



## Topic Exploration Report

Topic explorations are designed to provide a high-level briefing on new topics submitted for consideration by Health Technology Wales. The main objectives of this report are to:

1. Determine the quantity and quality of evidence available for a technology of interest.
2. Identify any gaps in the evidence/ongoing evidence collection.
3. Inform decisions on topics that warrant fuller assessment by Health Technology Wales.

Topic:	Remote microphones and wireless streaming devices for use with hearing aids and cochlear implants in children with hearing loss
Topic exploration report number:	TER188

### Introduction and aims

Health Technology Wales researchers searched for evidence on remote microphones used with hearing aids and cochlear implants, in children ( $\leq 18$  years of age) with hearing loss or impairment.

### Summary of evidence

#### Secondary evidence

We did not identify any guidance or secondary evidence that studied remote microphones used with hearing aids or cochlear implants in children.

#### Primary evidence

Two relevant primary studies were included in the topic submission. We identified a further seven potential studies.

Five of the studies used repeated measures design to compare different hearing modalities:

- Wolfe (2020) used a single group, repeated measures design to compare speech recognition with hearing aids with (i) an omnidirectional microphone mode, (ii) an automatic activation of a directional microphone, (iii) automatic activation of a directional microphone plus a remote microphone in 'small group' mode. Sentence recognition was significantly higher with the remote microphone than the other two methods. Participant preference was slightly higher for the remote microphone system.
- Mehrkian (2019) compared speech discrimination in noise in the presence and absence of a remote microphone in children with cochlear implants; improvement in speech discrimination was observed with the remote microphone.

- Johnstone (2018) used repeated measures design to assess the benefit of adaptive directional microphones or remote microphones on speech perception in background noise in children and adolescents with cochlear implants. Both options gave a significant improvement in speech recognition compared to a traditional ear-canal level microphone.
- Razza (2017) evaluated cochlear implant alone, or combined with a remote microphone for each patient. Use of a remote microphones demonstrated improvements in speech reception threshold and speech performances.
- Wolfe (2015) used repeated measures design to evaluate use of a noise improvement algorithm with remote microphones for cochlear implants and reported significant improvement when the remote microphone was used.

One of these studies included a mixed population of adults and children (Wolfe 2015). Johnstone (2018) included an age-matched normal hearing control group, but did not report any direct comparisons between the two participant arms within the abstract.

One additional study used a 'language environment analysis' recorder to compare the impact of remote microphone systems on caregiver speech, compared to no remote microphone (Benitez-Barrera 2018). The authors reported that children could potentially have access to 42% more words per day using the remote system. Caregivers reported perceived benefits with the remote system.

Three further studies were identified that reported on usage or access of remote systems, in the family or education setting (Walker 2019, Boddy 2018, Gutstafson 2017).

#### Ongoing evidence

One ongoing study was identified that aims to compare paediatric patients and normal hearing controls under various auditory conditions, include remote systems. This study aims to be completed in May 2020.

### Areas of uncertainty

Comparative evidence was limited to mainly repeat measures design with small participant numbers. One study included a normal hearing control arm, but this exploration could not establish whether comparisons between both arms were made.

The identified studies included different brands of cochlear implants, microphones, etc.; if they are substantially heterogeneous, synthesis of the evidence may not be appropriate. Further scoping would also be required to establish whether hearing aids and cochlear implants should be evaluated as separate sub-questions for an appraisal.

No economic evidence was identified in this exploration. It is uncertain whether the clinical evidence base would be substantial enough to develop de novo economic evaluation.

In their submission, the topic proposer refers to potential benefits of language development in younger children, but we did not find any clinical evidence that evaluated this specific outcome.

## Conclusions

We identified seven studies that evaluated the clinical benefit of remote microphones for children with hearing loss compared to other microphones. Only one study focused on hearing aids. The studies generally reported improved speech recognition when remote microphones were used. However, participant numbers were limited, heterogeneous in the technologies used and the majority employed a repeated measures approach, which may influence the quality of the evidence. We did not identify any randomised controlled studies in this exploration, nor any economic studies, which may limit the feasibility of a fuller appraisal.

