

Challenge name	Innovative Audiometry
Challenge owner	Maastricht University Medical Center (MUMC+)
	<input type="checkbox"/> Company <input checked="" type="checkbox"/> Research <input type="checkbox"/> Student team
	Jerome Waterval, MD PhD
Email challenge owner	
Phone challenge owner	
Preferred way to contact	<input checked="" type="checkbox"/> email <input checked="" type="checkbox"/> Phone call <input checked="" type="checkbox"/> SMS / what's app <input type="checkbox"/> Other; ...
Brief summary	Since different pathology might cause hearing loss, the testing of people's hearing function – particularly in the case of conductive and sensorineural hearing loss – is difficult due to the physical characteristics of the skull and the head. To help people around the world with limited healthcare access, as well as small hospitals and hearing aid specialists, we aim to develop a mobile and semi-automated audiometry test facility for areas of need to provide basic audiometric care, but also as a screening tool at healthcare locations where staff is insufficiently trained.

About the challenge owner

We are actually not only one challenge owner, but a team of otologists and audiologists, represented by Jérôme Waterval (otologist) and Gijs Hoskam (audiologist, clinical physicist).

We are a highly clinically oriented team with numerous patient contacts of patients with ear and hearing problems for doctor visits and hearing tests, varying from children who need ventilation tubes to deaf people who are implanted with cochlear implants.

We are based in the Maastricht University Medical Center at the polikliniek KNO and the Audiological Center.

Challenge description

This challenge is a follow-up of a 2020-2021 challenge. Students of this academic year are invited to elaborate this topic as it has shown to be relevant and worth developing to a higher level of implementation.

In most university departments hearing tests are performed by specially trained professionals. Hearing is tested by air conduction (headphones) and bone conduction (vibrating device on the bone behind the ears), as different pathology might cause the hearing loss. Conductive hearing loss is due to a problem in the ear canal or middle ear, whereas sensorineural hearing loss is caused by the cochlea, nerve or the brain. Testing is difficult in such cases due to the physical characteristics of the skull and the head. Noise can be used at the one side for masking purposes to test the other side.

However, this is a time consuming examination and much experience is necessary for reliable testing. A wrong technique can lead to a wrong diagnosis. In many hospitals these tests are performed by staff that are insufficiently trained, or – even worse – there is no money for the set-up that is needed for reliable testing.

We aim to develop a mobile and semi-automated audiometry test facility for areas of need to provide basic audiometric care, but also as a screening tool at healthcare locations where staff is insufficiently trained.

The group can be working towards testing the new set-up on patients (approval of the medical ethical committee has been obtained), setting up an algorithm for automated audiometry, initiating the construction of a (web based) platform for (online) audiometry.

One of the earlier ISBEP groups has developed an elastic headband entailing customized 3D-printed applicators for a bilateral bone conductor. Furthermore, a couple of healthy individuals have been tested with this set-up, with promising results.



Input and involvement of challenge owner

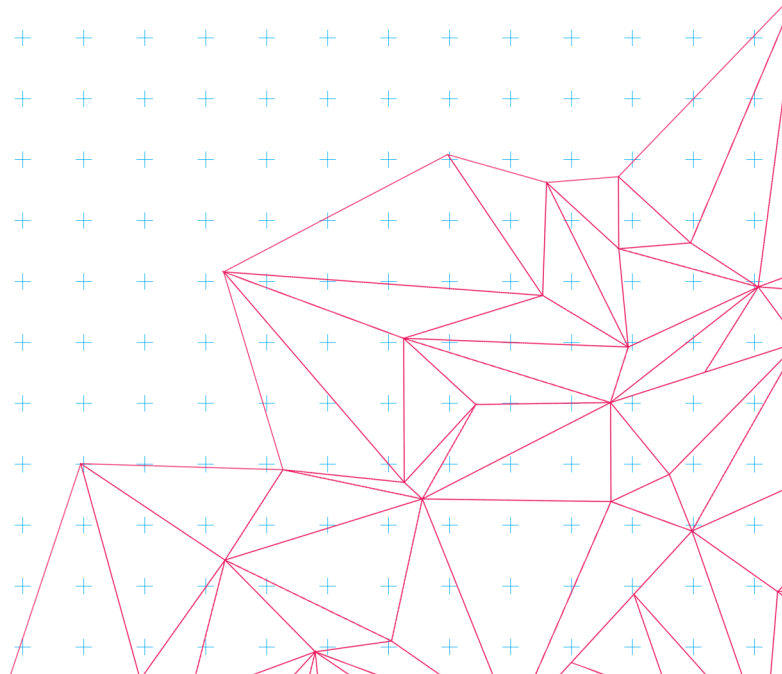
As we did last year, we are a highly interactive group. We have a specific vision and long-term goal with this challenge!

Not only our organization, but hearing aid specialists (audiciens), small hospitals and large parts of the world with limited healthcare access can potentially benefit from this type of application.

Resources

Time, knowledge and patients with abnormal hearing are required at this stage.

Expertise: audiological knowledge, hardware and software; patients who present at the department for hearing examination can be included.



Roles of different disciplines (only for ISBEP)

Automotive Technology	
Biomedical Engineering	
Architecture, Urbanism and Building Sciences	
Computer Science and Engineering	The eventual goal is to perform automated hearing tests. An algorithm should be built, in order for the patient to undergo a hearing test without intervention of an audiologist. Ideally, a user-friendly interface is built.
Data Science	
Electrical Engineering	
Industrial Design	There is now a prototype device available. This device can be optimised.
Medical Sciences and Technology	All of the other descriptions apply for these students
Psychology and Technology	The difference between standard hearing tests and this innovative way of testing can be evaluated by the students. The psychological impact of hearing loss can also be assessed.
Chemical Engineering and Chemistry	
Sustainable Innovation	
Industrial Engineering	
Applied Physics	
Applied Mathematics	The eventual goal is to perform automated hearing tests. An algorithm should be built, in order for the patient to undergo a hearing test without intervention of an audiologist. Ideally, a user-friendly interface is built.
Mechanical Engineering	

