DIGITAL HEALTH WORKSHOP

TELEAUDIOLOGY: A MODERN METHOD OF PROVIDING HEARING CARE

SUZANNE YOUNKER, AU.D.
DIRECTOR OF TELEHEALTH, YOUR HEARING NETWORK
OCTOBER 2019

OBJECTIVES

- Define **telehealth** components and terms.
- Obtain awareness of general **telehealth** rules and laws.
- Describe how **teleaudiology** fills a void in patient hearing care.

360° TELEAUDIOLOGY SERVICES

- Provide Full-Service Audiologic Procedures
- Requires Patient to be in a Facility where Equipment is Located
- Requires a Facilitator to be in the Facility where Equipment Located
- Requires Provider to be…Anywhere

BASIC TERMINOLOGY

- Telehealth: The use of telecommunications and information technology for exchange of information from one site to another.
- Synchronous: Using real-time interaction
- Asynchronous: "store and forward" where information is recorded and reviewed at a later time
- Videoconferencing: allows two or more locations to communicate simultaneous two-way video and audio transmissions.
- Presenting/Patient Site: the site where the patient is physically located for telehealth treatment service delivery
- Receiving/Remote Provider Site: place where provider is physically located when providing telehealth services
- **Facilitator**: personnel trained to assist remote provider in equipment and patient manipulation necessary for procedures to be completed

TELEHEALTH EXPANSION IN MEDICAL ARENA

More and more medical providers are implementing this modern method of care for many reasons.

- Does it reduce cost?
- Does it increase access to care?
- Does it increase patient satisfaction?
- Does it preserve quality care in a service industry?

TELEHEALTH EXPANSION IN MEDICAL ARENA

10 States with the highest telehealth utilization

Table 3: States with the Highest Utilization of Telehealth among Medicare FFS Beneficiaries, 2016

	State	2016 Medicare FFS Population	Number of FFS Beneficiaries Receiving at Least One Telehealth Service	% of Total FFS Beneficiaries Using Telehealth	Number of Telehealth Services	% of Total Telehealth Services	Telehealth Services per FFS Beneficiary
1	TEXAS	2,312,254	10,565	11.8	33,279	12.1	3.1
2	IOWA	468,419	4,480	5.0	21,405	7.8	4.8
3	CALIFORNIA	3,002,325	4,357	4.9	12,359	4.5	2.8
4	MISSOURI	770,598	4,107	4.6	13,443	4.9	3.3
5	MICHIGAN	1,185,648	3,901	4.4	10,864	3.9	2.8
6	MINNESOTA	371,449	3,608	4.0	10,773	3.9	3.0
7	WISCONSIN	624,039	3,510	3.9	8,839	3.2	2.5
8	GEORGIA	989,129	3,430	3.8	11,857	4.3	3.5
9	VIRGINIA	1,038,211	3,158	3.5	16,652	6.1	5.3
10	KENTUCKY	616,725	3,138	3.5	7,587	2.8	2.4
	ALL OTHER STATES	23,745,099	44,955	50.4	128,141	46.5	2.9
	National	**35,123,896**	**89,209**	**100%**	**275,199**	**100%**	**3.1**

Source: NORC and KPMG Analysis of CMS Medicare Research Identifiable Files

LAWS AND RULES

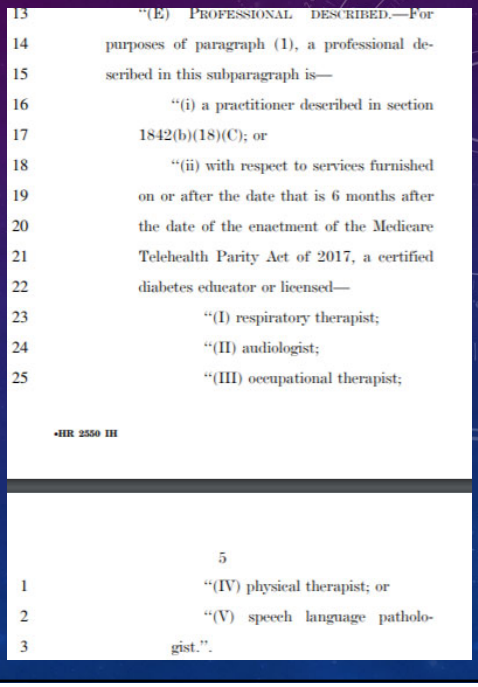
Healthcare Providers Eligible for Medicare Reimbursement for Telehealth Services

- Physicians
- Nurse Practitioners
- Physician Assistants
- Nurse Midwives
- Clinical Nurse Specialists
- Clinical Social Workers
- Registered Dietitians or Nutrition Professionals

MEDICARE TELEHEALTH PARITY ACT OF 2017

Lawmakers Want Medicare Changed to Expand Telehealth Services

A Congressional Telehealth Caucus is supporting legislation that would greatly expand the reach and scope of telehealth and telemedicine services covered by Medicare.



"(E) PROFESSIONAL DESCRIBED.—For purposes of paragraph (1), a professional described in this subparagraph is—

"(i) a practitioner described in section 1842(b)(18)(C); or

"(ii) with respect to services furnished on or after the date that is 6 months after the date of the enactment of the Medicare Telehealth Parity Act of 2017, a certified diabetes educator or licensed—

"(I) respiratory therapist;

"(II) audiologist;

"(III) occupational therapist;

•HR 2550 IH

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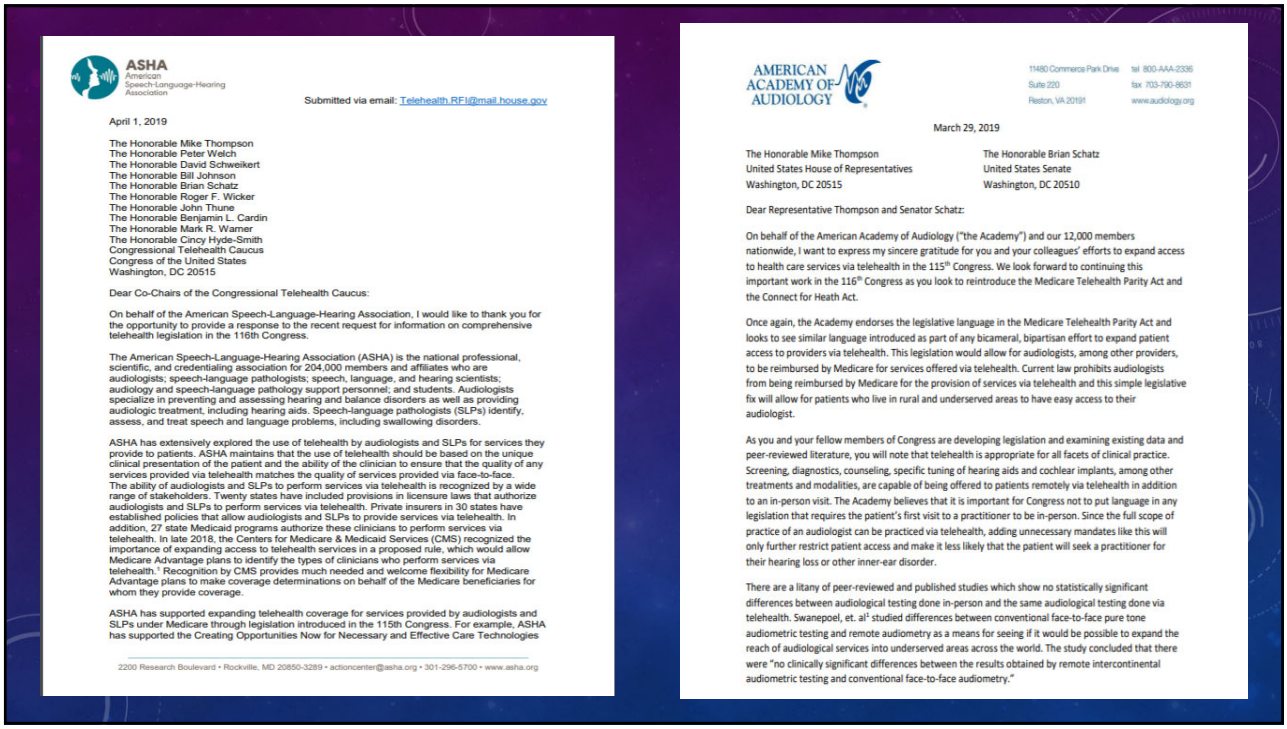
"(IV) physical therapist; or

"(V) speech language pathologist.".



ASHA
American Speech-Language-Hearing Association

Submitted via email: Telehealth.RFI@mail.house.gov

April 1, 2019

The Honorable Mike Thompson
The Honorable Peter Welch
The Honorable David Schweikert
The Honorable Bill Johnson
The Honorable Brian Schatz
The Honorable Roger F. Wicker
The Honorable John Thune
The Honorable Benjamin L. Cardin
The Honorable Mark R. Warner
The Honorable Cincy Hyde-Smith
Congressional Telehealth Caucus
Congress of the United States
Washington, DC 20515

Dear Co-Chairs of the Congressional Telehealth Caucus:

On behalf of the American Speech-Language-Hearing Association, I would like to thank you for the opportunity to provide a response to the recent request for information on comprehensive telehealth legislation in the 116th Congress.

The American Speech-Language-Hearing Association (ASHA) is the national professional, scientific, and credentialing association for 204,000 members and affiliates who are audiologists; speech-language pathologists; speech, language, and hearing scientists; audiology and speech-language pathology support personnel; and students. Audiologists specialize in preventing and assessing hearing and balance disorders as well as providing audiologic treatment, including hearing aids. Speech-language pathologists (SLPs) identify, assess, and treat speech and language problems, including swallowing disorders.

ASHA has extensively explored the use of telehealth by audiologists and SLPs for services they provide to patients. ASHA maintains that the use of telehealth should be based on the unique clinical presentation of the patient and the ability of the clinician to ensure that the quality of any services provided via telehealth matches the quality of services provided via face-to-face. The ability of audiologists and SLPs to perform services via telehealth is recognized by a wide range of stakeholders. Twenty states have included provisions in licensure laws that authorize audiologists and SLPs to perform services via telehealth. Private insurers in 30 states have established policies that allow audiologists and SLPs to provide services via telehealth. In addition, 27 state Medicaid programs authorize these clinicians to perform services via telehealth. In late 2018, the Centers for Medicare & Medicaid Services (CMS) recognized the importance of expanding access to telehealth services in a proposed rule, which would allow Medicare Advantage plans to identify the types of clinicians who perform services via telehealth.[1] Recognition by CMS provides much needed and welcome flexibility for Medicare Advantage plans to make coverage determinations on behalf of the Medicare beneficiaries for whom they provide coverage.

ASHA has supported expanding telehealth coverage for services provided by audiologists and SLPs under Medicare through legislation introduced in the 115th Congress. For example, ASHA has supported the Creating Opportunities Now for Necessary and Effective Care Technologies

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AMERICAN ACADEMY OF AUDIOLOGY

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tel 800-AAA-2336
fax 703-790-8631
www.audiology.org

March 29, 2019

The Honorable Mike Thompson
United States House of Representatives
Washington, DC 20515

The Honorable Brian Schatz
United States Senate
Washington, DC 20510

Dear Representative Thompson and Senator Schatz:

On behalf of the American Academy of Audiology ("the Academy") and our 12,000 members nationwide, I want to express my sincere gratitude for you and your colleagues' efforts to expand access to health care services via telehealth in the 115th Congress. We look forward to continuing this important work in the 116th Congress as you look to reintroduce the Medicare Telehealth Parity Act and the Connect for Heath Act.

Once again, the Academy endorses the legislative language in the Medicare Telehealth Parity Act and looks to see similar language introduced as part of any bicameral, bipartisan effort to expand patient access to providers via telehealth. This legislation would allow for audiologists, among other providers, to be reimbursed by Medicare for services offered via telehealth. Current law prohibits audiologists from being reimbursed by Medicare for the provision of services via telehealth and this simple legislative fix will allow for patients who live in rural and underserved areas to have easy access to their audiologist.

As you and your fellow members of Congress are developing legislation and examining existing data and peer-reviewed literature, you will note that telehealth is appropriate for all facets of clinical practice. Screening, diagnostics, counseling, specific tuning of hearing aids and cochlear implants, among other treatments and modalities, are capable of being offered to patients remotely via telehealth in addition to an in-person visit. The Academy believes that it is important for Congress not to put language in any legislation that requires the patient's first visit to a practitioner to be in-person. Since the full scope of practice of an audiologist can be practiced via telehealth, adding unnecessary mandates like this will only further restrict patient access and make it less likely that the patient will seek a practitioner for their hearing loss or other inner-ear disorder.

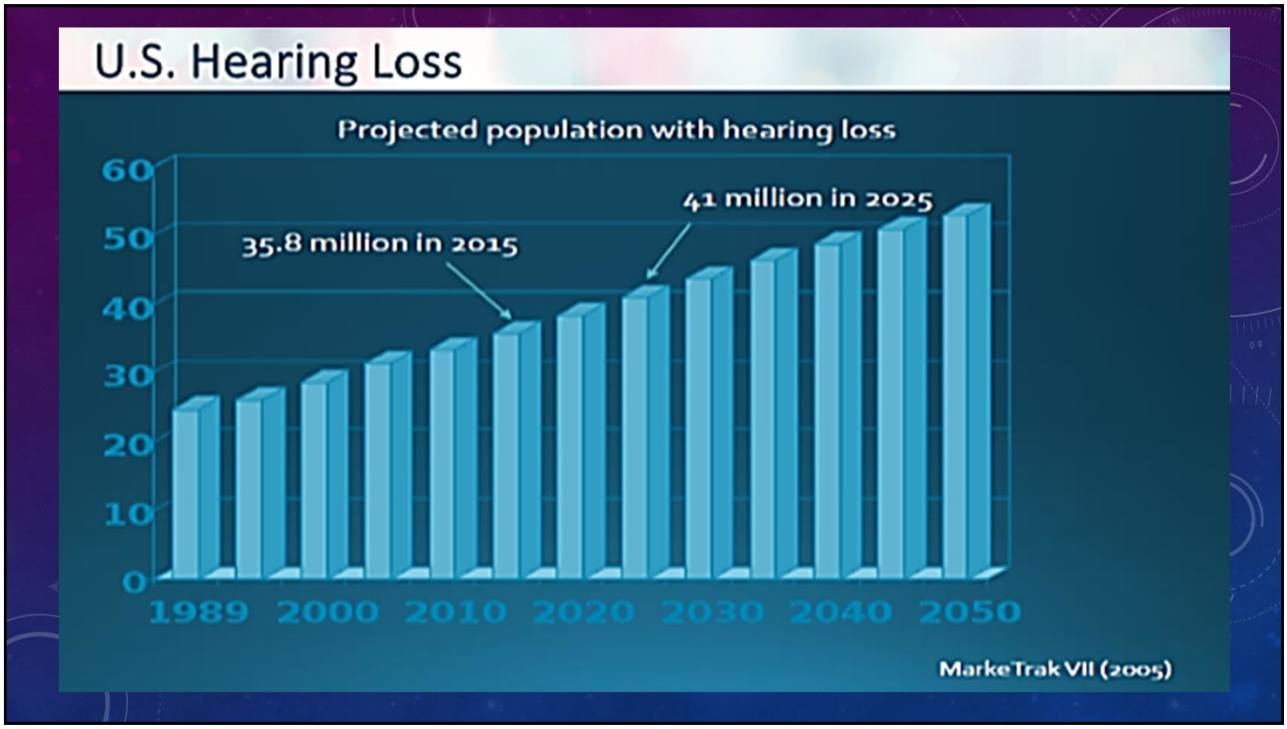
There are a litany of peer-reviewed and published studies which show no statistically significant differences between audiological testing done in-person and the same audiological testing done via telehealth. Swanepoel, et. al[1] studied differences between conventional face-to-face pure tone audiometric testing and remote audiometry as a means for seeing if it would be possible to expand the reach of audiological services into underserved areas across the world. The study concluded that there were "no clinically significant differences between the results obtained by remote intercontinental audiometric testing and conventional face-to-face audiometry."

