ear and hearing care including governments, international organizations, EHC professionals, civil society and private sector entities.

References:


Abarnna Balasubramaniam¹ and Balakrishnan Thirumaran²
¹Senior Registrar in Otorhinolaryngology & Head and Neck surgery Teaching Hospital Jaffna Sri Lanka
²Consultant ENT Surgeon, Teaching Hospital Jaffna Sri Lanka.

Introduction:

Government health care system of Sri Lanka is broadly classified into curative and preventive side. Curative side is further divided into primary, secondary and tertiary care (Table 1) depending on the availability of the facilities and the strength of the staff. ENT surgeons are appointed from secondary care onwards¹.

The population of Northern Province (NP) is around 1050000. NP has one Teaching hospital (Teaching Hospital Jaffna- THJ) with 2 consultant ENT Surgeons, 4 District general hospitals (DGH) and 2 type A Base hospitals for
secondary care services. Besides the TH, 2 DGH have acting ENT Surgeons, they are covering around 1:100000 populations during weekdays. Therefore ENT Surgeons in THJ cover 1:425000 during weekdays and 1:525000 populations during weekends.

ENT service in primary care setup is limited. They manage acute ENT infections such as ear wax ENT foreign bodies (if they are visible or large), vertigo and allergic rhinitis depending on their ENT training. Rest, they either transfer or refer the patients to the hospital with ENT surgeon, depending on the severity of the disease.

Following services related to ENT are available in TH Jaffna:

- Clinic – Patients are referred from outpatient department, referred from other clinics, other wards of THJ and other hospitals.
- Inward patient care – Two ENT wards are available, They have to share with Orthopaedic unit. Each ward has 10 beds for ENT patients with trained nursing officers. Here they manage the patients with infections, epistaxis, airway problems and surgical patients. Trauma patients are admitted separately in the Accident and Trauma unit.
- Investigations – Biochemical, imaging, endoscopic and histopathological facilities are available. Usual waiting list for routine imaging is less than a month except MRI. It goes upto 6

Following procedures such as examination under microscope, Fiberoptic laryngoscope/bronchoscope, Stroboscope, Rigid nasal endoscope and Functional endoscopic evaluation of swallowing are conducted whenever the patient needs it.

Table 1
to 7 months. ENT unit has one day endoscopic session per week. But if any emergency can do procedures in other days also after get the permission from relevant unit. Histopathology reports are usually available in 2 weeks from the date of procedure.

- Multidisciplinary team discussion both local and virtual is available for problematic cases.
- Surgeries – Wide range from minor to highly skilled surgeries and combined surgeries are done. During surgeries microscope, rigid endoscopes, laser and coblator are used whenever they are needed.
- Training – To undergraduate medical students, postgraduate trainees, nursing students and also conduct workshops to medical officers. Postgraduate ENT trainees should actively be involved to all the components of ENT services during their training period.
- Audiology services – Screening and diagnostic test battery for hearing are conducted to the patients from neonates to elderly including universal newborn hearing screening. Health advice and counselling to the patients regarding hearing loss and its prevention are given. Provide hearing aids freely to the patients with hearing loss.
- Speech and language therapy – These are provided to the patient with either speech or swallowing problems.
- Rehabilitation services - Eg: Vestibular rehabilitation therapy for patients with chronic vertigo.
Challenges to the ENT Units to provide services are,

- Long waiting list for surgery especially ear surgeries (Eg: myringoplasty) as large population is covered by THJ

Challenges after Covid-19 pandemic are,

- Most ENT examinations are aerosol producing procedures- so need to delay them until the RAT for Covid-19 were done.
- When the number of infected patients’ increases, routine theatre sessions are stopped. Only casualty cases, emergency cases and malignant cases are done.
- ENT casualty procedures for Covid 19 positive patients are done in a separate theatre with full PPE. Therefore the ENT team needs to arrange the theatre time for them. Transfer of patients also takes time.
- Difficult to conduct telemedicine due to lack of staff and communication problems to the patients.

References:

2. Monthly Audit, Department of ENT TH/Jaffna.
3. Personal communication with Primary care unit
Cost-effective innovations in airway surgery amidst the finite resources in Nepal: An endeavor on balancing the economic constraints with the surgical care

Bidayt Raj Gyawali, MRCS-ENT (UK), MS, FICS, FACS
Assistant Professor
Department of ENT-HNS, Maharajgunj Medical Campus, Institute of Medicine, T.U. Teaching Hospital, Kathmandu, Nepal

Surgical care in today’s world has been tightly linked with engineering and surgical outcomes have drastically improved with the advent of new technologies. Researches, inventions, and innovations have always been the foundation of patient care with the majority of them being done from the developed part of the world. With a good economy, developed countries have easy access to modern technologies, surgical equipment, and appliances and this has a huge impact on treatment outcomes. Developing countries like Nepal, on the other hand, are yet struggling with the basic health facilities in the far-flung areas of the country. A small market on one hand and exorbitant cost of the modern surgical equipment and appliances incommensurate with economic standards of the patient on the other makes it difficult to deliver quality surgical care especially amidst the scenario where the concept of health insurance is just emerging.

