A digital portable tablet audiometry monitoring tool for patients with drug-resistant tuberculosis

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What challenge or opportunity did you try to address? Were existing solutions not available or not good enough?

Ototoxicity is an unfortunate side-effect of second-line injectable drugs for drug-resistant tuberculosis (DRTB), including aminoglycosides and peptides. Worldwide, up to 15% of patients on treatment regimens containing these drugs develop a degree of ototoxicity. Patients who experience ototoxicity are generally switched to an oral treatment regimen. Although regular audiological evaluations are recommended for patients receiving these drugs, there is limited access to these services, and few patients with noticeable hearing problems are referred for confirmation and follow-up.

Why does this challenge or opportunity matter – why should MSF address it?

Before the introduction of this digital tool, the MSF DRTB project in Mozambique had to refer patients to the Central Hospital in Maputo. This limited the number of patients screened and referred for testing, curtailing the potential to switch treatment early for those showing mild-to-moderate hearing loss.

Describe your innovation and what makes it innovative

In 2018, the team piloted a way to simplify monitoring of hearing using a clinically approved mobile tablet-based tool that has been found to be comparable with traditional audiometry measurements in children and adults. MSF acquired three kits of CE-marked and FDA-certified iOS-based audiometry kits from SHOEBOX® Audiometry systems. The units were comprised of calibrated headphones and tablet-based software that have acceptable accuracy (±10dB) with 90% sensitivity and specificity. The portable units were deployed in rotation in six health centres over two years; a total of 673 audiometry tests were performed in MSF-supported public health centres in Maputo.

Patients were tested at baseline during their first consultation and then monthly while on treatment regimens that included injectable drugs.

Who will benefit (whose life / work will it improve?) and were they involved in the design?

The 2018 Mozambique National TB Committee approved treatment without injectable drugs in patients who had any degree of hearing impairment before the initiation of treatment. Patients screened using the digital tool directly benefitted from switching to oral DRTB treatment if they exhibited any hearing loss, without requiring hospital referral.

What objectives did you set for the project – what did you want to achieve and how did you define and measure success (improved service, lower cost, better efficiency, better user experience, etc.)?

We describe the implementation and use of a mobile audiometry system for patients with treatment-related ototoxicity in the MSF DRTB project in Mozambique, and consider its potential for easily assessing hearing deterioration in this cohort.

What data did you collect to measure the innovation against these indicators and how did you collect it? Include if you decided to change the indicators and why

Routinely collected data were evaluated.

Were there any limitations to the data you collected, how you collected it or how you analysed it, or were there any unforeseen factors that may have interfered with your results?

Data were analysed retrospectively from routine records and may not be exhaustive. Separate analysis of baseline and follow-up was not possible.

What results did you get?

Of the 673 audiometry tests conducted using the digital tool, 480 (71%) showed normal hearing, 65 (10%) mild hearing loss, 81 (12%) moderate hearing loss, and 47 (7%) severe-to-profound hearing loss.

Comparing the results from your data analysis to your objectives, explain why you consider your innovation a success or failure?

This decentralised approach does not need specialised setup, which may lead to increased screening, proper follow-up, and more potential for early switching of drug regimens.

To what extent did the innovation benefit people's lives / work?

Decreasing the need for hospital referrals improved time and transport costs for patients.

Is there anything that you would do differently if you were to do the work again?:

A cost-benefit analysis to compare the mobile audiometry system to referrals would be beneficial for programmatic decisions.

What are the next steps for the innovation itself (scale up, implementation, further development, discontinued)?

In December 2019, the project was phased out as there was a protocol change in which injectable drugs were replaced with more potent and fully oral regimens that made monitoring for ototoxicity unnecessary for most patients.

Is the innovation transferable or adaptable to other settings or domains?

The tools adapted are clinically approved for screening activities for any programmes that deal with hearing loss.

What broader implications are there from the innovation for MSF and / or others (change in practice, change in policy, change in guidelines, paradigm shift)?

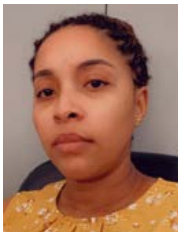
The project demonstrates the potential to improve follow-up and detect complications early for patients who take ototoxic medications.

What other learnings from your work are important to share?

User-friendly and automated audiometry systems that are mobile and do not require audiologists or sound-insulated booths could be extremely useful to various medical projects using potentially ototoxic drugs such as aminoglycosides. They may also be beneficial for environmental projects with noise and toxic pollutions. The high cost of the license could present a limitation necessitating a cost-benefit analysis before contemplating scale-up.

Ethics

This description and evaluation of an innovation project involved human participants or their data, and has had ethics oversight from Monica Rull, Medical Director, Operational Centre Geneva, MSF.



Núria Cumbi

Núria Cumbi has been working as a general practitioner in different medical structures in Maputo, Mozambique, for the last six years. Since 2018, Núria has worked with MSF in the drug-resistant tuberculosis project, supporting six health facilities in screening, treatment and care of drug-resistant tuberculosis patients. Interested in global approaches to public health, Núria is completing a Master's in Public Health with the Eduardo Mondlane University, Maputo.