

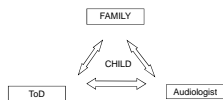
UK CHILDREN'S FM Working Group

Pilot study of procedures for evaluating benefit from fm systems using a speech in noise test and a questionnaire

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Introduction

FM systems play a hugely important role in the lives of many hearing impaired children, and provide a lifeline for children in adverse listening conditions such as mainstream classrooms. They are a crucial part of a child's 'amplification package'. They are currently provided and managed within the remit of LEAs/ education support services by Educational Audiologists (Ed Auds) and Teachers of the Deaf (ToDs). But times are changing.



Good communication and joint review clinics between health and education services (MCHAS, 2004) enable paediatric audiologists to play an increasingly important role, in partnership and collaboration with Ed Auds, ToDs, children and their families in the selection, fitting and management of FM systems. Procedures for setting up FM systems with DSP hearing aids were developed during the Modernisation of Children's Hearing Aid Services project (MCHAS). However, although systematic evaluation of fm systems is essential in order to ensure that they give the desired benefit, there are currently no recommended procedures or good practice guidelines in the UK. This pilot study was designed to begin to address the need for standardised procedures for the evaluation of FM systems. The aim was to develop procedures which would

- be feasible and useful in demonstrating and measuring benefit
 - highlight areas where further targeted investigation and support are required
 - identify barriers to the effective use of FM systems.
- Two procedures - an objective speech in noise test and a subjective questionnaire were piloted in this study. Both are appropriate for use in a clinic or classroom situation. Results from two groups using the speech in noise procedure (normally hearing students and hearing impaired children) are reported here. Some of the questionnaire results from a group of hearing impaired children are described. Future research and development is indicated.

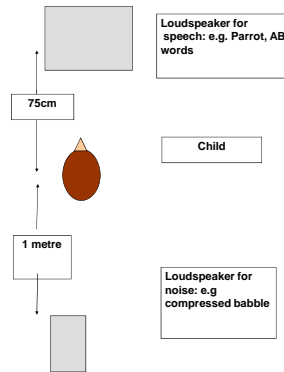
Part 1 speech in noise test

Method

The hearing instruments (HIs) were checked and the fm system was set up following fm Advantage procedures. (Evans, 2004.)

- AB word lists were used. The test procedure and required response was explained, with suitable examples.
 - See diagram for test set up. The loudspeakers were at approx. ear level height. Calibration was checked with a sound level meter (SLM).
 - The first list was delivered at 60dBa with the child using HIs only. The score was noted as the baseline performance with hearing aids in quiet.
- NOTE: The level can be increased to obtain an optimum score, in this case the noise levels will need adjusting accordingly.**
- The next list was delivered at a level of 50dBa (checked with a SLM at the child's ear) i.e. with Signal to Noise Ratio (SNR) of +10dB.
 - The noise was then increased by 10dB to 60dBa (i.e. SNR 0) and the next list delivered. Performance dropped to less than 50% in all cases with the children. With the normally hearing students, the noise was further increased in 5dB steps, until the score worsened to 50% or less.
 - The fm system was introduced. The fm transmitter (Tx) microphone was placed in front of the loudspeaker delivering the speech, at a distance where the input to it was 80dBa (measured with the SLM).
 - The next list was delivered with the noise at 60dBa, and the speech at 80dBa into the fm Tx microphone.
 - The worst score (with HIs only) in noise was compared with the score obtained with the fm system at the same SNR, and the improvement noted. (For the students the SNR this was obtained at was noted)
 - The results were evaluated, to check :
 - That the speech scores in quiet were commensurate with speech scores obtained during routine HI evaluations.
 - How the score obtained in noise with HI alone compared with that obtained in quiet.
 - When the fm system was used, how much the score improved towards the baseline score with the HIs alone.
- Where it does not improve significantly - further investigation is required.
- NOTE: The SNR conditions can be adjusted to reflect actual classroom conditions, if these are known (e.g. SNR -15, -20 etc) The test can be adaptive, depending on performance.**