While the country’s economy and flaws from the concerned authorities to prioritize health sector has led to this backlog, need-based researches
and innovations should now be our priority to improve patient care with utmost utilization of local resources and manpower to deliver safe, results-driven, cost-effective care. Here, we share some of our cost-effective innovations in airway surgery to uplift the level of airway surgical care in Nepal.

Airway surgery in Nepal is an emerging subspecialty in otolaryngology. With the generous support of experts from the USA, the country’s central referral hospital, Tribhuvan University Teaching Hospital has been able to start pediatric airway surgery services for the last couple of years.\textsuperscript{1} The surgery on one hand demands a good surgical finesse and on the other requires costly equipment if good outcomes are to be achieved. The paucity of the cases and the surgeries demanding good dexterity made us

\textit{Figure 1: 3D Designing and printing}
feel a dire need of a simulation surgical lab with airway specimens that could be practiced upon. Earlier, cadaveric goat larynx for simulation were used, however, they do not have a lot to offer when it comes to dealing with airway pathologies. This led us to incorporate 3D reconstruction and printing into our practice. Three-dimensional printing in medicine is relatively a new dimension in Nepal. Very few institutions in the country have 3D printers. We were supported by an organization named SAMA Nepal, which generates 3D printed implants for orthopedic rehabilitation of disabled children. Three-dimensional printing requires 3D reconstruction and generation of a printable format from the DICOM (digital imaging and communication in medicine) computed tomography files of the patients’ airway. We used ITK-SNAP software for reconstruction purposes. The printed airway specimens before surgery can be used not only for surgical simulation, practicing incisions and stitches, but also to explain to patients the pathology and the interventions being done as well as to design prosthesis, laryngeal stents, etc. The process of reconstruction and printing is depicted in figure 1. Also, for simulation surgery, we designed an airway surgery laboratory along with a laryngeal stand that can hold the specimen with an adjustable distance between the laryngoscope and the specimen. A range of endoscopic and open surgeries can be practiced in this laboratory. Figure 2 shows our airway surgery laboratory model along with the laryngeal stand that we designed.
As of today, pediatric airway surgery is only being practiced in Tribhuvan University Teaching Hospital in Nepal. Despite the tireless efforts, surgical expertise yet remains to be enhanced when it comes to dealing with complex airway reconstruction and we have to rely most of the time on the experts from abroad to come and perform surgery in those cases. Supraglottic airway stenosis is one such problem that is very hard to deal with and often the patients are left with tracheostomy tubes for a considerable period. While managing a child with supraglottic stenosis, we felt a need for a speaking valve that could let the child speak while on a tracheostomy tube until the reconstructive surgery was done. However, speaking valves are not available in Nepal due to a very small market and very few consumers. Getting it from the neighboring countries is possible however, the cost would be very high which generally is unaffordable to the majority of our patients. This made us innovate a prototype of a speaking valve based on the design of the Passy-Muir speaking valve. We collaborated with engineers of the National Innovation Center, an organization that helps researchers to promote local innovations in Nepal. We designed a 3D model of an outer case and printed it with surgical guide resin that could harbor the valve. We used valves used in conduits of the mechanical ventilator for one-way flow as the diaphragm. Figure 3 shows the end product, a prototype of a speaking valve. It was designed in such a way that the air will flow through the valve during inspiration and on expiration, the valve would close to allow airflow through vocal cords and thus generate the sound. On trial, the patient had a good speech with slight discomfort on expiration. With each expiration, speaking time was around 8 seconds, with a median pitch of 108.04 Hz, Jitter: 2.21%, Shimmer: 18.53%, and intensity of 63.9 dB. This prototype, however, needs approval from the DDA (Department of Drug Administration) of Nepal and currently is in the process of procurement of the approval. Once approved the valve will cost around 20 GBP which can be easily afforded by our patients.

Figure 3: Prototype of speaking valve
Surgical care should be tailored on a need basis and there should always be room for need-directed innovations. Every effort should be made to deliver the utmost patient care with the available resources. Our innovations, although being very small, could be a new start in achieving the best surgical outcomes for developing countries like Nepal.

