CHAPTER EIGHTEEN

# Provision and Fitting of New Technology Hearing Aids: Implications from a Survey of Some 'Good Practice Services' in UK and USA

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## Introduction

In the delivery of heath care services there is increasing focus on quality of provision and quality assurance mechanisms. Thus, consensus statements, guidelines, standards, protocols and audit are now concepts familiar to those providing services. The aim of quality assurance is, obviously, to improve quality, but also to reduce practice variability and its corollary, inequity of provision. The extent of variability in the quality of paediatric audiology services has been highlighted previously as a cause for concern (e.g., Bamford et al. 2001).

Currently, the two major advances in paediatric audiology, which arguably carry the greatest potential for significant improvement in outcomes are the introduction of newborn hearing screening, leading to early identification and early intervention, and the provision of Digital Signal Processing (DSP) hearing aids. The attraction of the latter over analog aids is that in general they offer the possibility of using advanced processing features (for those likely to benefit from them; which groups of users are likely to benefit from which features is still a matter for research (see Gatehouse 2001).

One way of helping the process of service development and quality enhancement is to monitor activity at the better end of the quality distribution. This may help to enhance quality in one or both of two ways: it may show other services what can be done, and thus encourage emulation; and it may point up general gaps in or barriers to development that have to be addressed at levels other than individual services (e.g., via research or training initiatives). In this context, the aim of this study was to explore aspects of the current service provision of new technology hearing aids (i.e., DSP hearing aids) in 'good practice' paediatric audiology services (i.e., from the better end of the quality distribution).

## Method

A questionnaire was designed to address the following overall questions:

1. What is current practice in 'good practice services' with regard to DSP hearing aids with children?
2. What selection and fitting procedures are being used?
3. What are the facilitators of and barriers to change in this area of service provision?

The questionnaire was constructed in six sections: selection of type of aid, timing of fitting, selection of acoustic settings, evaluation of fitting, constraints to service delivery, and training needs. Questions were posed with regard to two groups of children: newly identified cases aged 0–3 years, and established wearers aged 5–16 years. The questionnaire was piloted with a small number of services in the UK, with minor adjustments made as a result.

Thirty-five paediatric audiology services from each of the UK and the USA were selected and approached to see if they would be willing to complete the questionnaire. All agreed to participate. The selection of possible respondents in the UK was based on a combination of the Paediatric Audiology Service Index score (Bamford et al. 2001) and personal

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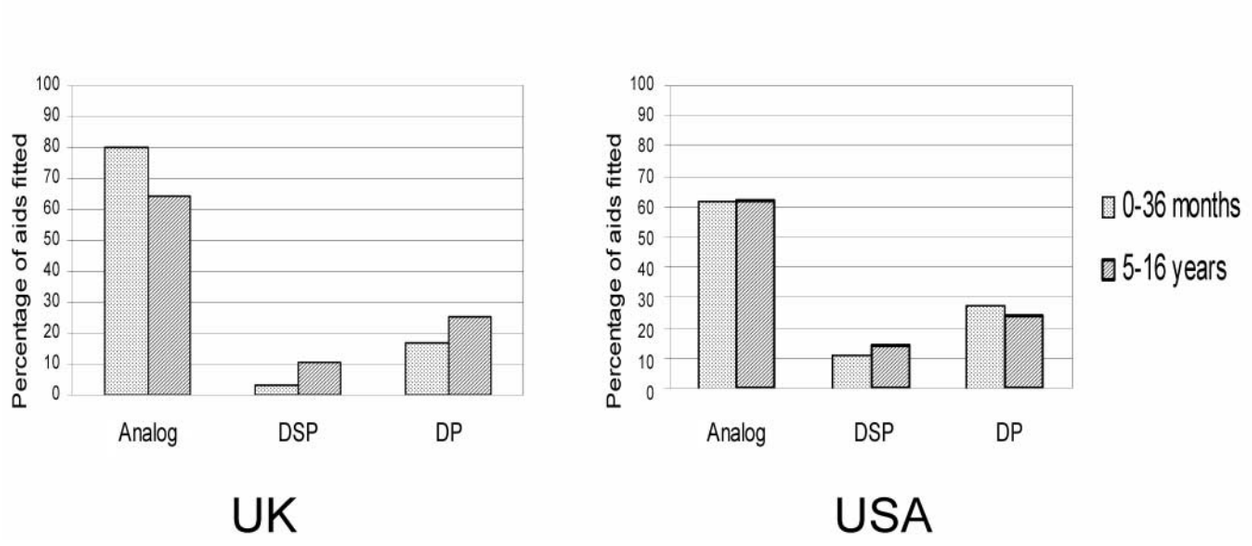


**Figure 1**. Proportion of DSP, DP and analog aids fitted to children by respondents during the previous 12 months.

recommendation. Selection of possible respondents in the USA was made on the basis of ASHA accreditation, geography, and personal recommendation.