INTERSTATE COMPACTS

ASLP-IC
Audiology & Speech-Language Pathology
Interstate Compact

- States allow privileges when licensed in a home state that belongs to the compact
- Privileged providers must adhere to receiving state's scope of practice
- Continuing Education based on home state's licensure
- Renewal of privileges based on home's state's licensure renewal
- Need Min of 10-States: Nebraska, Utah, Georgia, Oklahoma, Louisiana, and North Carolina are interested

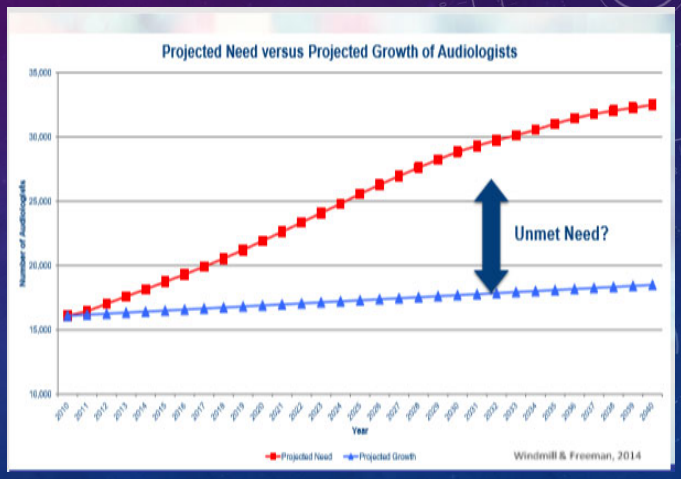
- **24 States and D.C.:** Interstate Medical Licensure Compact
- **31 States:** Nurse Licensure Compact
- **21 States:** Physical Therapy Compact
- **7 States:** Psychology Interjurisdictional Compact (PSYPACT)



CURRENT CHALLENGE IN MEETING NEEDS

There will be shortage of hearing care providers in near future.

- Audiologists:
  - 2010 = 16,095
  - 2016 = 12,310
- Hearing Instrument Specialists:
  - 2013 = 9,000
  - 2017 = 7,380
- More are retiring or leaving field than entering the field
- Ref: Office of Labor Statistics



VA INNOVATIONS FOR DELIVERY OF HEARING HEALTH CARE SERVICES

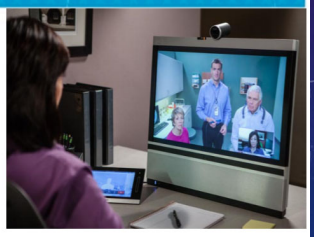
TeleAudiology used to provide remote diagnostics, remote hearing aid programming, and education on hearing loss and tinnitus

- Over 40K TeleAudiology appointments in 2018
- TeleAudiology outcomes are as good as or better than traditional face-to-face encounters

TeleAudiology Expansion Initiative FY 2014-2015

- Collaboration
  - Rehabilitation and Prosthetic Services
  - Audiology and Speech Pathology National Program Office
  - Office of Telehealth Services.
- Expand from original 10 Pilot sites to 71 sites nationally.
- Implement remote programming of hearing aids, as well as provide remote audiometry utilizing integrated sound level meter capabilities.
- Active TeleAudiology Programs exist in 20 of 21 VISNs.
- 132 sites with Telehealth carts containing audiology equipment

VETERANS HEALTH ADMINISTRATION

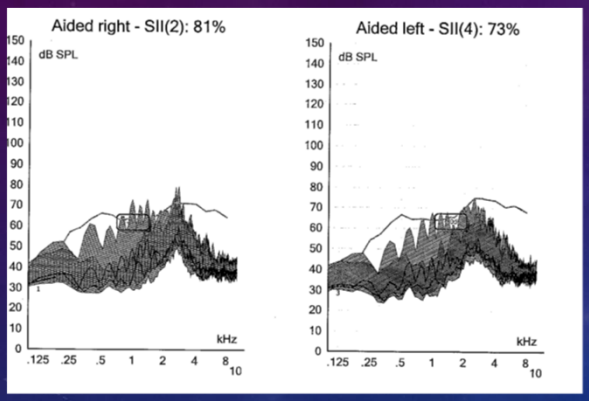


MODERN SOLUTION TO CHALLENGES - 360 ○

- Adopting a new healthcare strategy begins by changing how we think about the service delivery model and what we identify as challenges.
- Telehealth Benefits to Hearing Care:
  - Provides convenient, efficient, and quality care
  - Staffing concerns are negated
  - Providing more access to services
  - Able to provide “concierge care”

The patient experience is elevated to new levels of "Wow!"

TEST COMPONENTS

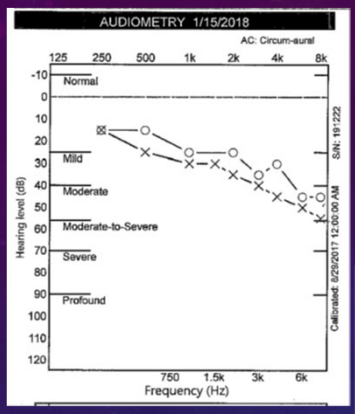


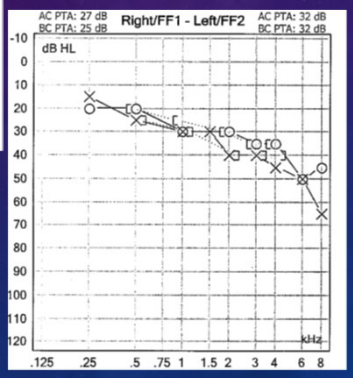
Testing procedures available REMOTELY:

- Videotoscopy
- Tympanometry
- Full audiometric testing with insert or circum-aural headphones
- Bone conduction testing
- Calibrated speech testing
- Hearing aid fittings
- Verification via REM or Speech Mapping
- Programming and Instrument adjustments

REMOTE EAR IMPRESSIONS

TEST, RE-TEST RELIABILITY

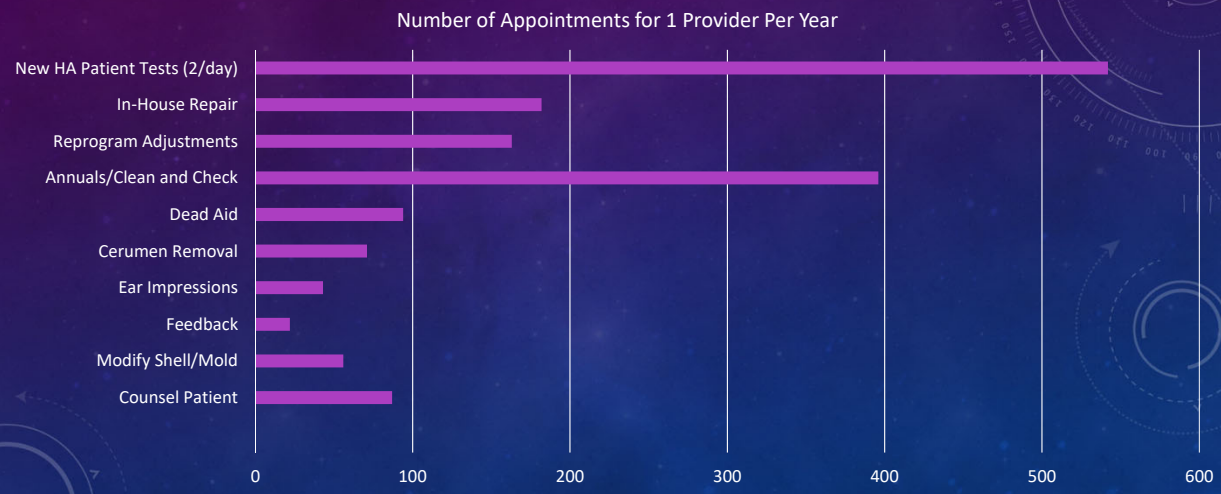




BUSINESS SMARTS – REDUCE TRAVEL, INCREASE ROI

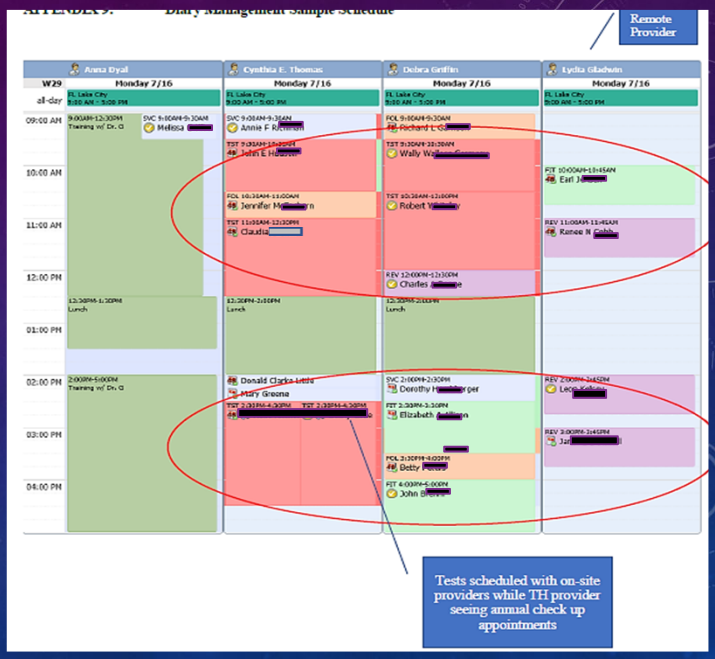
Single Provider; Multi Clinics		Financial Benefit of Not Traveling		and	Coverage for Days Out													
Assumptions	Assumptions	Nat Average Staff Wage/Hr	Travel Days/Week	Coverage Hours/Week	40 Miles Rtrip	Travel Hrs @ 45MPH	Hour Wage Lost for Rtrip	Mileage Expense (.545)	Hour/HAE Lost	Est HA close rate	Est BIN Rate	# HA sales Lost	Avg ASP	Revenue Lost	Expense + Revenue Loss 1 Day/Week	Total Expense + Revenue Loss 4 Day/MO	Total Expense + Revenue Loss 12 MO
Based on gross revenue	$400,000	Auto Calc.	Enter actual data	Auto Calc.	Enter actual data	Auto Calc.	Auto Calc.	Auto Calc	Auto Calc	Enter actual data	Auto Calc.	Auto Calc.	Enter actual data	Auto Calc.	Auto Calc.	Auto Calc.	Auto Calc.
Aud Yr. Sal	$78,500	$37.74	1	8	40	1	$34	$22	1	50%	1.73	0.77	$2,000	$1,538	1,593	6,372	76,470
HAS Yr. Sal	$53,000	$25.48	1	8	40	1	$23	$22	1	55%	1.73	0.85	$2,000	$1,692	1,736	6,944	83,328
			Onsite Days/Week	Onsite Hours/Week					Hour/HAE Gain - No Travel	Est HA close rate	Est BIN Rate	# HA sales gained	Avg ASP	Revenue Gained	NET Revenue 1 Day/Week	NET Revenue 4 Day/MO	NET Revenue 12 MO
Tech Yr. Sal	$37,000	$17.79	1	8	0	0	0	0	1	50%	1.73	0.77	$2,000	$1,538	1,520	6,080	72,959
Tech Yr. Sal	$37,000	$17.79	1	8	0	0	0	0	1	55%	1.73	0.85	$2,000	$1,692	1,674	6,695	80,341
Full Time Hours/Year	2,080																

BUSINESS SMARTS: ON-GOING EXISTING PATIENT SUPPORT VS. AVAILABILITY TO NEW PATIENTS



BUSINESS SMARTS – REDUCE SERVICE TIME, INCREASE NEW PATIENT ACCESSIBILITY

- 25-50% of hearing care provider's daily appointments spent on non-revenue producing HA activities
- Telehealth affords more time for on-site provider to see revenue appts.



PATIENT SURVEY RESPONSES (238)

"More comfortable and enjoyable than booth."

"Originally was leery, but is OK with this.."

"Comfortable, effective, Dr. Gladwin-personable… Learned a lot."

"It was very nice, just as good as being in person… It was fun! "

"Technology is amazing!"

"Was upset Dr. Griffin wasn't in, but lightened up at the end."

"Very interesting, painless, Dr. Younker was very good."

"Had a similar appointment recently (cardiologist office)."

"As long as it helps us to hear, I'm all for it."

Question	Yes	No
Were you aware that today's appointment would be via Telehealth?	15	223
Were you seen on time for your appointment?	221	17
Did you SEE the Telehealth provider Clearly?	238	
Did you HEAR the Telehealth provider Clearly?	237	1
Were your needs fully met through the Telehealth appointment today?	237	1
Would you be willing to schedule future Telehealth appointments?	236	2

EQUIPMENT OPTIONS

SUPPORT AND TRAINING NEEDS

- Develop Procedure Protocols
- Assure Regulatory Requirements (consent) Met
- Assure Presenting Site Requirements Met
- Assure Receiving Site Requirements Met
- Develop and Execute Staff Training
  - Audio-Video “Stage Presence”
  - Minor Technical Troubleshooting Strategies
  - Communication Skills Between Remote Provider and Facilitator

WORDS FROM THE EXPERTS

- Objectives
- Expectations
- Perspectives
- Provider Experience
- Patient Experience
- Unintended Consequences
- Unexpected Outcomes
- Surprising Observations

TELEHEALTH IS HERE TO STAY – DO YOU SEE IT IN YOUR FUTURE?

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The Rotary Hearing Center of San Felipe

A MODEL FOR SUSTAINABILITY

ASU College of Health Solutions

ASU College of Health Solutions
Arizona State University
Speech and Hearing Clinic

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ASU College of Health Solutions

San Felipe Mexico

ASU College of Health Solutions

Women's Cancer Care Center of San Felipe

In 2016, IHF partnered with Rotary to create The Rotary Hearing Center of San Felipe

ASU College of Health Solutions

Project Goals

- To establish a model for the delivery of hearing health services using tele-audiology that can be replicated in other under-served areas
- Provide tele-audiology training for ASU Doctor of Audiology students

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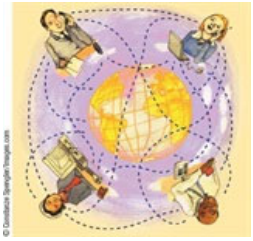
Tele-audiology: A model for sustainability

Possible benefits for developing countries

- Increased access to hearing healthcare
- Reduced costs of delivering global care
- Improved clinical outcomes



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https://www.otohub.com/tele-audiology-is-the-future-or-the-present/

Two Primary Types of Tele-Audiology

San Felipe model primarily uses **Synchronous Real Time interaction**

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San Felipe Tele-health Model

Two technicians work face-to-face with patients at the San Felipe clinic

A cancer clinic physician provides medical support when needed

Audiologist/student observe and supervise from a remote site (ASU)

Provide tele-audiology two half days per week with four to five patients scheduled for each half day

Recently introduced speech-language sessions

ASU College of Health Solutions

Key Members of the Teleaudiology Team

Tele-audiology
Clinical Technicians
- Berenice Quintanilla
- Mimi De La Cruz

ASU audiologist
Nurses and Physician
- Dr. Liliana Elizabeth Preciado Gonzalez
- Edith Fuentes Castillas

Rotary Audiologists
ASU students
Robert Margolis, Ph.D.
Nancy Flores
Jerry Punte, Ph.D
Itzel Padilla
Colton Clayton
Scott McGrath
Ingrid Pierce, Au.D
Technical Consultant
George Saly, B.Sc.