Acknowledgments

I would like to acknowledge Prof. Rajendra Guragain, Dr. Heempali Dutta, Dr. Yogesh Neupane, Mrs. Prabha Dawade from Institute of Medicine, Mr. Dhruba Raj Gyawali and Mr. Shyam Shrestha from AnD Health Services and ENT Care Center, Mr. Suresh Kaphle and Mr. Rabin Dhamala from SAMA Nepal, Mr. Mahabir Pun and Mr. Samir Aryal from National Innovation Center for providing their immense support in this endeavor.

References


Introduction

Having spent time in several LMIC, particularly some years of full-time work in Nepal, working in government hospitals, charity hospitals, mission hospitals, teaching hospitals, primary health centres and remote communities, I have experienced some of the issues associated with cross cultural work. Including running ear camps and building and staffing a specialist ear hospital. Apart from Nepal I have trained and worked for short periods in North and South India, Ethiopia, Uganda, and Thailand. This led me to think over the benefits and disbenefits of such work and discuss these with many people.

So, what did I learn, and would I do it all again?

Why go?

Motives vary and are often mixed. Many people simply want to help and know they have been lucky enough to have been given the skills to enable them to do so. Some want to develop their own skills and learn in a different environment and work with patients having more advanced or unusual conditions, and this is fine when checked by suitable supervision. Some, for ethical, moral, or political reasons feel called to go to people they perceive to be in need,
whether to serve, or to teach or both. Many just want to travel and have an adventure. It could be a desire to teach, combine with a holiday, to see family, or even perhaps dubiously as an enhancement to a CV. Think about your audience and what is most useful for them. Be aware that circumstances will probably not be exactly as you expect. Can you accept that, and are you able to adapt?

There are many personal benefits. You will almost certainly make new friends and relationships. Remember it is a partnership, working as a team and respecting colleagues.

You will have new experiences, challenges, comical moments, and incredible memories, and these may be some of the best of your life.

**Timing, when and how long should you go for?**

There are different phases in our careers when we may consider volunteering e.g.:

- As a trainee, between posts or as time out of training. Often the opportunity will depend on the attitudes of colleagues and bosses. Some will see great value in such work and others will be highly sceptical. Don’t be put off! It may well require some pushing, but you are very unlikely to regret the move and will learn a lot, not just medically but also in life experiences.
- As a specialist, perhaps as a senior trainee, consultant or GP. Manoeuvering to get time out may be difficult, you may need to use study leave, annual leave, unpaid leave, sabbatical, and negotiate with family. Depending on the length of time needed, a combination of these may be required.
- Retired. This may be an ideal time, you have built up wide experience, and hopefully are not too stuck in your ways! You trained at a time when equipment was more limited, and you may find the same equipment available in a LMIC. Or, you may have been at the forefront of some technique or training programme that you are asked to demonstrate in that LMIC.

You may be thinking of a short visit of a few days to a few weeks or much longer. Each has its benefits, depending on circumstances.

- Brief visits, such as a week or two, useful to do some specific teaching or as a sampler with the intention

![Opportunities to meet incredible people.](image1.jpg)

![Beautiful places and challenging travel.](image2.jpg)
of going back when you know more about the situation and can be more useful. This is probably what most people want to do and is most practical.

- Regular visits, with ongoing contact and commitment are very valuable.
- Longer term: months, or years. Not for everyone, but there are some who commit for longer periods even in some cases for life.

**Challenges**

- Identify opportunities to work overseas, this is often by word of mouth, perhaps something you heard in a conference, or may be part of a recognised regular programme.
- Alone or team? If you go as part of a team, you will have back up and camaraderie, but may be insulated from the daily difficulties faced by your hosts.
- Covering costs. there are grants available, but the costs are unlikely to be high. The major outgoing will be for travel. You may well spend more if you stay at home.
- Visa, medical registration. You need to know the local regulations, there may be a need to obtain a work permit, even as an unpaid volunteer. You should follow local medical regulations, as we would expect of someone coming to our home country. This will also protect you. This can take time and paperwork such as copying your certificates of qualification and higher trainings and providing a CV. It is straightforward to request the GMC to send notification of your UK medical registration directly to the medical council of the country involved, if needed.
- Ideally, work with local individual(s) with strong motivation. You need these for a lasting effect and to make your visit worthwhile. Preferably team up with someone, or an organisation, who has influence and diplomatic skills in their medical establishment.
- Situations and people change. Don’t be disappointed, it is not always easy to make cross cultural relationships, foster change or see development. You may find good people that you work well with move on, or even behave badly. That does not make the work ineffective, there will have been benefit, but perhaps not exactly what you hoped for.
- Accept limitations, failure, frustrations. If you are committed, you will find this hard. If you are a short-term visitor, do what you can in a short time, and hope it has been a fruitful experience for all concerned, and if possible, keep in touch and continue to encourage and learn.