## Results

Response rates were high, with all 35 questionnaires returned from UK services, and 27 (77 per cent) from USA services. The data presented in this paper have been selected as those which throw most light on the questions posed in the Introduction.

Services were asked to indicate the proportion of analog, digitally-programmable (DP), and DSP aids fitted to the two groups of children (0–3; 5–16 years of age) during the past twelve months. Figure 1 shows the overall mean percentages. It is clear that in both countries, there are relatively few DSP aids being fitted, and that the majority remains analog. Of course, there are very good quality analog hearing aids available, but in general we would expect DSP aids to offer more processing options and other features not available on analog aids. It was also clear that those DSP aids that were being fitted were not in large numbers from a few services, but small numbers from most services. This suggests that services would have limited opportunities to develop their experience with DSP aids.

In the sections probing audiological practice (timing of fittings, selection and evaluation of fittings) there was evidence of mixed practice. Services were asked to estimate the age at which they thought they would achieve 'audiological certainty' (that is, reliable estimates of hearing thresholds for low, mid and high frequencies, and clarity on whether the loss is sensorineural, conductive or mixed) for children with bilateral permanent hearing loss of mild, moderate, severe or profound degree referred by a newborn screening programme, without risk factors, and with no evidence of any other disabilities. Figures 2 and 3 show the results from these questions for USA and UK respectively. These are, of course, estimates from those completing the questionnaires, and not data from actual cases. We might suppose that in actuality the data are less good than those estimated in figures 2 and 3. We have emerging information on age of audiological certainty following newborn screening

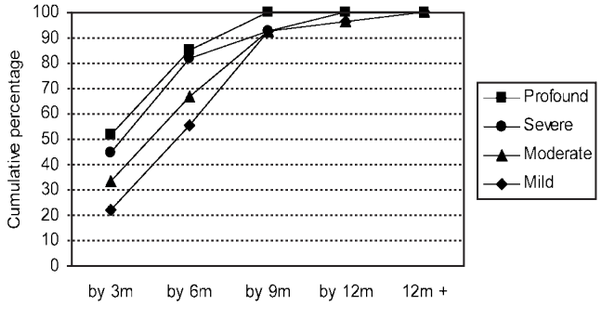


**Figure 2**. Expected age of 'audiological certainty' for non-complex cases referred by newborn screening (USA).

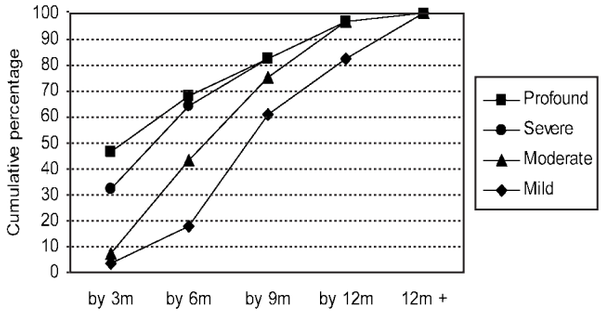


**Figure 3**. Expected age of 'audiological certainty' for non-complex cases referred by newborn screening (UK).

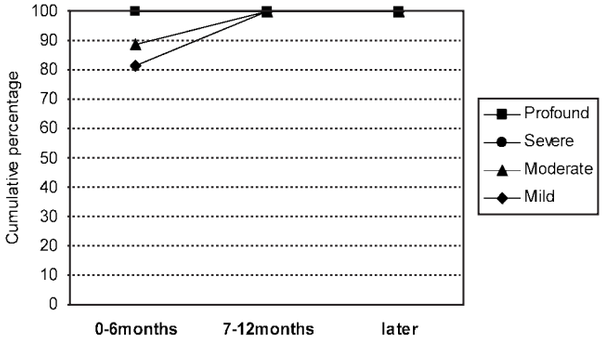


**Figure 4**. Expected age of first hearing aid fitting for non-complex cases referred by newborn screening (USA).

(e.g., Watkin and Baldwin 1999; Widen et al. 2000), but it is sensible to take the view that the earlier we can determine audiological status, the better for accurate and detailed planning of management. For uncomplicated cases referred by newborn screening, we might suppose that six months was achievable by the best services, yet there is no evidence in figures 2 and 3 that this is the case, and these are probably optimistic estimates in any case. Hearing aids are fitted on the basis of partial information, and ages of hearing aid fitting are likely therefore to be earlier. Figures 4 and 5 show the estimated ages for fitting uncomplicated cases referred by newborn screening.