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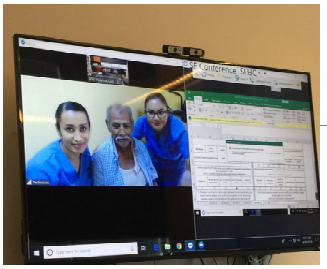
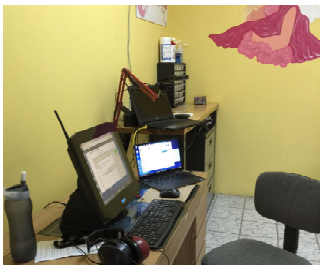
ASU





SF Clinic

Tele-Audiology Setup

Videoconferencing equipment (SF and ASU)

- 2 Logitech C930e 1080P HD video webcams and 2 Jabra Speak 410 conference speakerphones
- Zoom video conferencing software
  - Live communication with technicians and patient
- TeamViewer remote desktop software
  - View testing and test results in real time
  - Control computer for hearing aid programming

Allows live communication between the Audiologist, technicians, and patients without interruption, while testing or fitting hearing aids.

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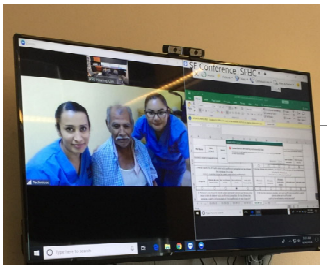
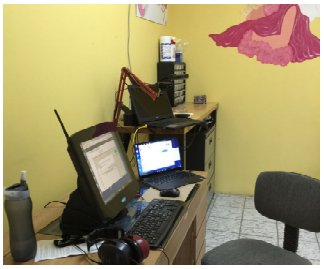
ASU





SF Clinic

Tele-Audiology Setup

SF Audiology-specific Hardware and Software

- Desktop test computer
  - AMTAS (Automated Method for Testing Auditory Sensitivity)
  - NOAH
    - Interacoustics Viot video otoscope
    - Interacoustics Titan tympanometer
    - Manufacturer fitting modules
      - HiPro box
- Conference laptop computer
  - Technicians and patients can view and communicate with the ASU team

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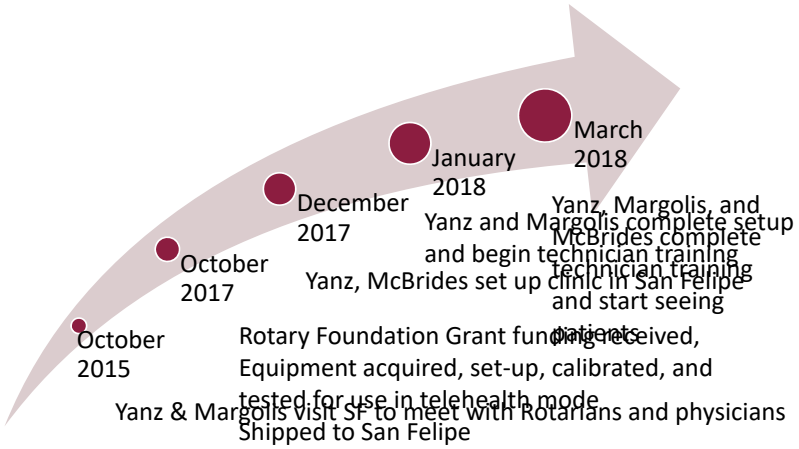
Project Timeline



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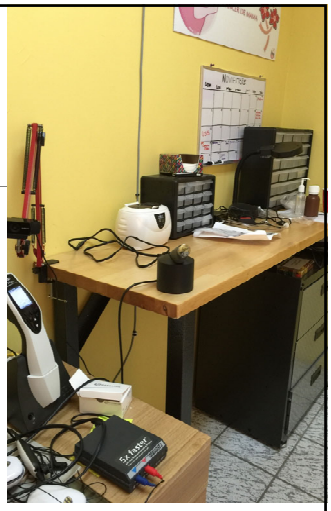

Rotary Hearing Clinic Opened March 28, 2018

ASU College of Health Solutions

SF Hearing Care Program

DIAGNOSIS

- History
- Video-Otoscopy
- Tympanometry
- Audiogram—Automated audiometry (AMTAS)

TREATMENT

- Cerumen removal
- Hearing aid Fitting
- Medical referral, as needed

AFTERCARE SERVICES

- HA adjustment
- EM modification
- Counseling
- Outcome Measures

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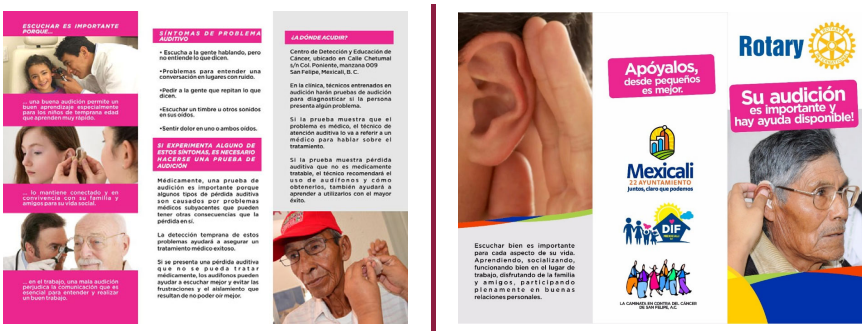

Hearing Clinic Brochure

Clinical Technician Training

Core set of training modules

Familiarization and practice using the diagnostic equipment and test protocols

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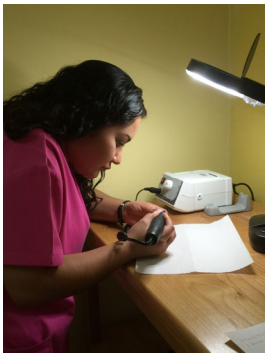


Clinical Technician Training—Ear impressions, earmolds

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Clinical Technician Training

HEARING AID FITTING

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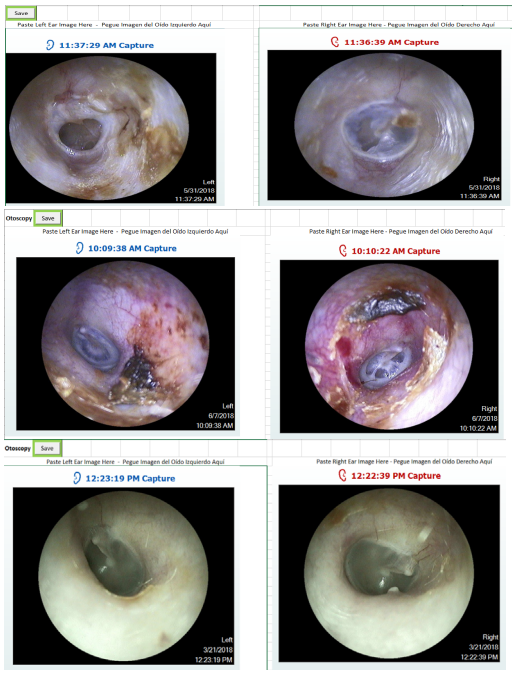
Synchronous Real Time Tele-audiology: Video-otoscopy

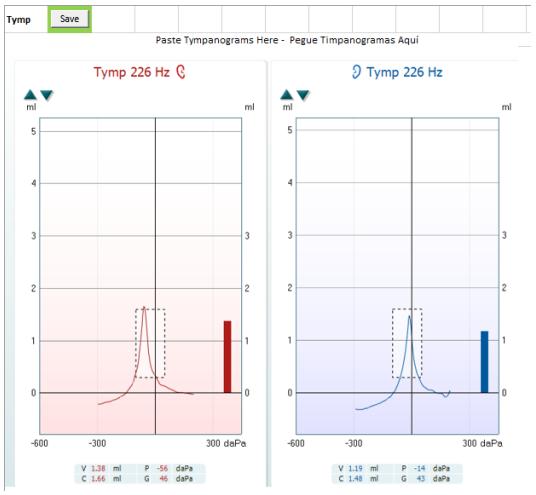
- Ear canal and tympanic membrane visualized remotely
- Technician copies/pastes into patient report



ASU College of Health Solutions

Synchronous Real Time Tele-audiology: Tympanometry

- Audiologist views video-tympanometry in real time
- Technician copies/pastes into patient report



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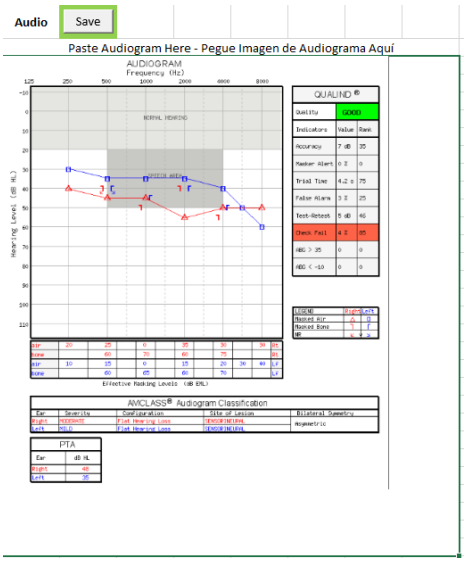
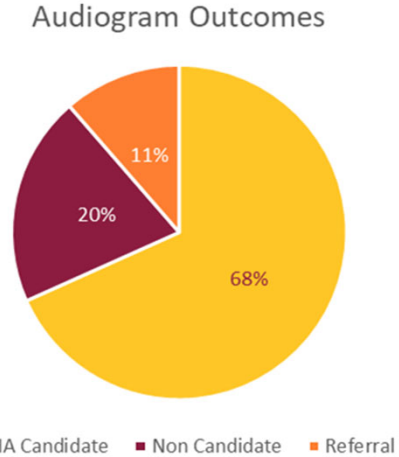
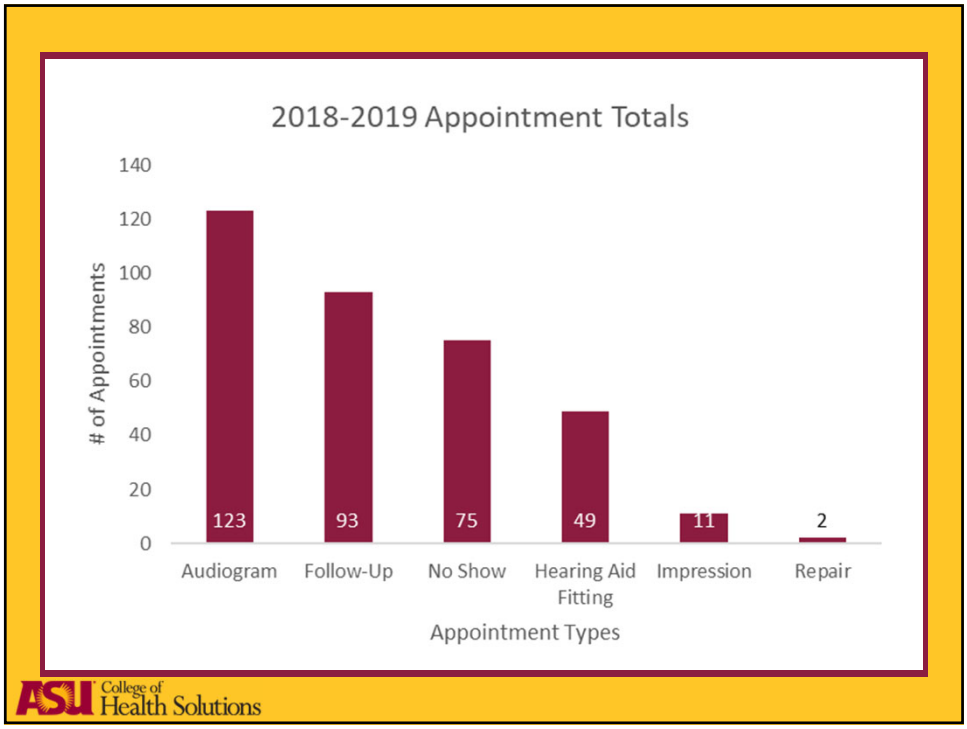
Synchronous Real Time Tele-audiology: Audiometry

- Audiologist views automated testing via AMTAS once it is completed
- Technician copies/pastes into patient report







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Tele-audiology Legal & Regulatory Considerations

HIPAA-related concerns

- For the SF program, legal counsel confirmed that HIPAA does not apply
  - Entity providing the services is a Mexican legal entity and legally separate from the ASU Clinic
  - The program, through the Mexican entity, does not provide services to patients in the USA
  - The Mexican entity does not engage in any HIPAA-covered transactions

Liability and licensure

- The University provides medical malpractice coverage for ASU employees as well as students acting in course and scope of a student placement agreement in Mexico
- There is no professional licensure for audiologists in Mexico
  - Physicians provide hearing health care

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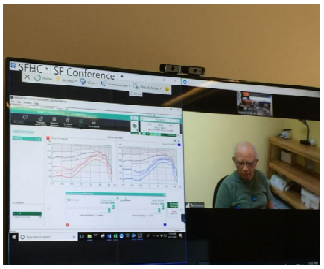

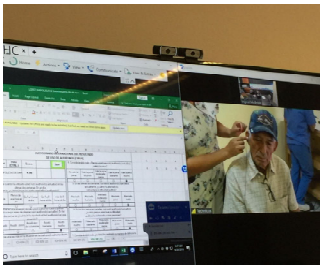

After Care Services

Follow-up appointments scheduled for 1-2 weeks and 4 weeks post hearing aid fitting

- Perform visual inspection of earmold and hearing aid
- Listening check of hearing aid
- Review data logging
- Programming adjustments as needed
- Administer HA Follow-up Questionnaire
- Administer IOI-HA
- Review care and handling

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International Outcome Inventory

File Name	Date (CTRL;)	Score		Save
Nombre1Nombre21900-01-00		0.00		

1. Think about how much you used your present hearing aid(s) over the past two weeks. On an average day, how many hours did you use the hearing aid(s)?

none	less than 1 hr/day	1 to 4 hr/day	4 to 8 hr/day	more than 8 hr/day
○	○	○	○	○

2. Think about the situation where you most wanted to hear better, before you got your present hearing aid(s). Over the past two weeks, how much has the hearing aid helped in that situation?

helped not at all	helped slightly	helped moderately	helped quite a lot	helped very much
○	○	○	○	○

3. Think again about the situation where you most wanted to hear better. When you use your present hearing aid(s), how much difficulty do you STILL have in that situation?