**Language and Culture**

- Do you speak a useful language for that country? If so, that could be invaluable. The medical staff may speak good English, but many patients will not. Try to learn and speak a few phrases. It shows you are keen to communicate and can be fun.
- The culture will be different, and there may be many cultures and languages even within one community. It is fascinating, not just for nice photos but to listen and appreciate different world views. You may be surprised how even simple assumptions and
attitudes in one culture can be quite different in another. That applies between international volunteers as much as with hosts. Don’t jump to judgement when something appears wrong to you. Mistakes can lead to offence or misunderstanding. Brush up on things like dress code, table manners and gestures.

Climate

There may be better seasons to go, for example in the dry season, when travel may be easier and safer. Be prepared with the right clothing.

Attitudes and expectations

- Don’t take on patients that are beyond your experience, especially for surgery. Even when you think no one else local can help, be very cautious. If things don’t go well, apart from the harm to the patient, you may not be supported.
- Expectations of you may be too high (from staff and patients).
- Consider alternatives to your first-choice treatment plan in your home country, there may be more suitable options in the circumstances. Don’t drive people into more poverty with expensive treatments. Remember that patients may not return for follow up or comply with medication. They have more immediate problems in their lives. They may have different views of illness, including traditional beliefs or have no choice but to follow advice from their family or community leaders.
- Use appropriate treatment, tailored
to the patient’s social situation, the equipment, and investigations available, and other facilities, such as nursing care.

• The local staff are used to this and experienced, listen to their wise counsel
• Do not criticize. In any culture, but particularly in honour-shame cultures, this will be offensive and very hard to repair damaged relationships.
• Local hierarchy and seniority are important, even if you can see obvious inequity, poor care or even corruption, be very careful what you say and to whom.
• Centres such as teaching hospitals in major cities need sub-specialists and complex expensive equipment and interaction with experts in the field. However, regional medical facilities need generalists and safe techniques that are appropriate, with teaching about the basics and red flags for referral.
• Do whatever you can to support those dedicated to work in their own country, despite the difficulties they encounter.

Development and change

Low and middle income countries (LMIC) are developing, often very fast.

Disparities in health care are growing between cities, deprived urban areas, remote areas, rich and poor, and private and government health care. Try to support those who are most in need.

Consider risks

These will differ by country e.g.:
• Sickness, some areas have significant risks, such as malaria, typhoid, hepatitis, HIV, dengue, Japanese encephalitis, rabies. Ensure you are vaccinated up to date and aware of local risk factors and preventative strategies. Make sure team members or hosts are aware of your pre-existing medical conditions and take adequate (permitted) medication with you.
• Natural disasters, such as floods and landslides pose risks.
• Travel, especially road travel at night, can be very hazardous. take all reasonable precautions. Don’t drive yourself if there is any choice.
• Crime, terrorism, kidnap, in some areas these are real risks, and you should avoid situations that could increase this.
• Politics; as a visitor keep clear of demonstrations, media comments and anything that could be perceived as offensive.
• Include time for travel delays in your itinerary.

Encourage research and audit

It will usually be welcome if you offer to be a mentor or share authorship to
help colleagues get published. Help the local team to critically analyse their own research proposals and how to write clearly and reach the standards required by peer reviewed journals. Run a journal club meeting. LMIC countries often lack data specific to their situation or about medical conditions rarely seen elsewhere. Much of the research conducted in-country will be poor quality, for many reasons. Assist in building up information to better inform public health and the evidence base. You may be able to assist in setting up research into low-cost solutions, especially for the underprivileged.

Promote reflective practice audit, to better understand personal and institutional results. Sharing you own audits and complications honestly may help. Ethics, and transparency in medical practice are often lacking, possibly for financial reasons, tread carefully, but try to demonstrate best practice.

- Webinars, host one yourself or share links and participate together then discuss afterwards.
- WhatsApp and social media groups, can offer good opportunities to discuss difficult cases (but consider patient confidentiality).
- Facilitate international research collaborations
- Help publicize global health issues, e.g.: Improve the ‘Audibility/Visibility’ of the problem of hearing loss and ear diseases to those with the power to make changes and through personal and professional contacts.

**Equipment donation**

There are many pitfalls but done well this can be an invaluable support.

- Consider what can be improvised, or bought locally, this may be cheaper and more sustainable. It may also be possible for others to replicate effectively.

**Make online connections**

You may be able to help develop connections, such as:

- Telemedicine, with access to experts.
- Seminars and case conferences.