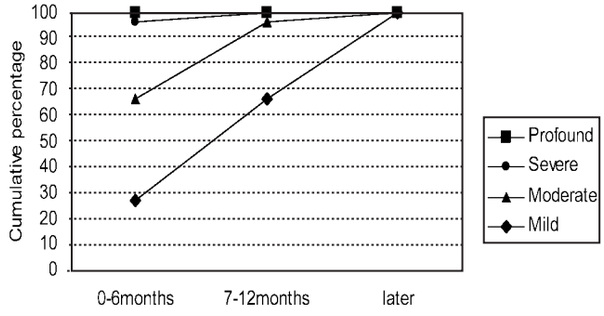


**Figure 5**. Expected age of first hearing aid fitting for non-complex cases referred by newborn screening (UK).

We asked the extent to which services used published hearing aid prescription procedures to guide fittings. Table 1 indicates that almost all of these 'good quality' services were using prescriptive fittings. We also asked about approaches to verification. Table 2 shows the numbers of services using functional gain (via sound field aided thresholds) for verification. Given the current view expressed in guidelines documents that functional gain is generally not appropriate as a verification measure (though it may be as an outcome measure—see Scollie and Seewald, Chapter 10 in this volume), then we must be concerned at its apparent widespread use by good quality services. The alternative approach to verification, the use of probe tube microphone (PTM) measures, is shown in table 3. Here, the data are divided by age group, since it might be supposed that services would find it easier to use such measures routinely with older children. This is indeed the case, with significantly more use with older children, but the

**Table 1.** Number of respondents using published hearing aid prescription procedures.

| **UK** | | **USA** | |
|---|---|---|---|
| Yes | 33 | Yes | 24 |
| No | 2 | No | 3 |

**Table 2.** Number and percentage of respondents using aided thresholds for verification.

| **UK (35 sites)** | | **USA (27 sites)** | |
|---|---|---|---|
| Analog | DSP | Analog | DSP |
| 34 (97%) | 34 (97%) | 24 (89%) | 21 (78%) |

**Table 3.** Number and percentage of respondents using probe tube microphone measures for verification for the two age groups (REAR = real ear aided response; REIR = real ear insertion response; RESR = real ear saturation response).

| | UK | | USA | |
|---|---|---|---|---|
| | 0–36 months | 5–16 years | 0–36 months | 5–16 years |
| REAR | 9 (26%) | 20 (57%) | 15 (43%) | 20 (57%) |
| REIR | 9 (26%) | 20 (57%) | 7 (20%) | 12 (34%) |
| RESR | 4 (11%) | 7 (20%) | 12 (34%) | 15 (43%) |

**Table 4.** Rating of training priorities.

| UK | | USA | |
|---|---|---|---|
| **New hearing aids** | 1 | **New hearing aids** | 1 |
| **Non-linear fitting** | 2 | **Latest research findings** | 2 |
| **Software skills** | 3 | **Non-linear fitting** | 3 |
| **Assessment skills** | 4 | **Software skills** | 4 |
| Working with families | 5 | Knowledge social/cultural issues | 5 |
| Latest research findings | 6 | Skills in Inter-agency working | 6 |
| Handling young babies | 7 | Working with families | 7 |
| Skills in Inter-agency working | 8 | Handling young babies | 8 |
| Knowledge social/cultural issues | 9 | Assessment skills | 9 |

Overall importance 1 = Most important

major message from table 3 is that probe-tube measures are used much less frequently than aided thresholds; a matter of some concern.

The PTM measures offered as alternatives by the question (REAR, REIR, RESR) did not include RECDs (real ear to coupler differences). It could be that services are using RECDs and verifying hearing aid performance in 2cc couplers, rather than using the three PTM measures. In fact, in response to this question, 21 respondents in the UK and 21 in the USA said they frequently used this method. However, when asked to indicate whether they used average RECD corrections or individually-measured RECDs, only 33 percent in the UK and 52 percent in the USA used individual RECDs.