very much	quite a lot of	moderate	slight	no difficulty
○	○	○	○	○

4. Considering everything, do you think your present hearing aid(s) is worth the trouble?

not at all worth it	slightly worth it	moderately worth it	quite a lot worth it	very much worth it
○	○	○	○	○

5. Over the past two weeks, with your present hearing aid(s), how much have your hearing difficulties affected the things you can do?

affected very much	affected quite a lot	affected moderately	affected slightly	affected not at all
○	○	○	○	○

6. Over the past two weeks, with your present hearing aid(s), how much do you think other people were bothered by your hearing difficulties?

bothered very much	bothered quite a lot	bothered moderately	bothered slightly	bothered not at all
○	○	○	○	○

7. Considering everything, how much has your present hearing aid(s) changed your enjoyment of life?

worse	no change	slightly	quite a lot	very much
○	○	○	○	○

Outcome Measures: IOI-HA

Outcome Measures

Hearing Aid Follow-up Questionnaire

Is the hearing aid comfortable in your ear?
- Right __ Yes __ No
- Left __ Yes __ No

Does the hearing aid cause any pain in your ear?
- Right __ Yes __ No
- Left __ Yes __ No

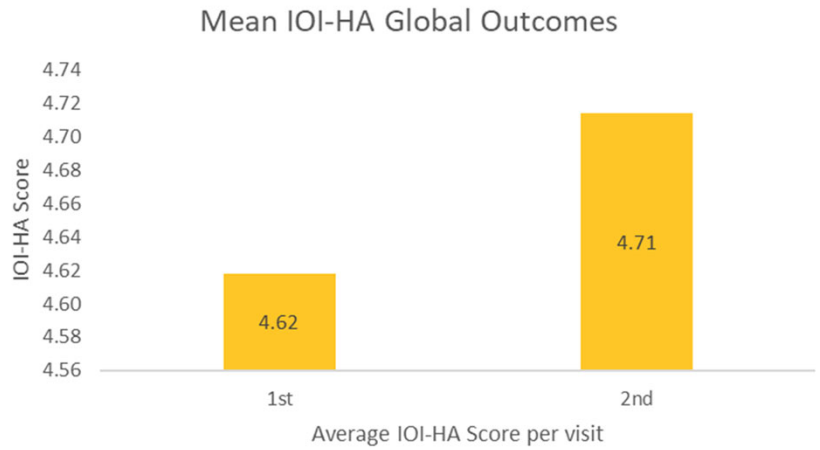
Does the hearing aid help you hear in quiet situations? __ Yes __ No

Does the hearing aid help you hear in noisy situations? __ Yes __ No

How many hours per day do you wear the hearing aid?

__ Less than 1
__ 1-3
__ 3-5
__ more than 5

Comments



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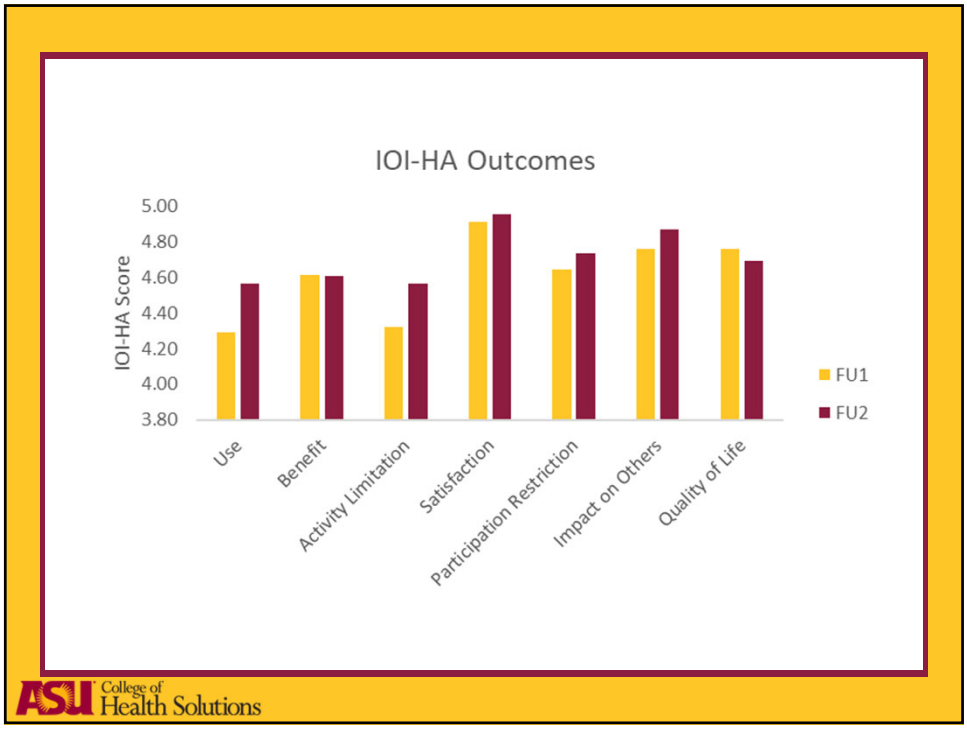
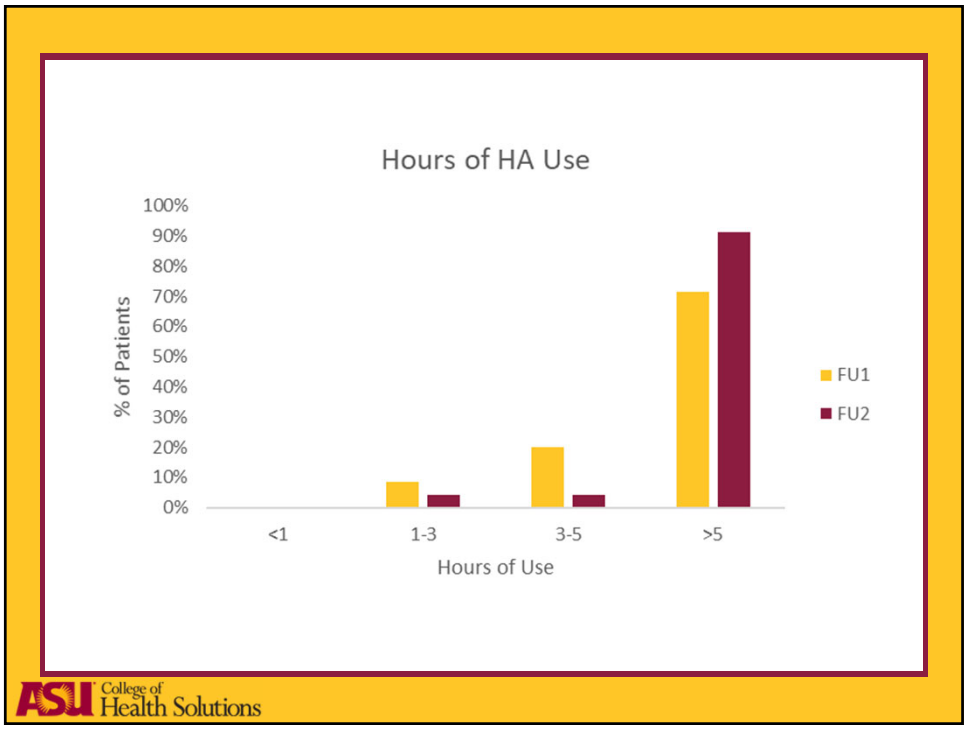

IOI-HA Outcomes
IOI-HA Score
5.00
4.80
4.60
4.40
4.20
4.00
3.80
Use
Benefit
Activity Limitation
Satisfaction
Participation Restriction
Impact on Others
Quality of Life
FU1
FU2


Hours of HA Use
% of Patients
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
<1
1-3
3-5
>5
Hours of Use
FU1
FU2

Summary: SF Tele-audiology Model

Program sustainability

- Provide tele-audiology services and hearing aids to American and Canadian residents for a significantly lower cost than they would pay north of the border
- The revenue stream provides the needed funds to serve the local population at no cost to the patients

SF tele-audiology model has:

- Increased access to hearing healthcare in San Felipe Mexico
- Provided quality diagnostic and rehabilitative services; focus is not on quantity
- Permitted continuity of care with a focus on after-care appointments

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Thank you to all the partners who have made this project possible

Minneapolis-University Rotary Club

San Felipe Rotary Club

International Hearing Foundation

Arizona State University

Rotary Cancer Clinic of San Felipe

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Questions??

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Mobile Smartphone Audiometry to Improve Hearing Outcomes in Nicaraguan Children

James Saunders, MD
Professor of Otology, Geisel School of Medicine at Dartmouth

Karen Mojica ,MD
Mayflower Medical Outreach, INC

Greare

Dartmouth GEISEL SCHOOL OF MEDICINE

Motivation

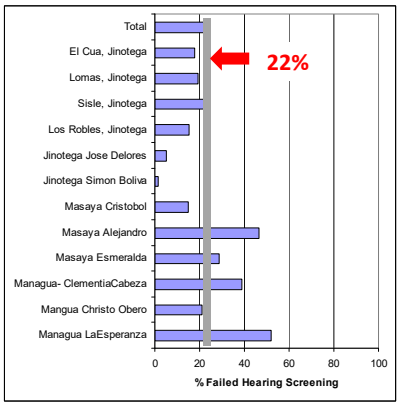
- 360 million people globally with disabling hearing loss including 32 million children.
- Leading cause of Global Burden of Disease (6th cause of YLD)
- 80% of affected people live in low resource countries (LMIC)
- Childhood hearing loss often leads to poor language development, educational outcomes, and employment opportunities
- Early intervention is critical to improve outcomes

GBD 2015

1. Ischemic Heart Disease
2. Lower Respiratory Infection
3. Neonatal Preterm Birth
4. Hemorrhagic Stroke
5. Diarrheal Diseases
6. Neonatal Encephalopathy
7. Diabetes
8. COPD
9. Low Back Pain
10. Malaria
11, HIV/AIDS Other
12. Iron-deficiency Anemia
13. Ischemic Stroke
14. Major Depression
15. Hearing loss
16. Tuberculosis
17. Lung Cancer
18. Neck Pain
19. Self-harm
20. Other musculoskeletal
21. Migraine
22. Neonatal Sepsis
23. Asthma
25. Congenital Heart Disease
27. Pedestrian Road injuries
31. Protein-energy Malnutrition
32. Other Neonatal
33. Drowning
93. Measles

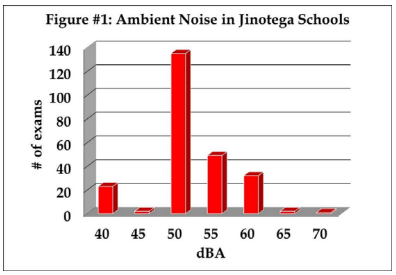
Hearing Screening in Low Resource Settings

- Hearing screening in LMIC is challenging partly due to poor equipment design and lack of trained personnel
- Preliminary data from schools in Jinotega, Nicaragua
  - Second poorest country is western hemisphere
  - Rural development index similar to sub Saharan Africa
  - 22% of children fail screening



Hearing Screening in Low Resource Settings

- Ambient noise leads to poor specificity
- Secondary diagnostic testing is costly or unavailable
- < 10 % of identified children receive diagnostic testing or services

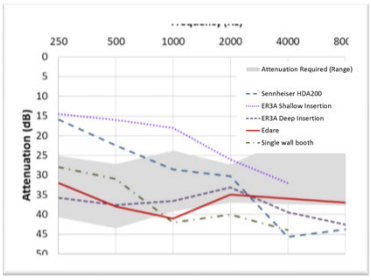


Mobile Technology Hardware

Hardware

- Prototype wireless (Bluetooth), noise attenuating, audiometric headset
- Noise attenuation comparable to single-wall sound proof booth
- Electronics integrated inside headset to ensure consistent calibration and performance

*Battery contained in opposite earcup



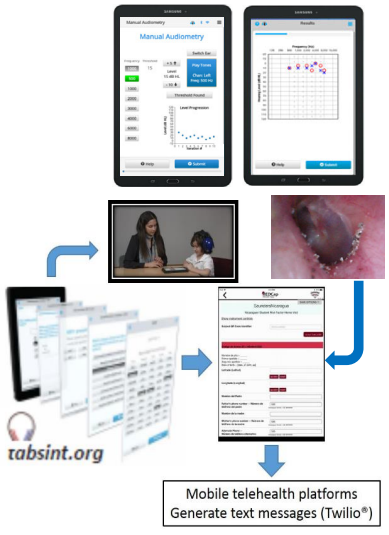
Mobile Technology Software

Tabsint

- Intuitive tablet / mobile testing interface
- Multi-lingual capability
- Automated and manual testing capability
- Customizable - e.g. embedded child training video

Redcap

- Demographic and Questionnaire data (HIPPA compliant)
- Multi-lingual capability
- Tabsint audiometric data upload via API interface
- Integrate other data (digital otoscopy photo)
- Generate SMS text messages via commercially available software (Twillio®,

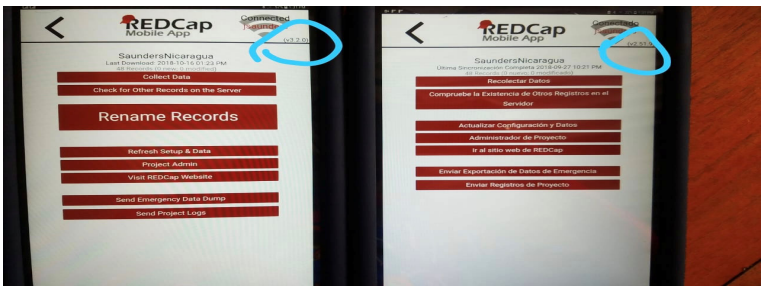


REDCap
Research Electronic Data Capture

- Demographic Measure is completed on a tablet and synced to the Redcap server.
- Home visit is completed on a tablet and Redcap data is synced to the Redcap server. Additionally, Tabsint audiology data is sent to Redcap.
- The above data is evaluated by a clinician and they have the opportunity to recommend audiology or a repeat home visit.
- Automatic text invitations are sent to the subject scheduling a specific day and what type of follow up they will do.
- Audiology data is either entered on a tablet or completed on a computer and synced to the Redcap database.

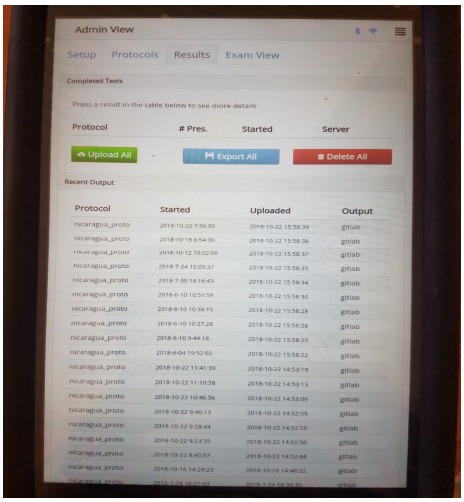
REDCap SERVER & REDCap MOBILE APP

- **Mobile app syncing**
  - The Redcap mobile app is designed so that data can be collected offline and then sent to the server at a later time—it is this very functionality that lead us to choose it for implementation on our project.