**Auditing patient flow.**

A donated anaesthetic machine arrives with broken glass and missing parts.
• Think whether a donated item can be affordably maintained.
• If you have the chance to beg or buy suitable equipment that you can take with you, do so, but do not add to a mountain of junk that lacks parts or is past its useful life. (Take care with customs rules and do not take items that are past their use by date).
• Only bring expensive equipment at your peril! If parts such as spare bulbs will be needed, then take a good supply.

Repair and maintenance

Learn how to fix simple problems yourself and show others. When there is no local repair mechanism, items are often discarded.

Training courses

Some examples of courses you could offer or assist with would be:
• ENT red flag teaching to health workers

Seminars for ENT surgeons and general physicians, ask what subjects they would like you to teach, and offer some examples.
• Share your personal experience.
• Pre-prepare some suitable teaching materials/presentations, case studies, ready to deliver at short notice if needed.

Donors and Fund raising

• Can you raise donations (or useful equipment) before you go, or after returning?
• Think of creative fundraising ideas, events, presentations, etc.
• Consider who to pass any donations to and how to ensure they reach the right place.
• Feedback to supporters.

Set up or support a charity

Involve yourself in fund raising, whether you are a runner or a socialite everyone has some way to help their chosen charities. Most charities desperately need manpower, for admin, website development, social media and a host of other tasks. Ask and see what they need.

Fortunately in this case, with the help of a visiting colleague and the local maintenance man, it was possible to replace or repair the broken parts.
Gratitude and reward

Yes, it is possible to make a difference and to enjoy the experience. OK, so there are some challenges and preparations to consider, but you will be forgiven a lot as a foreigner and you will make many new friends and memories, and hopefully leave something useful behind, and yes, I would do it all again.

Contact details
www.earaidnepal.org
mike.smith@earaidnepal.org

Teamwork, making lifelong friends and colleagues.

Periodical surveillance meetings to monitor the success of the hub & spoke model
Deafness Screening & Cochlear Implantation in the Indian Subcontinent - “The Hub & Spoke Model of Tamil Nadu”

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Introduction

As per a recent WHO report, there are at present 360 million people worldwide who have disabling hearing loss, out of which children constitute nearly 35%. In the Indian subcontinent the national statistics report nearly 65 million people to suffer from severe to profound hearing disability, which puts the estimate of childhood deafness at about 23 million. A nation-wide survey by the National Program for Prevention and Control of Deafness (NPPCD), has concluded that deafness is the commonest congenital anomaly to affect the huge 1.30 billion strong Indian population, with the incidence being
3:1000 live births. The presence of such a high incidence of hearing loss in children has been causing significant losses to physical and economic productivity, since these children lose their skill to develop speech and language to grow up as disabled persons.

Certain parts of India, especially the southernmost state of Tamil Nadu is heralded as the 'deafness state of India', and reports nearly double the incidence of congenital deafness when compared to the rest of the country. One possible reason for such high incidence in Tamil Nadu (6/1000 live births) is the traditional custom of consanguineous marriages, which leads to propagation of the defective genes amongst members of the family across generations. Multi-centric research work is presently ongoing to identify the unknown genetic factor responsible for the high deafness rates.

Deafness Screening Programs

Implementing universal newborn screening in a vast country like India has been a challenging task because of a high birth rate (25 babies per 1000), diverse socio-economic and cultural backgrounds, limited resources and a large rural population. Newborn hearing screening (NHS) programs were implemented in India beginning in the early 1970s and later, several hospitals established their own hearing screening programs. Presently, despite the lack of a universal newborn hearing screening program, several hospital-based programs and some community-based programs have evolved. In 2006, India launched the National Program for Prevention and Control of Deafness (NPPCD), through which Institution-based screening began to screen every baby born in a hospital or admitted there soon after birth using OAE. Community-based screening also was done simultaneously to screen babies who are not born in hospitals, using a brief questionnaire with behavioral testing done by healthcare workers at the time of their first immunization. By this effort, several children received Cochlear implants and hearing aids in a timely manner to achieve good outcomes.

Government Cochlear Implant Schemes

In India, establishing cochlear implantation as a treatment modality for profound hearing loss has been a daunting task. India was late to wake up to the reality of cochlear implantation. In the late 90’s there was skepticism amongst the medical professionals and the public alike regarding the usefulness of this procedure. Prohibitive costs, multilingual society and deep-rooted cultural prejudices were other reasons for non-acceptance of this technology. The dilemma was to balance an advanced and expensive technology with the requirements of a developing country with economic pressures. Gradually, the situation began to change and in the last two decades, cochlear implantation has been established with universal

Deafness screening program at a peripheral centre in Tamil Nadu
India has now crossed more than two decades since CI technology reached its shores. Today there are around 200 state-of-the-art cochlear implant centers across India, in each major city with talented professionals and well equipped habilitation units for comprehensive management of deaf individuals. The “Cochlear Implant Group of India” which was conceptualized 15 years ago based on the British Cochlear Implant Group, has successfully created awareness regarding CI and has provided the guidelines and support for its propagation across the country.