Test Setup



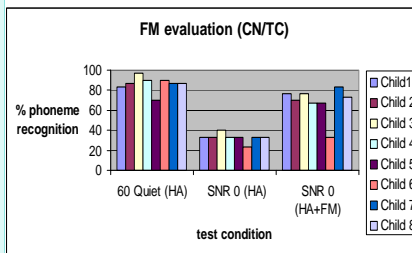
Test set up in a classroom



Results, speech in noise test

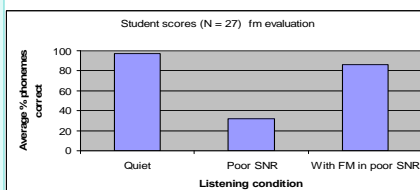
The table below shows results from 8 children aged 7-13 years. Note that hearing aids/CIs were in FM+M mode. Greater benefit is possible in FM only mode. Note that one (child 6) did not show expected benefit from fm (CI user)

Results from 8 children with moderate s/n loss, h.a. wearers (details available)
2 children with profound loss, CI wearers



Average increase in phoneme recognition with FM, when listening in noise at SNR 0 for this group = 34%,
max = 50% min = 10%

Results from 27 students (normal hearing, with one ear occluded and low power hearing aid/mould on the other ear)



Average increase with FM, when listening in noise (SNR variable) for students = 52% Max= 80% min=20%

Part 2: Questionnaire

Four secondary aged children and eight primary children (N=12) completed a questionnaire about their fm systems. The questionnaire (FMQ) is in development by members of the National FM Working Group.

The same FMQ was used for both primary and secondary children. Children were interviewed face to face, (but could complete the fmQ themselves if they wished) Few data were missing.

Details of the type of hearing aids, CIs and FM systems used are available.

Results, questionnaire

Overall, these children's subjective assessment of their fm systems was positive, and they reported high levels of use in school.

Use in different listening situations:

For whole class teaching 10/12 use FM always or most of the time and report a lot of benefit and much easier listening.

Use in other situations varies, in small group work 7/12 use FM most of the time or always, 8/12 use FM in assembly, 6/12 use it most of the time or always on a school trip. 7/12 use FM in other situations in school such as (in this order of frequency) TV, computer, language tapes, interactive whiteboard.

Use out of school:

10/12 do NOT use FM out of school, though all those surveyed have this option available to them.

Ease of use:

8/12 find FM very easy to use, and 7/12 find handing over the transmitter no problem.

Faults/breakdown:

5 reported not often, 5 reported sometimes, 2 reported very often

Overall rating:

6/12 rated their FM system as "OK" and 3 said they were delighted with it. 2 said they were "a little" happy with it and 1 did not answer!

What would the children like to change? (not everyone answered this) Some examples: Want wireless (2), no shoes to attach, blue colour, smaller, not to be the only one wearing one.

One said "it rubbish" Two said they wouldn't change a thing!

Overall, good feedback was obtained on problems with wording, presentation and concepts. ToDs expressed some concern about deliberately seeking negative feedback, by asking about problems, or prompting the child to report on looks/hassle etc.

Conclusions

Both these objective and subjective procedures are feasible and together provide a comprehensive evaluation of the use, benefit and impact of FM systems. The speech in noise test could reveal when FM benefit was poorer than expected and quantified the extent of benefit for individuals in a way which also allowed for data to be pooled and compared. This makes the results useful for both individual management and monitoring of services. The questionnaires produced useful information for individual management/support decisions. It could also be useful if pooled to indicate general trends such areas for improvement.

Developments/further research:

Speech in noise test: Reporting of the results as 'SNR loss' (i.e. increase in SNR required to achieve a score of 50%, compared to normal performance) This requires generating performance/intensity functions for different speech tests in noise, for normal hearing and hearing impaired groups.

Questionnaire: This has now been re-drafted as two different, but similar instruments, and pictures have been added for the primary school children. It is still in development. The next phase of its validation is a larger study to determine psychometric parameters.

References

- Bamford, J. et al (2004) Report on first wave studies (Modernisation of NHS Hearing Aid Services: Paediatric Arm) HCD Group, Manchester.
- Evans, D. (2004) FM Advantage: procedures for setting up fm radio systems for use with hearing aids. Connevens, Reigate.