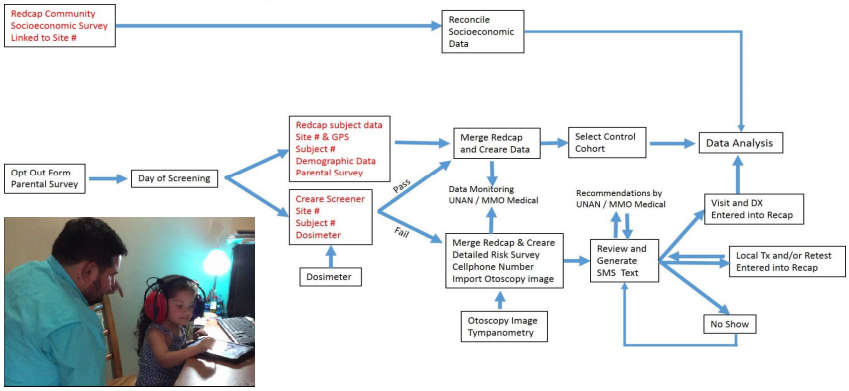
TabSINT

Tabsint is a custom audiology testing app that stores data locally on a tablet until the device receives a wifi connection, at which time the data is sent in text files to a central repository. For the purposes of our project, we needed the audiology data to be imported into Redcap in a human-readable format.



Study Design

- Collaborate with Autonomous University of Nicaragua (UNAN-Leon)
- ~4000 school children in rural Jinotega, Nicaragua
- Minimally trained screeners / embedded video training modules
- Automated and manual hearing screenings with Creare WiScreener
- Collect detailed Risk Factor data on failed screening exams including otoscopy and tympanometry – lined to telemedicine platform
- Generate SMS text messages to families – improve follow up



Minimally Trained Personnel

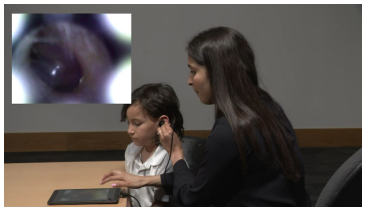
Applicants for audiometric screener position (n=4)

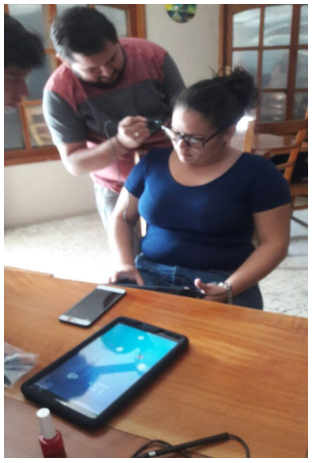
Minimally trained (Nurses, Law student, Psychologist)

Tablet-based instructional videos (23 min total)

Competencies:

- Database management – 100%
- Automated Audiometry – 100%
- Manual audiometry – 75%
- Otoscopic image clarity – 75%
- Noise measurements – 75%





Hearing Screening with Mobile technology

Research Team / Collaborators

Dartmouth Space Innovations Lab
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Abigail Fellows
Devin Cowan

Creare
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Jesse Norris, PhD
Mark Shapiro, MS

National Autonomous University of Nicaragua
Donoso Penalba, MD
Aurora Auragon, MD
Marvin Gonzales, PhD

Mayflower Medical Outreach
Karen Mojica, MD

Dartmouth Synergy Clinical and Translational Science Institute
John Higgins

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Content does not necessarily represent views of NIH or Army.

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Minimizing barriers to access through CONEXIONES: A teleaudiology study

Laura Coco AuD CCC-A
Nicole Marrone PhD CCC-A

Presented by: Laura Coco AuD CCC-A

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- Arizona Community Foundation Grant
- SERTOMA Club Community Grant
- University of Arizona Graduate and Professional Council Research Grant

Content is solely the responsibility of the author(s) and does not necessarily represent the official views of the NIH or other funding agencies.

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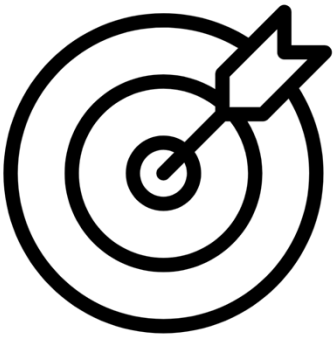
Overarching goals

- ✓ Improve quality of life and communication for older adults with hearing loss.
- ✓ Improve access to hearing health care for underserved populations.



NASEM 2016; NIDCD 2015

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Challenges

- ✗ Too few audiologists overall
- ✗ Rural workforce shortages
- ✗ Delays in care for rural patients

Windmill & Freeman 2013; Coco, Sorlie-Titlow, & Marrone, 2018; Chan et al., 2017; Behl & Tharpe 2013; Bush et al., 2014

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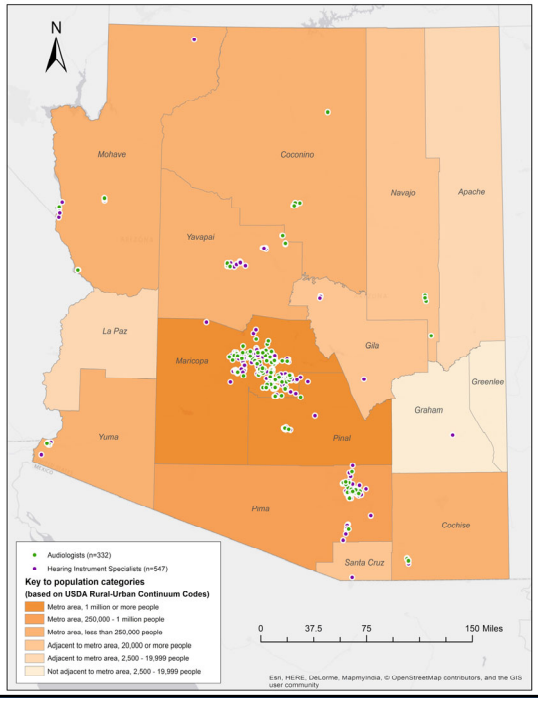
"There is nothing for hearing aids [here]. Our doctors know that and don't refer us even though they know we have hearing loss because there is nothing here."

- Oyendo Bien participant, resident of Santa Cruz County. (translated from Spanish)



Geographic workforce analysis:
Coco, Sorlie-Titlow, & Marrone, 2018 *Amer J Audiol*

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CONEXIONES

Aim: Test the feasibility of a **Community Health Worker-assisted teleaudiology** intervention as a method for improving hearing aid rehabilitation for rural, under-resourced older adults.

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Who are CHWs?

In the U.S., Community Health Workers (CHWs) are:

Frontline public health workers who are trusted members of the community served and/or who have an unusually close understanding of the community served.

https://www.apha.org/apha-communities/member-sections/community-health-workers

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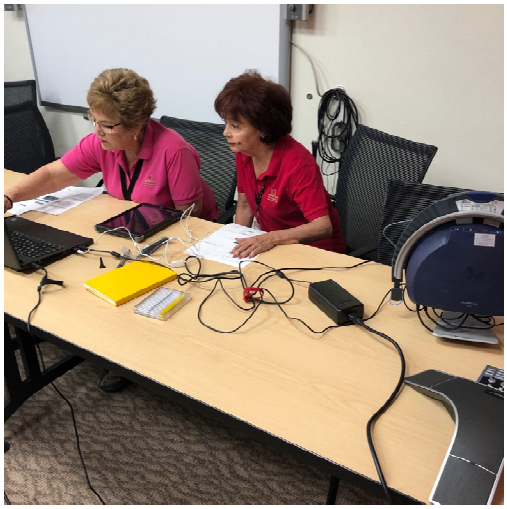
CONEXIONES: CHWs



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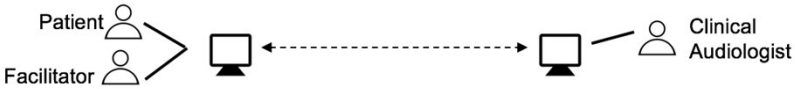
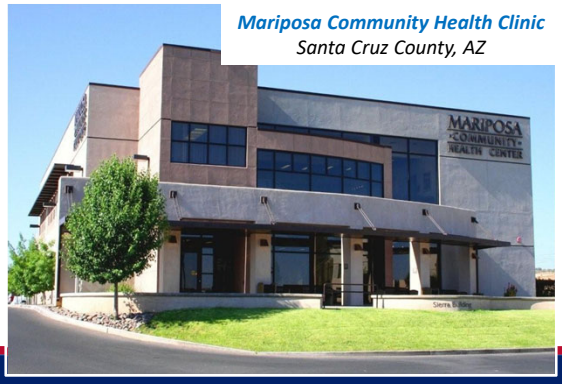
CONEXIONES: Project sites



Patient site ***Provider site***

Mariposa Community Health Clinic
Santa Cruz County, AZ



University of Arizona
Pima County, AZ

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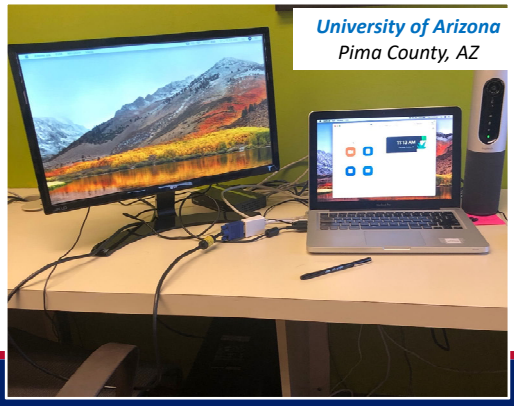
CONEXIONES: Project sites

Patient
Facilitator
Clinical Audiologist

Patient site ***Provider site***

Mariposa Community Health Clinic
Santa Cruz County, AZ

University of Arizona
Pima County, AZ



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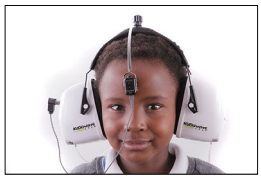
CONEXIONES: Technology



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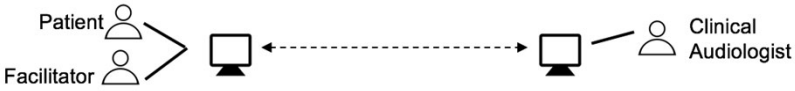
CONEXIONES: Team roles



Facilitator:

- Hands-on tasks (e.g. place headphones)
- Help with patient comfort
- Communicate with audiologist
- Help equipment run smoothly

Audiologist:

- Conduct and analyze all tests
- Diagnose hearing loss
- Come up w/ treatment plan w/ patient
- Program and verify hearing aids
- Train and supervise facilitator

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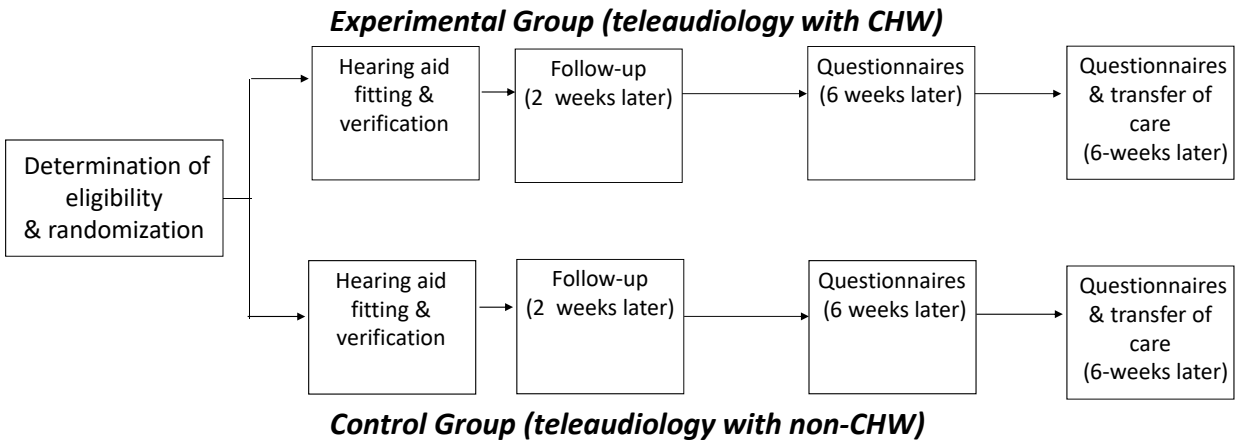
CONEXIONES: RCT study design



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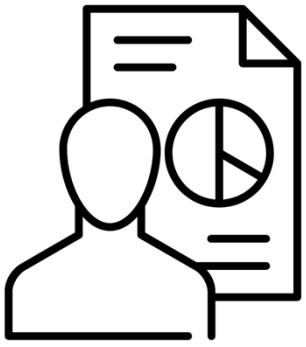
CONEXIONES

Outcomes to be measured

- Communication self-efficacy (SESMQ)
- Hearing aid benefit (EAR)
- Health-related quality of life (SF-12)
- Hearing aid usage (hours per day)



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CONEXIONES: Study timeline

Obtain funds

Develop training & study protocols

Engage community partners

Train staff

Stage equipment

Enroll participants

Hearing aid fittings via teleaudiology

Longitudinal data collection

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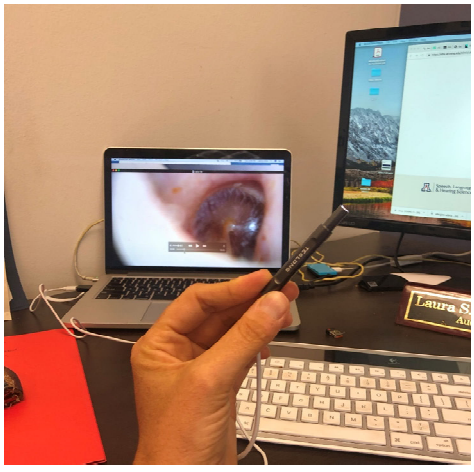
CONEXIONES: Lessons learned so far

"The only thing you can't rely on is technology." –IT professional

"Don't treat it like a computer game." –IT professional

"They need to know we aren't broadcasting them on YouTube." - Community Health Worker



16

THE UNIVERSITY OF ARIZONA COLLEGE OF SCIENCE
Speech, Language, & Hearing Sciences

MARIPOSA Your COMMUNITY HEALTH CENTER

CONEXIONES

Thank you!

Questions? Comments?

lauracoco@email.arizona.edu / laura-coco.com

17

Tele-Intervention Services at Utah State University

Lauri H. Nelson, Ph.D.