Even though more than 40,000 cochlear implantations has thus far been done across India, we still face an uphill task with potentially one million children awaiting implantation, for many of whom cost of implant is a deterrent. Hence, many State Governments have now taken the initiative for fully funding Cochlear Implants through their “Chief Ministers Comprehensive Health Insurance Schemes”. This innovative program has been a resounding success with a large number of congenitally deaf children aged below 6 years that have received free of cost implants and with meticulous habilitation have now progressed to gain normal speech and language development to join mainstream schools. More recently, the Government of India under its Ministry of Social Welfare’s Assistance to Disabled Persons scheme (ADIP) has launched a Cochlear Implant Program that has more than 130 empanelled centers for performing implant surgeries. There are nearly 10 states in the country that have successfully launched government supported CI programs in the past few years.

The Successful Tamil Nadu State 'Hub & Spoke' Model

The Tamil Nadu Chief Minister’s Comprehensive Cochlear Implant Scheme, stands as one of the pioneering programs of India, with more than 4000 cochlear implantations having been done free of cost for poor and needy children below the age of 6 years, which covers nearly 40 million population of rural Tamil Nadu. However, it soon became clear that the biggest challenge for this scheme was auditory habilitation as the habilitation centers were few and located only in the major cities. This necessitated that the child and parents would have to be in the vicinity of such centers for at least an year –
an economic impossibility for many families. To overcome this obstacle, the ‘Hub & Spoke’ model was developed in 2006. It helped to deliver habilitation via quality assured satellite centers in rural areas at the doorstep of the patient and helped to overcome the need for families to relocate many miles to the state capital for the sake of their child. As a result, the percentage of children attending habilitation increased from 60 to nearly 90%. The main center acted as the main hub and peripheral ‘centers of hearing’ were created in 5 corners of TN state with full facilities for diagnosing hearing loss & habilitating children with hearing loss who have received Hearing aids or Cochlear Implants.

A recent cross-sectional study assessing the quality of outcomes in peripheral centers showed no statistical difference to those recorded in the state capital Chennai and found to correlate well with the duration of habilitation. The implications of this unique model have a definite impact for clinical practice and has provided the pedestal for comparative multi-centric research work. As the next step, currently 2 districts have been identified for implementing a pilot scheme for making the districts deafness free. At the end of 2 years, the experience garnered from this ‘pilot project’ will be useful for expanding the scheme to the whole state with the goal to have a ‘deafness free Tamil Nadu’ by 2025. Similar success has been achieved by neighboring southern states and the rest of India.

The focus has now shifted to propagate this technology further to the grass-root level and reach all the remote rural villages across this vast country. The highly successful Indian IT industry, which provides 24x7 services to the Global citizens, has facilitated setting up a network of Telemedicine centers with broadband connectivity to offer remote programming and habilitation services at the door-step for cochlear implantees hundreds of miles away from the parent CI centre. The implant companies have also extended their network of support services to reach up to these implantees at their hometowns.

**Take Home Message**

The Indian hearing screening & habilitation model’s huge success has helped start similar programs in neighboring countries such as Nepal, Srilanka, and Bangladesh. Indian surgeons have also been mentoring similar CI programs in the African countries of Kenya, Tanzania and Nigeria. With the success of this national program for eradication of deafness, the distant dream of a ‘deafness free India’ now remains a possibility in the near future. The need of the hour today is for the Indian government to enforce compulsory newborn hearing screening and for hearing verification at the time of school admissions. Efforts to integrate newborn hearing screening into the immensely popular national vaccination program has now been initiated, with the hope of making it more effective than before.

Creating Public Awareness: Out-reach counseling program for parents
Figure 1. Bill Gates of the Bill and Melinda Gates Foundation participates in the Ice Bucket ALS Challenge
The role of Social Media in Global Health

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ENT Consultant and lead for ENT And Audiology. Committee Member, website and social media lead.

The Ice bucket Challenge and the power of social media

The Ice Bucket Challenge also known as the ALS Ice Bucket Challenge was a challenge introduced by Pat Quinn and Pete Frates in 2014.\(^2\) It involved pouring a bucket of ice water over one’s head to promote awareness of the disease Amyotrophic Lateral Sclerosis (also known as Motor Neurone Disease and Lou Gehrig’s Disease). Participants encouraged donations to research.