Respondents were asked to indicate their priorities for training in this area from a list provided. The priorities given were summed across respondents and are shown in order in table 4 (1 = top priority). Three of the top four priorities were the same for respondents from both countries: information about new DSP hearing aids; understanding the fitting of non-linear aids; and experience in use of the software for fitting DSP aids. Training in audiological assessment skills was the fourth priority for UK respondents, but a low priority for US respondents, perhaps reflecting the relatively limited training offered to UK audiologists (a situation currently under urgent review), while the US respondents identified increased knowledge of the latest research findings as a major priority.

Services were asked what they thought would be the effects of using DSP aids on outcomes for children. Very few indicated no improvement, with most anticipating 'considerable' or 'very significant' improvement (figure 6). Furthermore, when asked to indicate whether the fitting of DSP aids might be easier or harder, there was a tendency across all

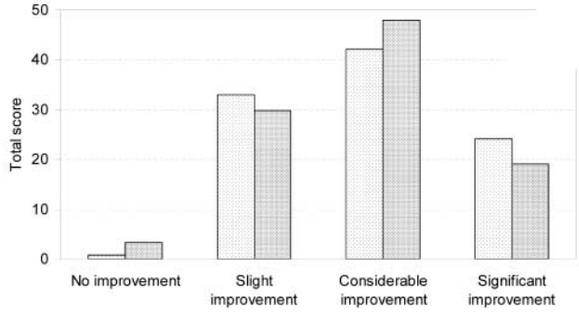


**Figure 6**. Expected effect of DSP aids on children's outcomes.

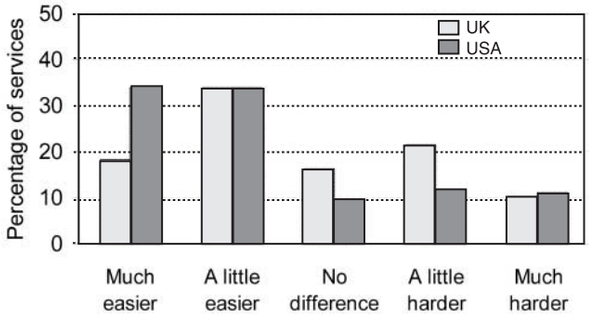


**Figure 7**. Responses to the question of whether fitting DSP aids to children would be easier or harder than current practice.

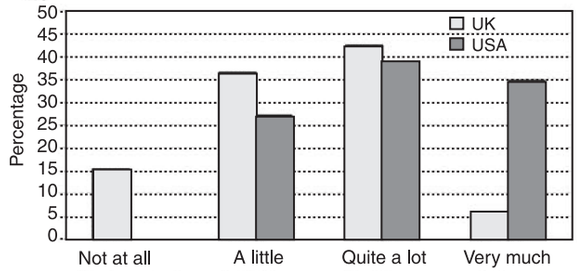


**Figure 9**. Influence of cost on services' use of DSP aids.

respondents to think it would be easier (although with a significant minority suggesting it would be harder)—see figure 7. However, this has to be placed in a wider context: when respondents were asked to indicate the relative contribution of a list of possible determinants of outcomes by allocating a total of 100 points according to importance, 'fitting DSP aids' came much lower than most other alternatives, with 'parental support and involvement', 'well-trained paediatric audiologists', and 'fitting to targets' considered most important by respondents in both countries (figure 8).

If outcomes are expected to be favourably affected, albeit that there are more important determinants, why then are DSP hearing aids not in more widespread use? One obvious possibility is cost, and figure 9 supports this: the US respondents thought cost a big determinant of services' use of DSP aids ('quite a lot' or 'very much'), and even the UK respondents thought it 'a little' or 'quite a lot' of a determinant. The fact that hearing aids are free to users in the UK should not hide the issue of cost to services, although current tendering arrangements for DSP aids in that country are reducing costs dramatically.

Other clues are given by the response to a question about the perceived constraints to service development in this area. Given a list of possible factors, respondents were asked to indicate for each whether it was 'not at all', 'a little', 'quite a lot' or 'very much' a constraint. Responses were scored 1–4 ('not at all' = 1).