UtahState University

Tele-Intervention Services

- Intervention services for development of speech, language, and auditory perception for children who use listening and spoken language (LSL)
- Services provided in conjunction with USU LSL graduate training program

UtahState University

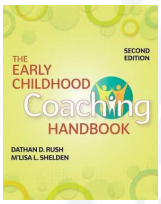
Benefits of Tele-Intervention

- Increase services for families who live in rural or underserved areas
- Options for programs that do not have service providers with LSL expertise
- Cost savings due to reduced service provider travel
- Fewer missed visits due to minor illness or weather
- Convenience for families
- Naturally lends itself to parent engagement as child's most important teacher

UtahState University

Parent Coaching

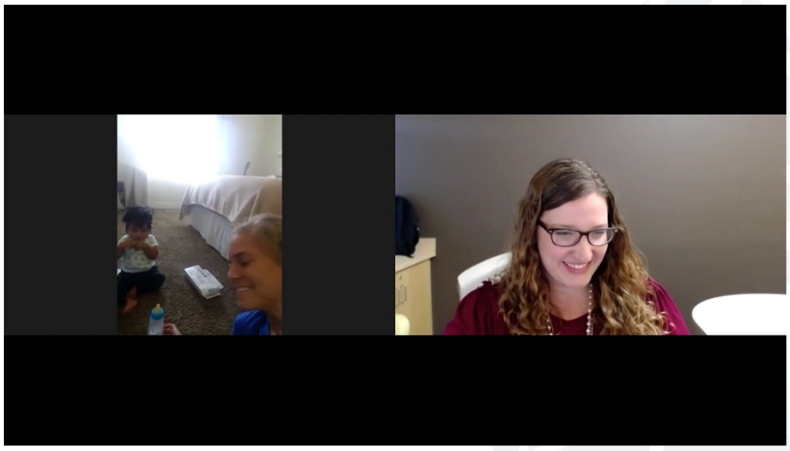
- Parent / Professional Partnership
  - TI is NOT a barrier to developing positive family relationships
- Coach parents to understand how to implement goals throughout the week and across environments
- The Early Childhood Coaching Handbook (Rush and Shelden)



UtahState University

Services Preparation

- Take the time to orient families to this model of service delivery – allow for Q & A
- Help parents understand how to set up environment consistent with session goals
  - Managing toys or materials
  - Setting for optimal session, for example . . .
    - High chair?
    - Small room area?
    - Kitchen?
    - Outside?



Challenges

- Licensure
- Funding
- Internet connections
- Assessment
- Establishing agency partnerships

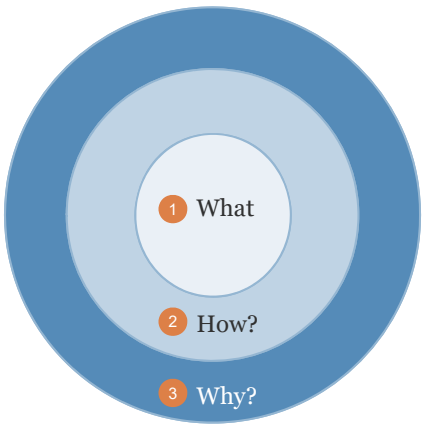
Final Comments

- Tele-intervention can provide excellent therapy option
- Take the time to orient family, discuss their priorities, and establish positive relationship as would happen with in-home visits
- Utilize strongest internet connection available
  - Minimize others' use of internet in the home during the session
  - Consider sound needs (e.g., microphone quality)
- Have fun!

World Wide Hearing

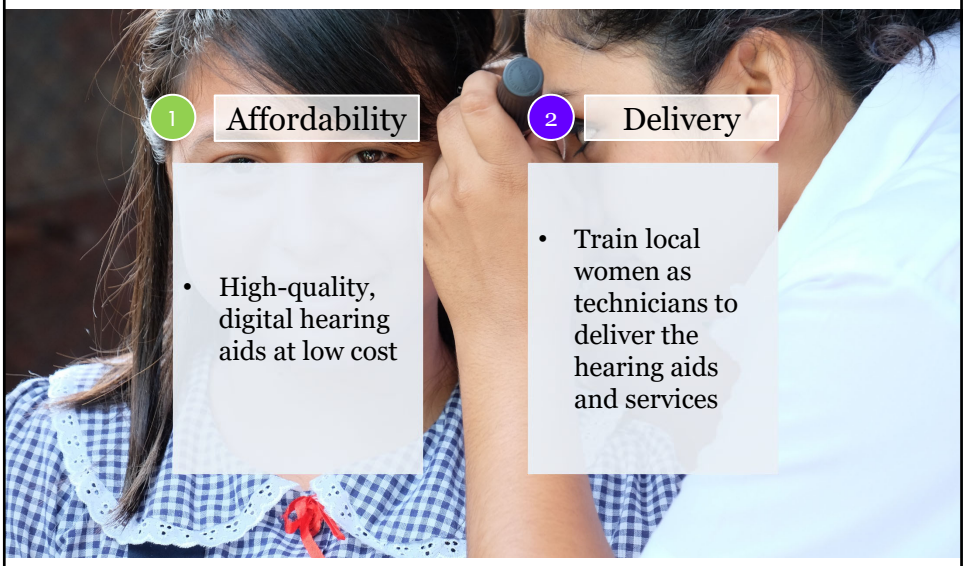
World Wide Hearing Foundation International

World Wide Hearing: Mission



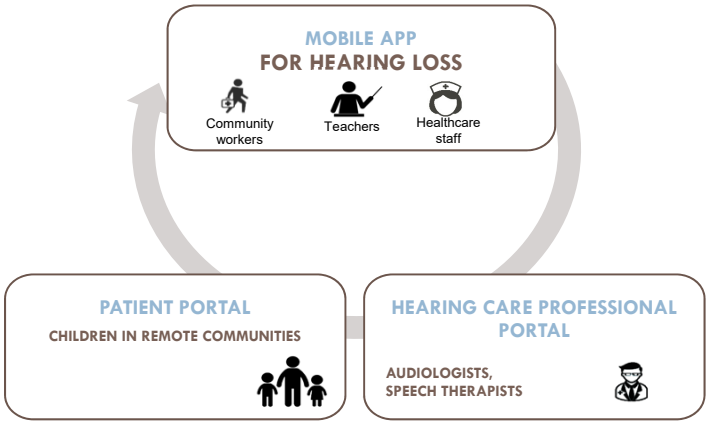
1. **What?**
   Providing hearing aids for children and youth in developing countries
2. **How?**
   Through a social enterprise model
3. **Why?**
   Make a powerful impact on poverty, mental health, and education

Our Solution



Our Solution

3 Remote Audiology System (RAS)

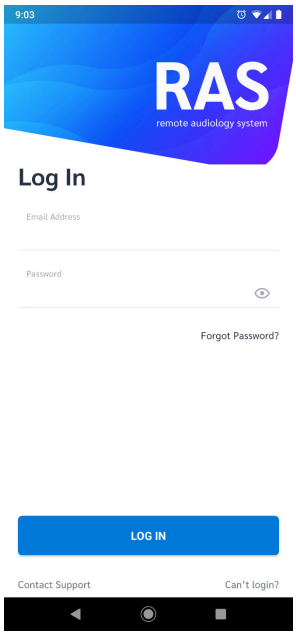


RAS - Features

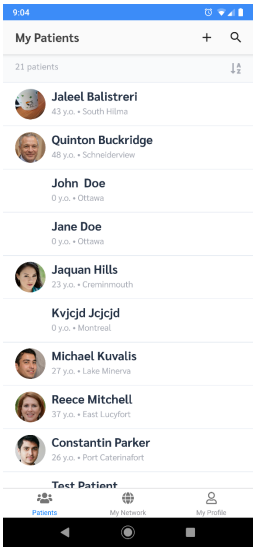
- Android-based app
  - Online / offline functionality
  - Languages: English (Spanish coming soon)
- Web portal
  - Dashboard
  - Reminders
  - Caregivers
- Follows HIPAA guidelines
- Free of charge (open-access)

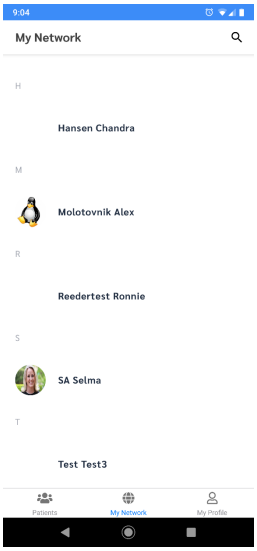
RAS - Advantages

- **Portable** made for areas with **limited connectivity.**
- **Non-profit:** free for use by healthcare workers and hearing care experts. Impact-driven initiative.
- **Easy uptake:** made for people with limited audiology training (frontline health workers and hearing technicians).

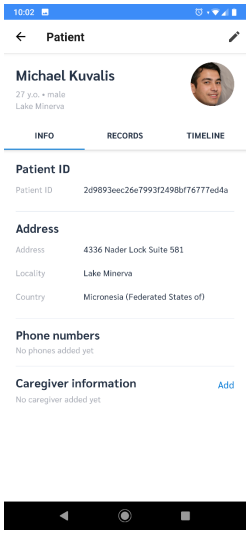


Patient and Care-Network List

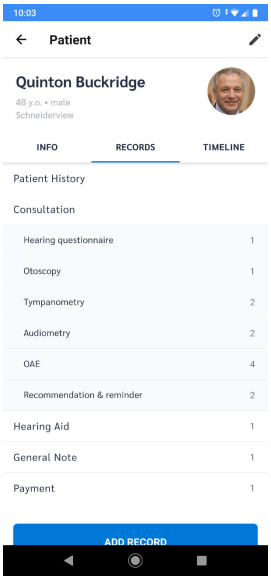




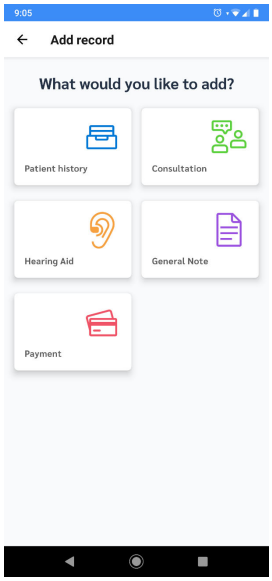
Patient Data and Timeline

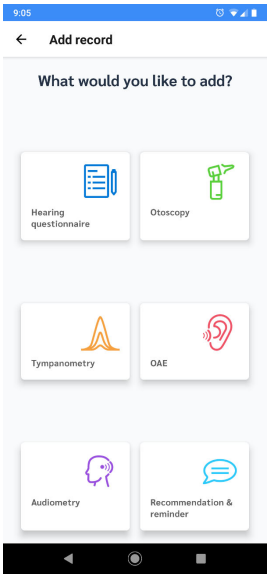


Patient Records

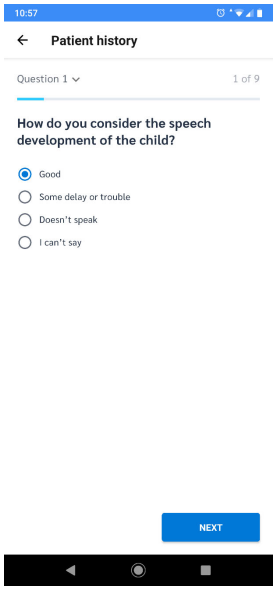


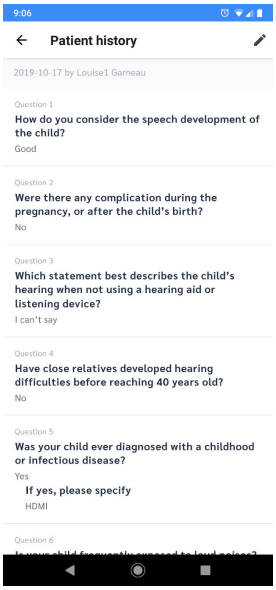
Add Patient Records



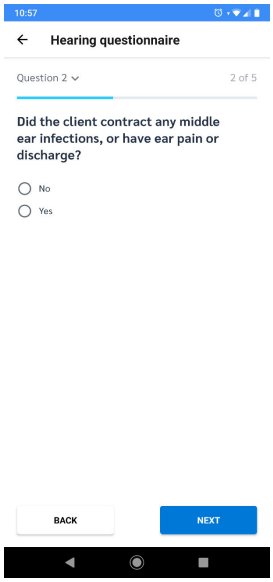


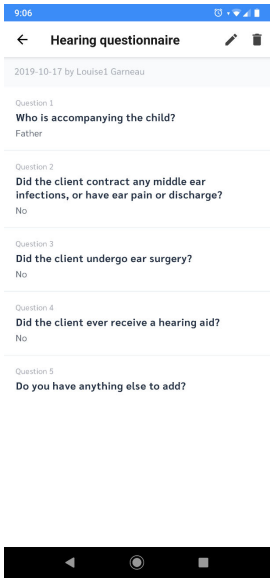
Patient History



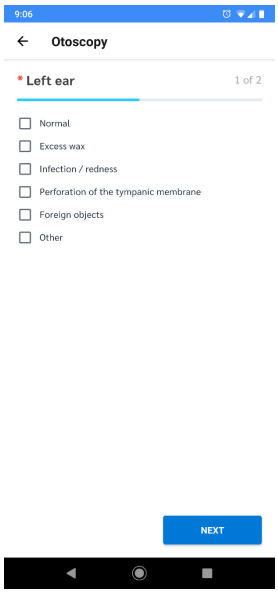


Hearing Questionnaire

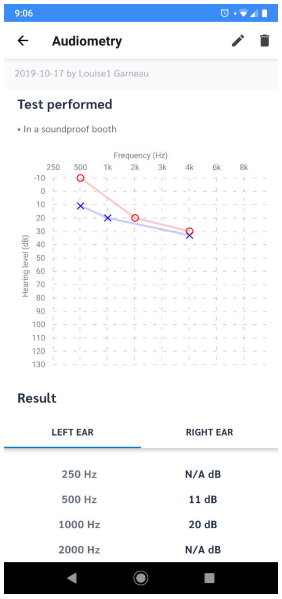




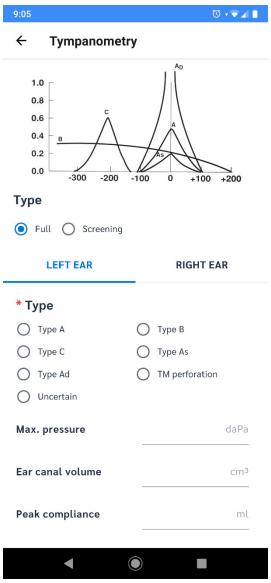
Otoscopy



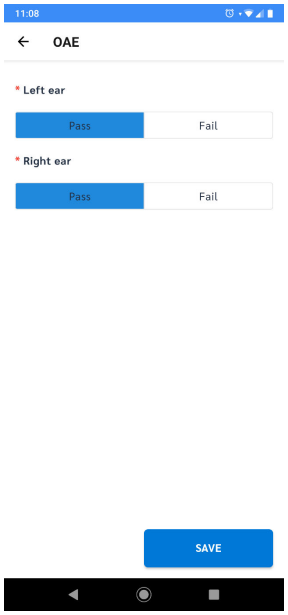
Audiometry (manual entry or file/photo upload)



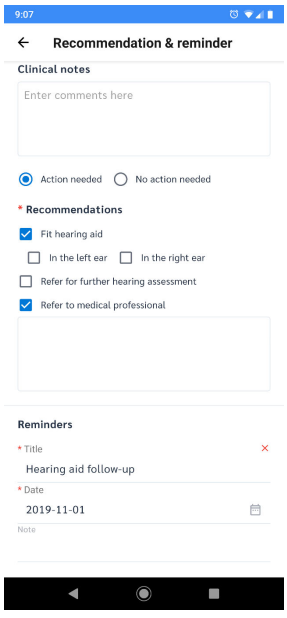
Tympanometry (Screening or Full)