The campaign went viral in the summer of 2014 and then again in 2015 raising 162 million pounds in the process. There were some criticisms of the campaign which are applicable to social media in general:
• Competitiveness
• Social media peer pressure
• Online narcissism

However the overall advantage of social media is the fact that there are low barriers to its usage. Its ease of access meant that this campaign resulted in more than 2.4 million new videos online.

Social Media and Global Health: background

Social media can be a very powerful tool in global health.\(^3\) Medical journals have repeatedly described the important role social media has in the dissemination of health information and public health strategies.\(^4\) They have become widely used as a resource for health information. However, the corollary is that it can also lead to great misinformation. This has been particularly evident recently during the COVID-19 pandemic (see Figure 2; ).\(^5\) A recent survey\(^4\) of 1003 US adults was conducted (through Prodege a leading US based Market
Research provider) to determine how health consumers use social media as a source of information on the COVID-19 pandemic along with other scientific sources. The results showed that 76% of respondents used social media ‘at least a little’ with regards information on COVID-19. Furthermore, 63% of social media users were unlikely to check the information with a health professional. The above table shows that only 23.7% of respondents did not follow a health related social media account. However, this data only represents the 76% who reported at least ‘a little’ reliance on social media.

All of this suggests Global Health professionals need to be both strategic and proactive with social media.

**Social Media in context**

<table>
<thead>
<tr>
<th>Interesting Social Media Facts</th>
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<tbody>
<tr>
<td>• 91% of mobile access in teens is used for social networking.</td>
</tr>
<tr>
<td>• 400 million tweets/day on average on Twitter</td>
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<tr>
<td>• 23% of Facebook users check their account 5/day</td>
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<tr>
<td>• 230,060 years is the total amount of time the United States spend on social media.</td>
</tr>
<tr>
<td>• 22 percent of online time is accounted by social networking</td>
</tr>
</tbody>
</table>

*Table 1. Health information sources on social media followed by respondents*<sup>4</sup>  
*Table 2. Interesting Social Media Facts*<sup>6,7</sup>
Suggested use of social media in ENT global healthcare

- **Professional Networking**

Communicating with colleagues
a) Connecting healthcare professionals in High Income Countries with those in Low and Middle Income countries;
b) Streaming of surgical procedures (see Figure 3 for an example)

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**Figure 2.** WHO director General Statement on the Role of Social Media platforms in Health Information.

**Figure 3.** YouTube video of the Live Otolaryngological Network (LION) broadcast of Endoscopic Sinus Surgery.
• **Crowdsourcing**

‘harnessing the knowledge and skills of a community to solve problems or to gather information and opinions’ see Figure 4 for an example

![Figure 4. Screenshot of a popular Facebook group ‘GP Clinical questions’](image)

- **Professional Education:**

One survey has reported that 53% of nursing schools in their sample are using social media tools.\(^{11}\)

- **Organisational promotion:**

It is increasingly important to have an online presence. Organisations can communicate with their followers ‘en masse’ (see Figure 5)

![Figure 5. Screenshot of the twitter account for ENT UK Global Health](image)
Establishing an ENT global health community: key steps

Engage with social media
Join Twitter and follow @entukglobal
Tag (this notifies the account of your tweet/photo etc) entukglobal
Use the hashtags (this classifies all tweets for ease of search) entukglobal, globalent, globalorl

Let's connect!

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Introduction

Globally, the third-largest cause of the number of years lived with disability is unaddressed disabling hearing loss¹. Hearing loss is expected to affect 2.5 billion individuals by 2050¹. The cost associated with unaddressed hearing loss annually is estimated at $980 billion worldwide¹-³. Although hearing loss affects individuals globally, low-and middle-income countries (LMICs) are home to nearly 80% of individuals living with hearing loss¹. The reality is that persons with hearing loss in most LMICs do not have access to hearing care due to barriers including a severe shortage of hearing health professionals, centralised service-delivery models, expensive diagnostic equipment requiring highly trained persons to operate¹.

Innovative digital technologies are an important strategy proposed by the World Health Organisation to support hearing health service delivery, especially in LMICs¹. With a smartphone penetration rate of 89% in LMICs⁴, the
The use of digital technologies is becoming especially relevant. Digital technologies have the potential to address many of the current barriers preventing effective hearing healthcare services in LMICs such as access and affordability. The rise of the COVID-19 pandemic has further catapulted the need and use of digital technologies to provide safe hearing healthcare services as traditionally the test set-up, proximity and duration of appointments put both the audiologist and patient at a high risk of contracting COVID-19.

**Innovative community-based hearing care**

A new innovative model using a range of digital technologies operated by community healthcare workers (CHWs) to deliver end-to-end hearing healthcare services to adults in LMICs was recently piloted in the Western Cape, South Africa. The five-step model is illustrated in figure 1.

