

Introduction

Worldwide, 34 million children have hearing loss [1]. With the proper screening equipment, 57% of these hearing losses are detectable at birth [1]. Interviews and technological research have shown otoacoustic emissions (OAE) screening to be favorable in low-resource contexts if the testing is accessible. Dr Patricia Castellanos, director of the only hearing screening program in Guatemala, put it this way: "Many countries do not have any technology for newborn hearing screening. **OAE is a great starting technology for countries in Latin America, Africa, and Asia.**"

Our Goal

By offering an affordable OAE device to trained healthcare workers, our team aims to support universal newborn hearing screening and toddler/preschool hearing screening worldwide so families can gain agency to make informed health decisions in order to improve their children's life outcomes.

Most OAE screening devices cost 3000-5000 USD. This can create a large barrier for majority world contexts, where resources are limited. We aim to produce an OAE screening device on the scale of hundreds of USD, which we have validated through cost analysis of current OAE devices.

User interviews, research and prototyping are key elements in our design of a smartphone-based OAE screening device. Our collaboration with hearing health professionals has been instrumental, as their insights highlight critical details and considerations. We also work with Solar Ear, a social business with expertise in hearing health devices and manufacturing and distribution strategies [2]. This device will be more accessible and more affordable than current screening solutions.

About The Team

We are a team of engineering and business students from Babson College and Olin College's Affordable Design and Entrepreneurship (ADE) program. ADE is an international and experiential social entrepreneurship and design course focusing on designing solutions with people.



Seeking Collaborators in Co-Design

Our next step is to co-create a smartphone-based OAE device with people who provide screening in under-resourced environments. **We seek co-design collaborators experienced in screening newborns and young children in under-resourced areas to provide early concept feedback to guide the design of the first fully functional device. We are especially interested in speaking with audiologists and lay people who have experiences with hearing screening.**

During co-designing, designers provide models and representations for their ideas to the stakeholders. The stakeholders will play and experiment with the given ideas and share impressions and feedback to the designers. **If you are interested, please scan the QR code.**


Get Involved!



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Stakeholder Engagement

Engagement Strategies



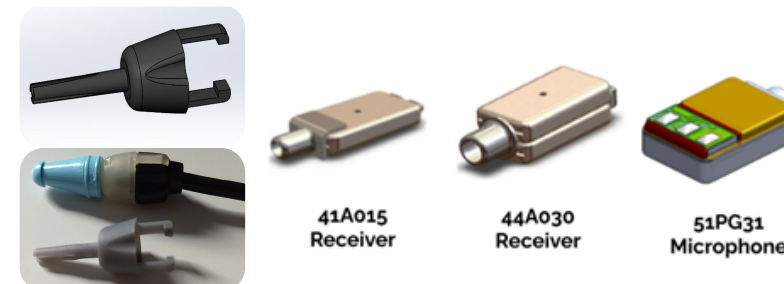
<p>13 Deaf & HoH Adults</p> <p>TikTok & Instagram Hashtags, HoH Community Facebook Groups, Family Contacts</p>	<p>16 Audiologists</p> <p>Local & International Health Institutions, Emails, Audiologist FB Groups</p>
<p>Parents of HoH Children</p> <p>We are looking to speak to parents of HoH children. Scan the QR code to get involved!</p>	<p>3 Device Purchasers</p> <p>Conversations with Deaf/HoH Adults, Research, Facebook Groups & Pages</p>

Main Takeaways

Primary Device User	Device Purchasers
<ul style="list-style-type: none"> The US has a universal newborn hearing screening policy, but most countries do not Only audiologists can perform hearing screenings in Colombia and Brazil, while other contexts allow the relatively simple test to be performed by students 	<ul style="list-style-type: none"> In Latin American countries, depending on the country, there may be private and/or public insurance that can cover hearing screening costs for patients, but some are still left without coverage. Non-profit groups also purchase devices with grants or donor funds
OAE vs. ABR	Community Challenges
<ul style="list-style-type: none"> ABR has a lower false positive rate but OAE has lower barriers to adoption OAE also presents the ability to screen children in the preschool age range <p><i>"OAEs can be a versatile tool that serve well as an entry-level technology for screening a wide range of individuals, from well-babies to middle-aged adults who do not have a history of noise exposure. With relatively low-cost and easy administration, OAEs lower the barrier for fast development of the very-much-needed hearing screening programs around the world."</i></p> <p>- King Chung, Ph.D, CCC-A, Audiology Professor, Northern Illinois University</p>	<ul style="list-style-type: none"> People often assume deaf or HoH individuals have a mental disability. Many of our interviewees described this experience as degrading. <p><i>"I wish I could have gotten resources earlier so that I wouldn't have failed half my classes, so that kids wouldn't call me stupid, so that I wouldn't have been bullied and so that I could just work any regular job like everyone else does at my age."</i></p> <p>-HoH stakeholder in Bolivia</p>

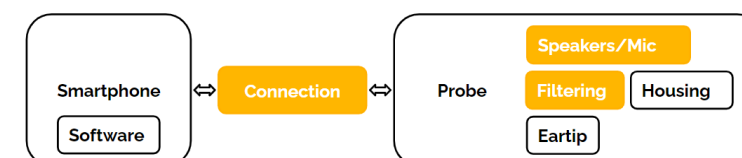
Technical Progress

We dissected an OAE probe and found its components cost 1% of its sale price. We also identified over 20 expired patents regarding OAE signal processing algorithms we could use for the underlying device technology to make it effective and affordable.



We have been designing and prototyping the ear tip. We identified microphones and speakers suitable for the design of an affordable, smartphone-compatible OAE probe and started testing them by sending and receiving sound signals.

Future Product System Diagram



Acknowledgements

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Bibliography

- [1] "Deafness and Hearing Loss." World Health Organization, World Health Organization, 1 Mar. 2020, www.who.int/news-room/fact-sheets/detail/deafness-and-hearing-loss.
- [2] "Transforming Dreams Into Sounds." Solar Ear, 14 Dec. 2020, solarear.com.br/.