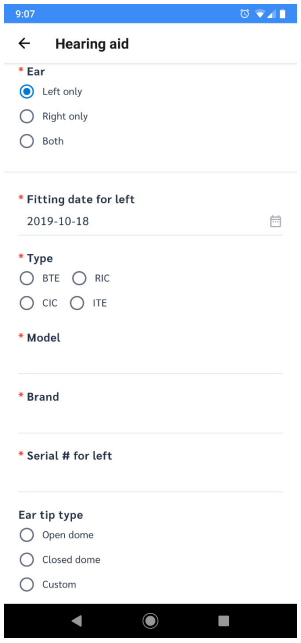
OAE Screening



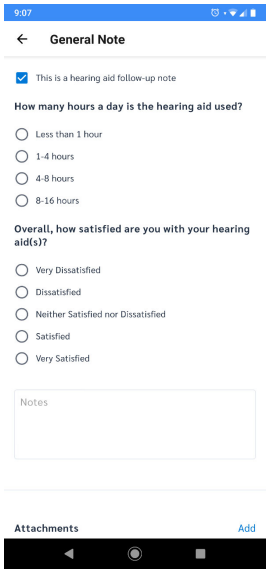
Recommendation & Reminders

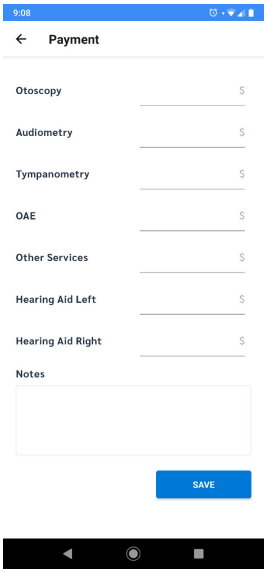


Hearing Aid

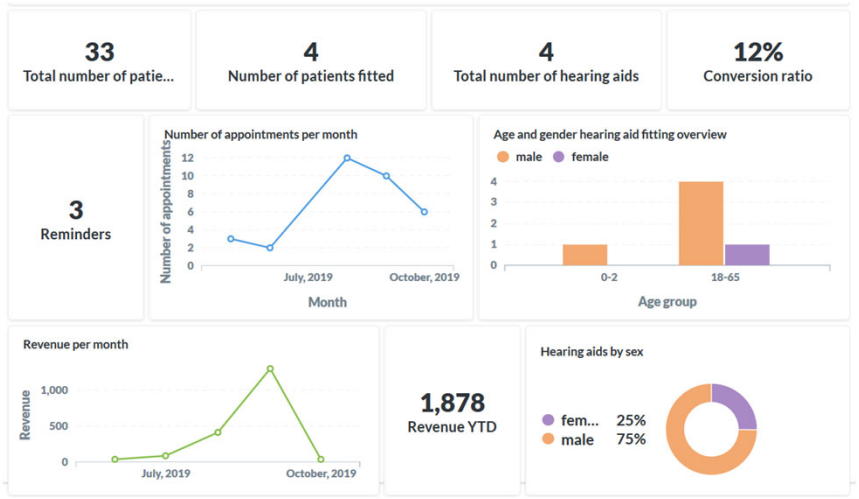


General Note & Payments

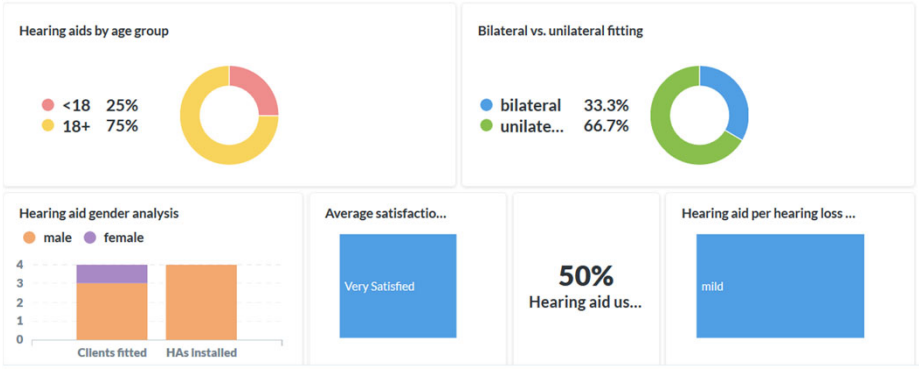




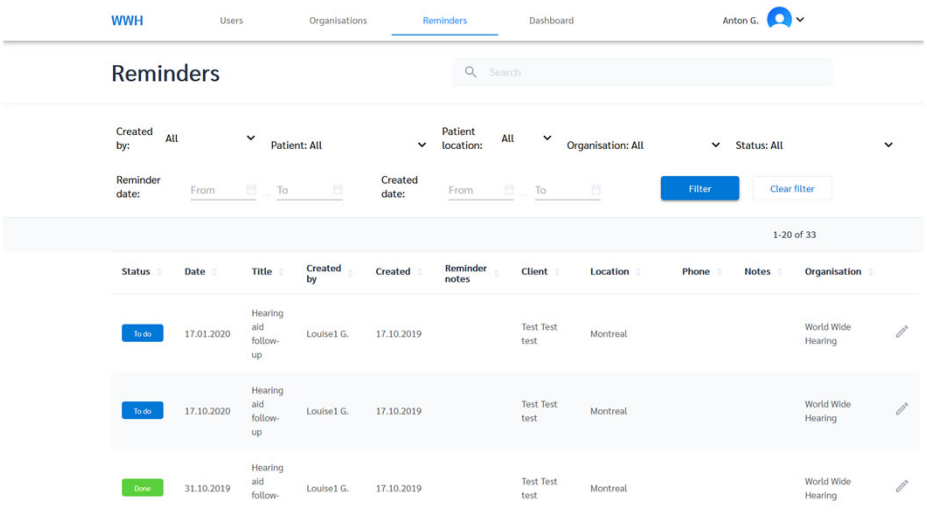
Portal Dashboard



Portal Dashboard



Portal Reminders



Lessons Learned

- **Discovery Phase:**
  - Patient journey mapping: not everyone had the same perception of where the bottlenecks lie and what the use cases are
  - Extensive consultation with field partners: easier to provide feedback on existing tech than ideate on possible tech solutions
- **Choosing the right developers:**
  - In-house vs. external
  - Healthcare vs. non-healthcare specialists
- **Clearly defining scope, budget and timelines**
  - …while still staying flexible and open to innovation!

Accessing the RAS

- **App Available in Google Play Store:**
  - play.google.com/store
- **Web Portal:**
  - web.remoteaudiologysystem.org
- **For login and support, please email:**
  - info@wwhearing.org

Audra Renyi
arenyi@wwwhearing.org

RAS Tech Support:
info@wwhearing.org

WWW.WWHEARING.ORG

Global Hearing Loss Database

The following map shows the worldwide hearing loss prevalence studies.

GSI AMTAS: Digital Health Preconference Workshop: Equipment Demo

Laura Prigge, AuD

gsi Grason-Stadler

1

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Agenda

- Introduction and Demonstration of GSI AMTAS
- Use of AMTAS in TeleAudiometry
- Questions

2

amtas™

3

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GSI AMTAS - Overview

- **A**utomated **M**ethod for **T**esting **A**uditory **S**ensitivity
- Software program – works with GSI audiometers or Microsoft Tablets
  - ***Software*** is loaded on a PC or tablet
  - Connected to a GSI Audiometer
  - Connected to a tablet
- Self administered automated test for obtaining a diagnostic or screening audiogram
- Patented algorithms ensure quality and reliability of evaluation.

4

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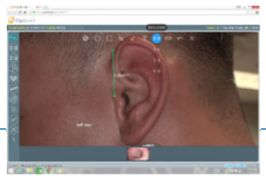
AMTAS Pro and AMTAS Flex

5

amtas pro™

- Telehealth:
  - Masked air and bone conduction thresholds
  - Masked SRT and WRS speech audiometry
- Required:
  - GSI Audiometer (AudioStar Pro or Pello with AMTAS License)
  - PC with AMTAS Software
  - Quiet Testing Area
- Optional
  - Telehealth software
  - Telehealth camera with otoscope attachment



6

amtasflex™

- Threshold Mode:
  - Pure tone air conduction thresholds
  - Masking
- Required:
  - Windows Tablet with AMTAS Software
  - Calibrated Headphones
  - Quiet room

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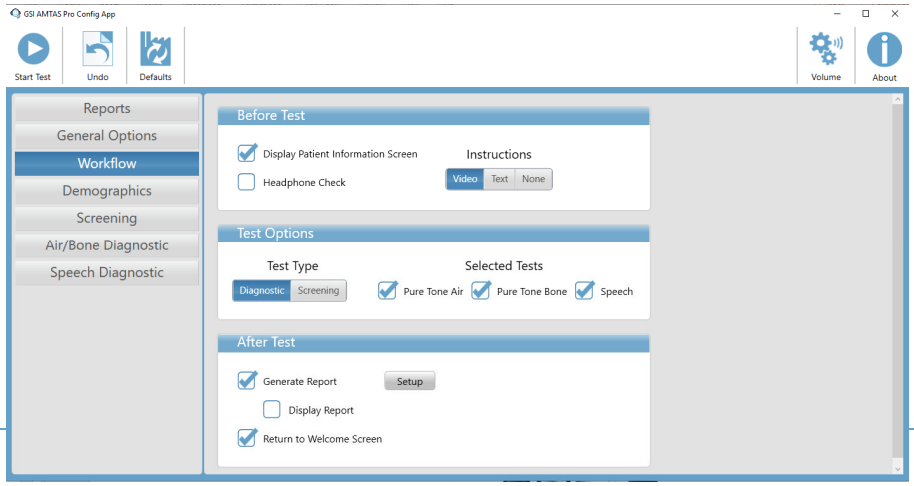
AMTAS Pro Operation

8

Test Set Up – site or patient specific



9

Patient Set Up – Headphone Placement

- Circumaural headphones
- HDA200 or DD450
- Forehead placement.
- AMBAND

10

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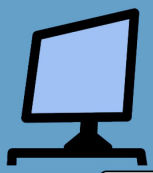
Welcome to

GSI AMTAS ™

Self Administered Automated Audiogram



Get Started

11

gsi Grason-Stadler

Listen for a TONE.

2%

gsi

Did you hear the TONE?

YES

NO

2%

gsi

12

Automated Report

- Patient Information
- Audiogram
- Audiogram Symbol Legend
- Masking Level Table
- Quality Assessment Table
- Audiogram Classification Table
- Speech Recognition Table
- Comments

13

Qualind: Interpretation

- Patented method for determining the accuracy of a test results
- Data was collected at three sites from a wide range of settings, patient demographics, and hearing loss characteristics.
- Large subject sample (n = 120), a strong relationship was found between predicted and measured accuracy.
- Method may be useful for automated test procedures to provide quality assurance.

Qualind™: A Method for Assessing the Accuracy of Automated Tests. Margolis, et al,2007, JAAA, 18: 78-89.

14

Quality Assessment Table (Qualind)

- **Predicted Accuracy** (Overall Quality -Good, Fair, Poor)
- **Predicted Average Absolute Difference** –Difference between automated and manual thresholds
- **Masker Alerts**-thresholds where masking may have been too high or low
- **Time per Trial** - average time from stimulus to patient response
- **False Alarm Rate** – number of times patient responded with no stimulus presented divided by number of trials when no stim present
- **Average Test-Retest Difference** – average difference between 1 KHz test and retest in right and left hear
- **Quality Check Fail Rate** – number of times patient did not respond to stimulus above threshold divided by the number of measured thresholds
- **Number of Air / Bone Gap > 35 dB** – number of air bone gaps that exceed 35 dB
- **Number of Air / Bone Gap < -10 dB** – number of air bone gaps that are less than 10db

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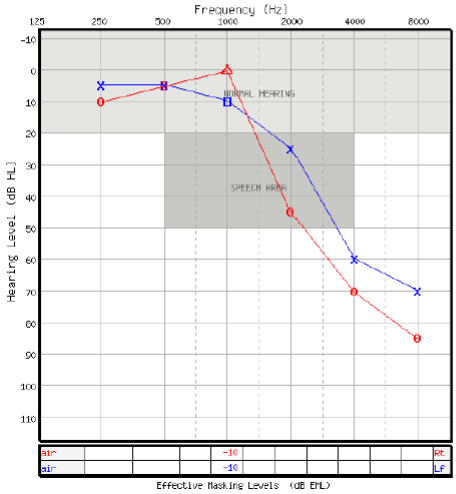
Patient Information
Gene Bertsch

GSI-AMTAS™ Hearing Report

AUDIOGRAM
Frequency (Hz)



QUALITY ASSESSMENT (Air Only)		
Predicted Accuracy	GOOD	
Quality Indicators	Value	%ile
Predicted Avg. Abs. Diff. (dB)	3.593	45
Time per Trial (s)	3.544	40
False Alarm (%)	11.11	70
Avg. Test Retest Diff. (dB)	2.500	23
QC Fail (%)	0.000	0

LEGEND	Right	Left
Masked Air	△	□
Unmasked Air	O	X

QUALITY ASSESSMENT (Air Only)		
Predicted Accuracy	GOOD	
Quality Indicators	Value	%ile
Predicted Avg. Abs. Diff. (dB)	3.593	45
Time per Trial (s)	3.544	40
False Alarm (%)	11.11	70
Avg. Test Retest Diff. (dB)	2.500	23
QC Fail (%)	0.000	0

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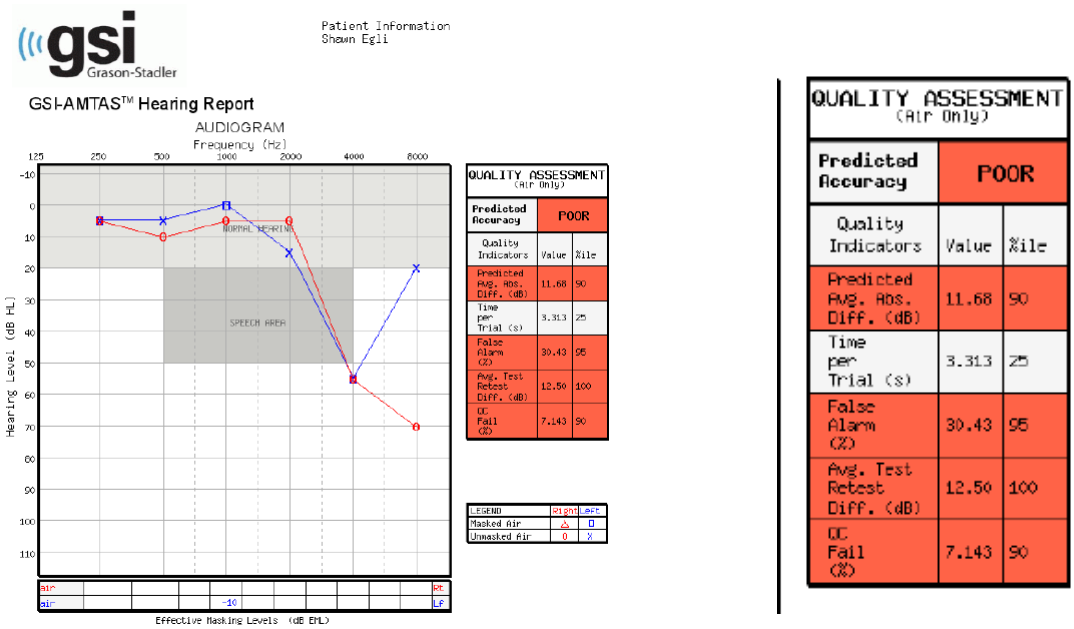

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Amtas Flex Operation

18


Apply Headphones
To ensure an accurate evaluation, it is important that headphones are correctly placed on the left and right ears.
The left side has a blue indicator on it and the right side has a red indicator.
Quit
Continue
Headphone Check
Select the ear where you hear the sound.
Left Ear
Right Ear
Quit
Continue
19


Text Instructions or Video Instructions
Hearing Test Instructions
You will hear tones presented at different pitches. Some tones will be loud and others will be very quiet.
Press Yes, if you hear the tone, even if it is very quiet. Press No, if you did not hear the tone.
If you hear static or noise, ignore it, and only press Yes if you hear a tone.
Quit
Continue
20

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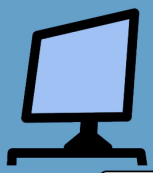
Welcome to

GSI AMTAS ™

Self Administered Automated Audiogram



Get Started

21

Listen for a TONE.