**Screening for adult hearing loss**

The first step in this model was to detect adult community members in need of hearing care through “self-report” and “community-referral” modes of detection. CHWs, recruited from the same community, were able to connect with community networks to create awareness and follow-up with interested individuals. Once community members were detected and identified, the next step was to diagnose hearing loss.

**Home-based diagnostic hearing testing**

The CHWs conducted home visits with the community members with suspected self-reported hearing loss to confirm if a hearing loss was present. Low-cost, commercially available smartphones and circumaural hearing protectors were used to facilitate the testing (figure 2). Clinically validated in-situ audiometry via a low-cost, high-quality hearing aid (16-channel WDRC, Bluetooth, adaptive directionality, and noise reduction) with circumaural hearing protectors

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Figure 1: Work-flow process of the adult community hearing service delivery model
placed over the hearing aids (creates an environment comparable to a single-walled sound booth) was conducted to obtain an individuals’ audiogram. Smartphone AI video-otoscopy via the hearScope (hearX group, Pretoria, South Africa) was conducted to evaluate patency of the ear canal to accommodate a hearing aid and identify ear disease (wax obstruction or possible middle-ear infection). Relevant referrals to clinics or ENTs were made if any abnormalities were detected. Lastly, the risk profile for potential asymmetric or conductive losses was determined through an algorithm using digits-in-noise (DIN) test results in combination with air conduction pure tone audiometry thresholds. This recently validated technique has a reported 94% accuracy to differentiate sensorineural hearing loss from conductive or asymmetric hearing loss requiring medical follow-up. This approach negates the need for bone conduction testing in community-based settings by triaging patients at risk to more advanced diagnostic services. At the same time, it allows a decentralised model of care for the vast majority of persons with hearing loss who have a sensorineural cause and who can benefit from hearing aids.

**Demonstrate hearing aid benefit**

The digital technologies used to diagnose hearing loss were all integrated with a mobile platform, had a user-friendly design, and made use of automated test protocols, which enabled CHWs to facilitate the testing. Program managers could also do remote surveillance through the cloud-based platform for quality control and support. When a hearing loss was confirmed, a demonstration to experience the benefit of the hearing aids was done immediately (figure 3). The autofit option programs the hearing aids from the smartphone based on the test results (NAL-NL2 fitting formula).
through Bluetooth. This experience supports an informed decision to take up hearing aids as an intervention.

**Home-based hearing aid fitting and support**

After the demonstration, if the community member wished to continue, they were fitted bilaterally by the CHWs with the in-situ hearing aids. The low-cost high-feature digital hearing aids (hearX Lumen) are suitable for mild to moderate-severe hearing loss and includes wide dynamic range compression, 16-channels, and directionality. CHWs orientated the community members on the hearing aid user-operated controls and device maintenance. Finally, persons fitted with hearing aids were provided with a mHealth support and acclimatisation program (figure 4). This program includes the provision of information on device management and use, troubleshooting and general acclimatisation tips provided via text message or WhatsApp messaging service over a 45-day period. CHWs also provided batteries and disposables as well as conducted follow-up visits.

**Outcomes**

The pilot study has been an overwhelming success, with participants reporting very positive outcomes with their hearing aids. Some examples of participant testimonials include: "It is as if I am able to see. Everything is clear"; "Having hearing aids changed my life. It gives me confidence around other people. I can hear and do not have to ask for repetition." Another community member reported that, "People respond positively to the fact that I wear hearing aids. They notice that I respond more and quicker than before. They previously thought that I was unfriendly, they did not realise that I could not hear." Additional comments include, "Now I can engage with my family again - I love my hearing aids"; "I recommend a hearing aid to anyone with a hearing problem because this hearing aid helps so much, it changed my life."

**Looking forward**

Future goals for this innovative service delivery model include the implementation of a scaled-up launch in Kenya. The project in Kenya is being funded by the Assistive Technology Impact Fund (ATIF) Fund. The ATIF was launched out of the UK Aid-funded AT2030 programme, led by the Global Disability Innovation Hub (GDI Hub) and offers support to get Assistive Technology solutions for low- and middle-income
populations on a path to scale. hearX Group and Foundation together with partner Ilara Health (a Kenya-based healthtech start-up bringing affordable and accessible diagnostics to primary care facilities) will implement the pilot to bring hearing care to communities whilst also testing monthly payment plans to increase affordability. More info available https://www.hearxgroup.com/blog/HEARX%C2%AE-BECOMES-THE-FIRST-TO-RECEIVE-FUNDING-FROM-THE-ASSISTIVE-TECHNOLOGY-IMPACT-FUND.html.

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