## Brief literature search results

Resource	Results
HTA organisations	
<a href="#">Healthcare Improvement Scotland</a>	We did not identify any relevant guidance from this source
<a href="#">Health Technology Assessment Group</a>	We identified sections on Deafness and Deafblindness - using remote microphones was not mentioned.
<a href="#">Health Information and Quality Authority</a>	We did not identify any relevant publications from this source
UK guidelines and guidance	
<a href="#">SIGN</a>	We did not identify any relevant guidance from this source
<a href="#">NICE</a>	Cochlear implants for children and adults with severe to profound deafness. Technology appraisal guidance [TA566]. March 2019. <a href="https://www.nice.org.uk/guidance/ta566">https://www.nice.org.uk/guidance/ta566</a> Does not mention remote microphones.
Secondary literature and economic evaluations	
<a href="#">ECRI</a>	Not searched
<a href="#">EUnetHTA</a>	We did not identify any relevant publications from this source
<a href="#">Cochrane library</a>	We did not identify any relevant publications from this source
<a href="#">Medline</a> (Ovid)	We did not identify any relevant publications from this source
Primary studies	
<a href="#">Cochrane library</a>	We did not identify any relevant publications from this source
<a href="#">Medline</a>	<p>Walker EA, Curran M, Spratford M, et al. (2019). Remote microphone systems for preschool-age children who are hard of hearing: access and utilization. <i>International Journal of Audiology</i>. 58(4): 200-7. doi: <a href="https://dx.doi.org/10.1080/14992027.2018.1537523">https://dx.doi.org/10.1080/14992027.2018.1537523</a></p> <p>Mehrlian S, Bayat Z, Javanbakht M, et al. (2019). Effect of wireless remote microphone application on speech discrimination in noise in children with cochlear implants. <i>International Journal of Pediatric Otorhinolaryngology</i>. 125: 192-5. doi: <a href="https://dx.doi.org/10.1016/j.ijporl.2019.07.007">https://dx.doi.org/10.1016/j.ijporl.2019.07.007</a></p> <p>Johnstone PM, Mills KET, Humphrey E, et al. (2018). Using Microphone Technology to Improve Speech Perception in Noise in Children with Cochlear Implants. <i>Journal of the American Academy of Audiology</i>. 29(9): 814-25. doi: <a href="https://dx.doi.org/10.3766/jaaa.17035">https://dx.doi.org/10.3766/jaaa.17035</a></p> <p>Boddy C, Datta G. (2018). The use of the Cochlear Mini Microphone (MM) as a personal radio system (FM) with young children who are deaf. <i>Cochlear Implants International</i>. 19(6): 330-7. doi: <a href="https://dx.doi.org/10.1080/14670100.2018.1505324">https://dx.doi.org/10.1080/14670100.2018.1505324</a></p> <p>Razza S, Zaccone M, Meli A, et al. (2017). Evaluation of speech reception threshold in noise in young Cochlear TM Nucleus&lt;sup&gt; R&lt;/sup&gt; system 6 implant recipients using two different digital remote microphone</p>

	<p>technologies and a speech enhancement sound processing algorithm. International Journal of Pediatric Otorhinolaryngology. 103: 71-5. doi: <a href="https://dx.doi.org/10.1016/j.ijporl.2017.10.002">https://dx.doi.org/10.1016/j.ijporl.2017.10.002</a></p> <p>Gustafson SJ, Ricketts TA, Tharpe AM. (2017). Hearing Technology Use and Management in School-Age Children: Reports from Data Logs, Parents, and Teachers. Journal of the American Academy of Audiology. 28(10): 883-92. doi: <a href="https://dx.doi.org/10.3766/jaaa.16042">https://dx.doi.org/10.3766/jaaa.16042</a></p> <p>Wolfe J, Morais M, Schafer E, et al. (2015). Evaluation of Speech Recognition of Cochlear Implant Recipients Using Adaptive, Digital Remote Microphone Technology and a Speech Enhancement Sound Processing Algorithm. Journal of the American Academy of Audiology. 26(5): 502-8. doi: <a href="https://dx.doi.org/10.3766/jaaa.14099">https://dx.doi.org/10.3766/jaaa.14099</a></p>
Ongoing primary or secondary research	
<a href="#">PROSPERO database</a>	We did not identify any relevant publications from this source
<a href="#">Clinicaltrials.gov</a>	Remote Microphone (RM) Technology in Children Using Bone Conduction Devices: A Comparative Study. <a href="#">NCT04147611</a> . Estimated study completion date May 2020.
Other	
Sources provided by the topic proposer	<p>Wolfe J, Duke M, Schafer E, et al. (2020). Evaluation of a Remote Microphone System with Tri-Microphone Beamformer. J Am Acad Audiol. 31(1): 50-60. doi: <a href="https://doi.org/10.3766/jaaa.18065">10.3766/jaaa.18065</a>.</p> <p>Benítez-Barrera CR, Angley GP, Tharpe AM. (2018). Remote Microphone System Use at Home: Impact on Caregiver Talk. Journal of Speech, Language, and Hearing Research. 61(2): 399-409. doi: <a href="https://doi.org/10.1044/2017_JSLHR-H-17-0168">10.1044/2017_JSLHR-H-17-0168</a></p>

Date of search:	February 2020
Concepts used:	Hearing loss, hearing impairment, deaf or deafness, hearing aid, cochlear implants, (remote) microphone