2%

gsi

Did you hear the TONE?

YES NO

2%

gsi

23

Key Differences between AMTAS Pro and Flex

AMTAS PRO

- Must be used with an audiometer
  - AudioStar Pro
  - Pello
- Diagnoses Hearing Loss
  - Site of lesion
  - Configuration
- Air/Bone/Speech

AMTAS Flex

- Used with a tablet
- Portable
- Air Conduction ONLY
  - Screening
  - Threshold
- Does not Diagnose Hearing Loss

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Ideal for Digital Health

- Minimal training required
- Proven Reliability
- Quality Indicators
- Improve access to quality diagnostic testing

25

AMTAS Publications

- Margolis, R.H. Automated Audiometry – Progress or Pariah? Audiology Online (www.audiologyonline.com). January 17, 2005.
- Margolis, R.H. Automated Audiometry: Progress or Pariah. Audiology Today 17:21, 2005.
- Margolis, R.H., Saly, G., Le, C., Laurence, J. Qualind™: A Method for Assessing the Accuracy of Automated Tests. J. Amer. Acad. Audiol., 18, 78-89, 2007.
- Margolis, R.H., Saly, G.S. Toward a standard description of hearing loss. Int. J. Audiology 46, 746-758, 2007.
- Margolis, R.H., Morgan, D.E. The Value of Automated Audiometry. Insights in Practice for Clinical Audiology, January 2008.
- Margolis, R.H., Saly, G.L. Prevalence of hearing loss types in a clinical population. Ear and Hearing, 29, 524-532, 2008.
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- Margolis, R.H., Morgan D.E. Automated Pure-Tone Audiometry – An Analysis of Capacity, Need, and Benefit. Amer. J. of Audiology, 17, 109-113, 2008.
- Margolis, R.H., Glasberg, B.R., Creeke, S., Moore, B.C.J. AMTAS – Automated Method for Testing Auditory Sensitivity: Validation Studies. Int. J. Audiology,49, 185-194, 2010.
- Margolis, R.H., Frisina, R., Walton, J.P. (2011). Automated method for testing auditory sensitivity: II. Air Conduction Audiograms in Children and Adults. *Int J Audiology,* 50, 434-439, 2011.
- Margolis, R.H., Moore, B.C.J. Automated method for testing auditory sensitivity: III. Sensorineural hearing loss and air-bone gaps. *Int J Audiology,* 50, 440-447, 2011.
- Margolis, R.H., Eikelboom, R.H., Johnson, C., Ginter, S.M., Swanepoel, D.W., Moore, B.C.J. False Air-Bone Gaps at 4 kHz in Listeners with Normal Hearing and Sensorineural Hearing Loss. *Int. J. Audiology* 52:526-532, 2013.

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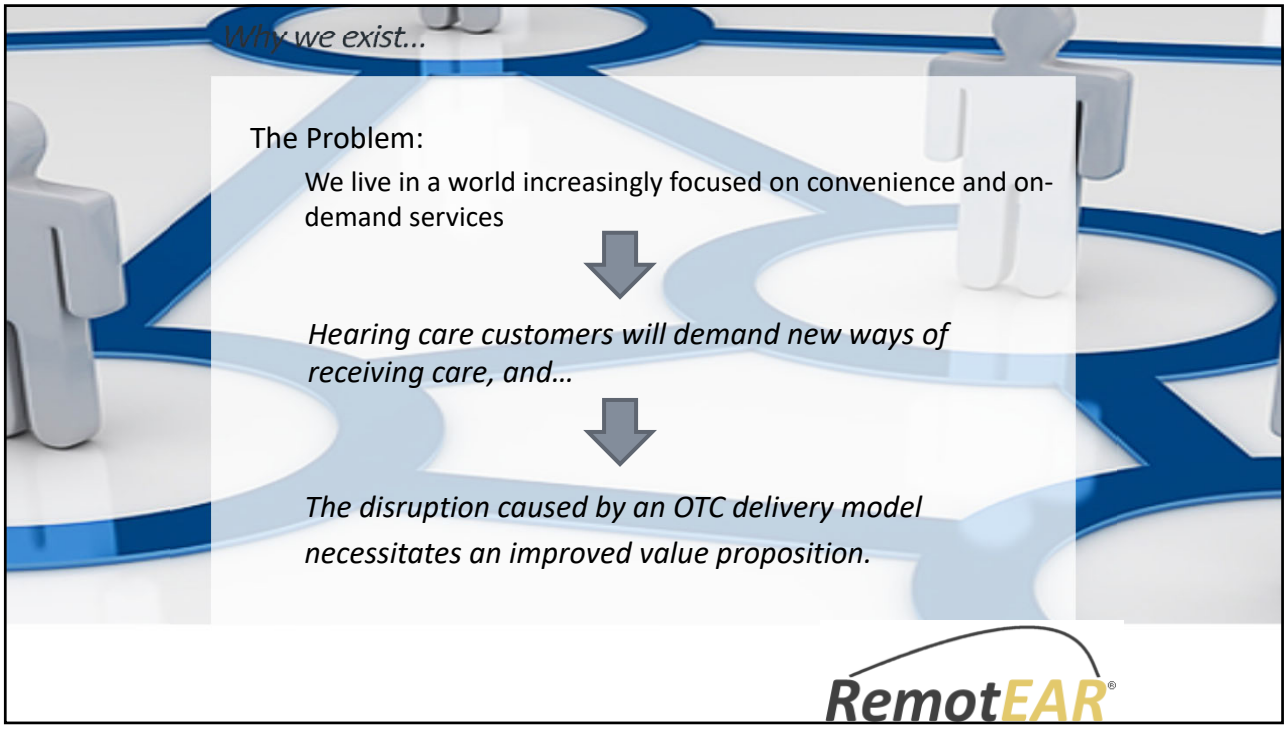
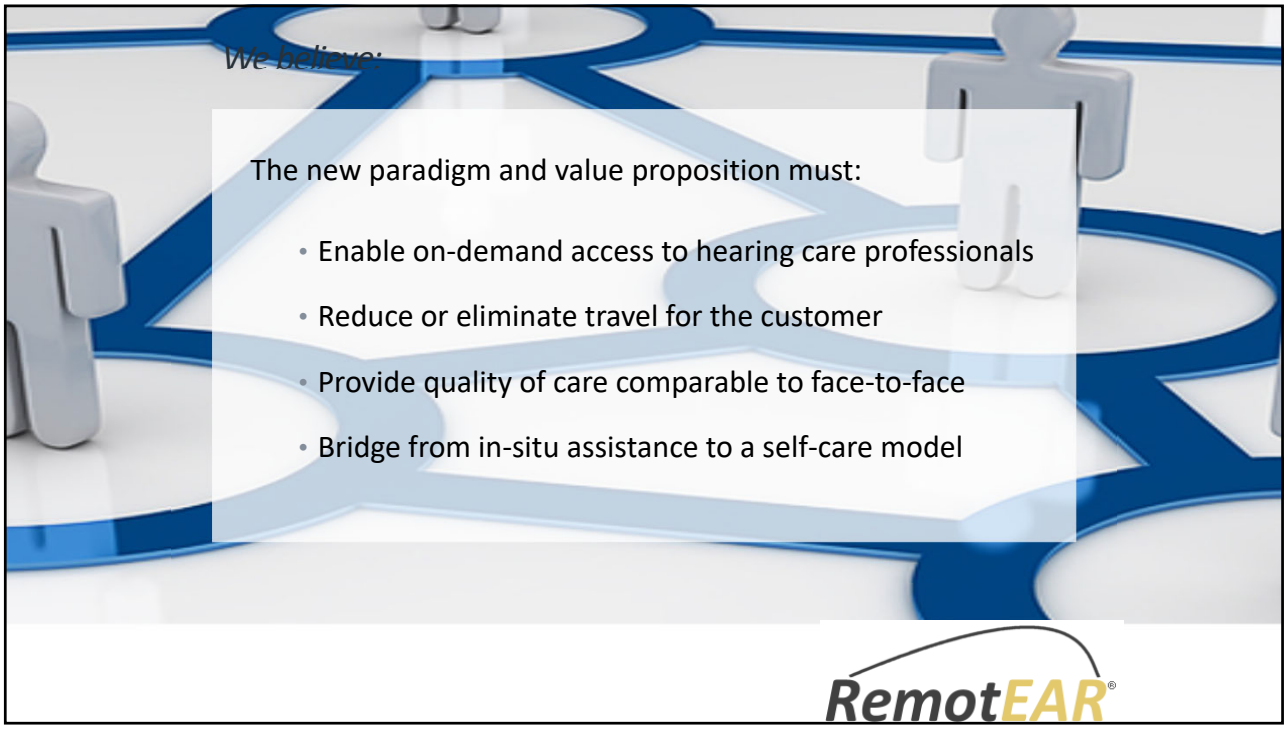
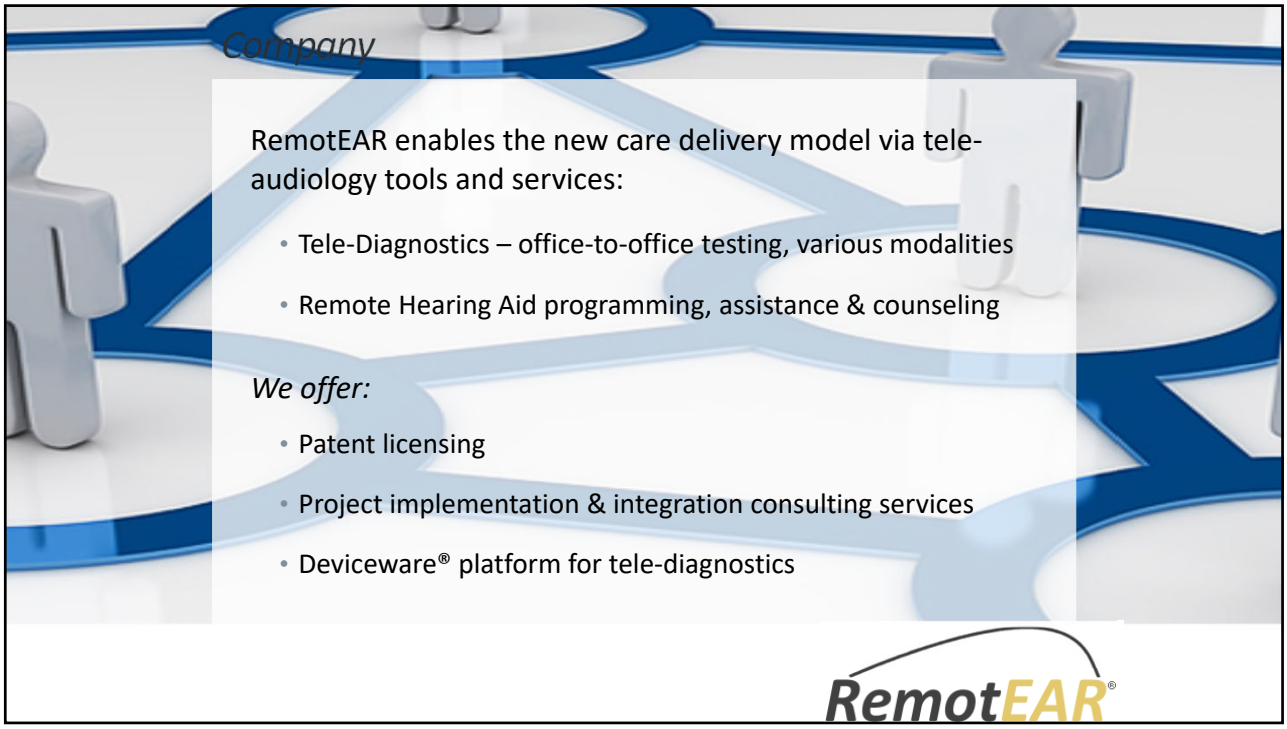
Questions?


RemotEAR®
Company Overview


Why we exist…
The Problem:
We live in a world increasingly focused on convenience and on-demand services
Hearing care customers will demand new ways of receiving care, and…
The disruption caused by an OTC delivery model necessitates an improved value proposition.
RemotEAR®


We believe:
The new paradigm and value proposition must:
• Enable on-demand access to hearing care professionals
• Reduce or eliminate travel for the customer
• Provide quality of care comparable to face-to-face
• Bridge from in-situ assistance to a self-care model
RemotEAR®


Company
RemotEAR enables the new care delivery model via tele-audiology tools and services:
• Tele-Diagnostics – office-to-office testing, various modalities
• Remote Hearing Aid programming, assistance & counseling
We offer:
• Patent licensing
• Project implementation & integration consulting services
• Deviceware® platform for tele-diagnostics
RemotEAR®

People, place, and things…

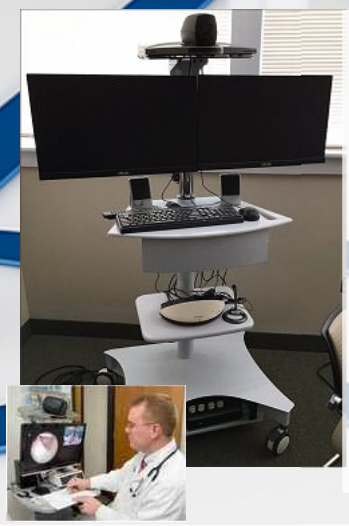
Principals have decades of experience in the hearing care industry:

- Tom Powers, Ph.D. – Industry veteran: 30+ years with Siemens (now WS) at VP level
- Dave Davis – 15 years in hearing diagnostics, ran one of the fastest growing device companies from 2005-2015; prior telemedicine experience

- Company is based in suburban Philadelphia
- Patent portfolio: 7 issued/licensed in

RemotEAR®

Deviceware® - Universal Tele-Diagnostics Platform



- Utilizes web conferencing technology
- Unique feature: SaaS or dedicated device
- Scalable from single office to enterprise, mobile to cart system
- Remotely operate any PC-software controlled diagnostic device
- Integrated audio and HD videoconferencing for testing and counseling
- Secure, highly reliable, robust features

RemotEAR®

Aegis

- New platform technology for home-based hearing aid programming, assistance, and counseling
- Any device, any setting
- Concentration on human factors for any type of user
- Now in development

AEGIS™

RemotEAR®

RemotEAR is:

- Comprehensively addressing the need for a flexible and future-looking hearing care model
- Developing tools and services that improve the convenience and efficiency for both patient and hearing care provider
- Cost-effectively helping organizations implement the new model

How can we help you?

Dave Davis ddavis@remotear.com +1 610-590-1590

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