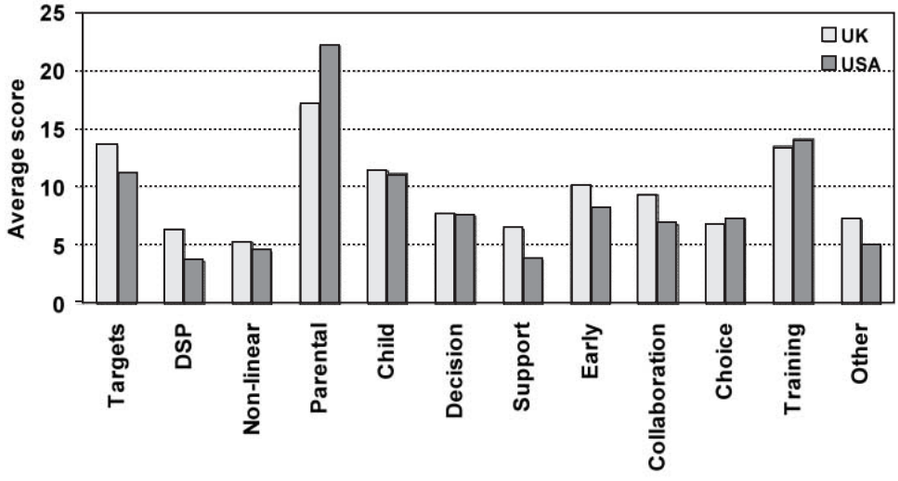


**Figure 8**. Relative weight of factors thought to contribute to improvement in outcomes.

**Table 5.** Rating of constraints to development of provision.

| UK | (average score) | USA | (average score) |
|---|---|---|---|
| **Limited resources** | **1.9** | **Limited resources** | **2.0** |
| **Lack of evidence on cost effectiveness** | **1.4** | **Lack of evidence on cost effectiveness** | **1.1** |
| **Lack of IT infrastructure** | **1.2** | Limited inter-agency cooperation | 0.7 |
| **Availability of key people** | **1.1** | Lack of IT infrastructure | 0.4 |
| Limited staff knowledge | 1.0 | Limited staff knowledge | 0.4 |
| Limited staff training | 1.0 | Limited staff training | 0.4 |
| Lack of managerial support | 1.0 | Lack of managerial support | 0.4 |
| Limited inter-agency cooperation | 0.4 | Availability of key people | 0.3 |

Averaged scores are shown in table 5, with those averaging above 1.0 highlighted. It is clear that lack of adequate resources is the main factor for both countries, followed by lack of evidence on the cost-effectiveness of DSP aids. The two are linked of course, since cost constraints can be challenged if there is good evidence of effectiveness.

## Concluding Remarks

The results from this survey indicate a number of trends. First, services have limited experience of using DSP aids with children. Second, there is evidence of poor audiological practices (in the sense of not following current guidelines or meeting expected service targets); furthermore, this survey was carried out with examples of 'better' services. Both of these point to the urgent need for training programmes and workshops. Third, the cost of DSP aids is currently an important constraint to their use, although this is likely to reduce dramatically soon (at least in the UK). Related to this, there is a need (identified in the UK by the report from the National Institute for Clinical Excellence—see Taylor, Paisley and Davis 2001, and Gatehouse 2001) for better data on the relative effectiveness of DSP hearing aids, and the different processing features they offer, in different populations.

The current Modernising Hearing Aid Services project in the UK, due to report in late 2002, may provide a start in this direction. This project has already indicated a number of further issues for services moving from analogue to DSP hearing aid provision for children, other than those highlighted by the survey reported here. The potential unsuitability for children of some proprietary fitting rules in DSP aids is clear; but the use of 'stand-alone' software for generic published prescription procedures (e.g., DSL i/o, NAL-NL1, Camfit) is not always easy to configure with the DSP aid or real ear measurement system software. This points to the incorporation of 'authorised' versions of the generic prescriptions into the DSP aid software. The use of FM systems with DSP aids (and non-linear aids) needs careful attention, and new protocols for setting FM advantage are now available (see, for example, www.connevans.com/information/fmadvantage). Checking DSP aids 'in the field' by support workers raises some challenging issues to do with signal compatibility, and protocols have been drafted for these (Hostler in press). The way in which parents might manage bouts of otitis media with effusion in young children with underlying permanent hearing loss who are wearing DSP aids, especially if there is no volume control on the aids, needs careful thought. If young children are to be using DSP aids with multiple programmes, then the way in which support workers and parents are enabled to identify which programme the child is on, and switch if necessary, is important. All this, and some of the issues raised by the survey reported here, points to the need for DSP hearing aids designed specifically to meet the varied needs of the paediatric population, needs which are quite different from those of the adult population.

## Acknowledgements

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