Verification and/or Validation
Verification and/or validation some evidence does it make a difference?

&

What do we mean by it?

Effect of
New technologies

What type of
Orientation do we provide

Comfort Optimiser
How a new method in speech mapping MCHI based on a psychoacoustic model may be useful in this process.
Verification and/or Validation

MarkeTrak VIII: Reducing Patient Visits Through Verification & Validation

V & V can eliminate the need for over 521,000 patient refitting visits annually

http://www.betterhearing.org/pdfs/M8_Verification_Validation_Study.pdf

76% of patients with above average success were fitted within 1 or 2 visits

47% of patients with below average success required 4-6 visits

This survey suggested that the patients with above average success were more likely to have been through a process of V & V than the patients with below average satisfaction.
Patient satisfaction appears to increase if verification and or validation has been used in the hearing aid fitting process. But Only 35% of audiologist actually said they did both. Some did verification only and some did validation only!
• If higher satisfaction can be achieved in 1 or 2 visits what happens in those visits is very important.

• Can we improve what we do?

• Do we have time to improve what we do?
Verification

The **ASHA Practice Policy** states.

Verification stage, the audiologist determines that the hearing aids meet a set of standardized measures that include basic electroacoustics, cosmetic appeal, comfortable fit, and real-ear electroacoustic performance.

ASHA  American Speech and Hearing Association
Verification and/or Validation

Verification of hearing aid fit we mostly use:

REM to verify objectively against a validated fitting rationale.

THEN

How often do we verify?

Noise reduction                          Directional microphones
Telecoil                                  Feedback management
Occlusion effects +/-                     FM
Bluetooth connectivity                    Speech In noise
Audibility
Areas we need to be assessing

<table>
<thead>
<tr>
<th>Dispenser/NHS</th>
<th>Influence on overall satisfaction with HA*</th>
<th>Comparison with 2009</th>
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<tbody>
<tr>
<td>Quality of service after purchase</td>
<td>0.66</td>
<td>↑</td>
</tr>
<tr>
<td>Quality of dispenser’s counselling</td>
<td>0.64</td>
<td>↑</td>
</tr>
<tr>
<td>Professionalism of dispenser</td>
<td>0.62</td>
<td>↑</td>
</tr>
<tr>
<td>Quality of service during hearing aid fitting period</td>
<td>0.61</td>
<td>↑</td>
</tr>
<tr>
<td>Conversation with one person</td>
<td>0.71</td>
<td>↑</td>
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<tr>
<td>Watching TV</td>
<td>0.70</td>
<td>↑</td>
</tr>
<tr>
<td>Listening to Music</td>
<td>0.69</td>
<td>↑</td>
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<tr>
<td>Leisure activities</td>
<td>0.68</td>
<td>↑</td>
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<tr>
<td>Conversation in small groups</td>
<td>0.67</td>
<td>↑</td>
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<tr>
<td>Conversation in large groups</td>
<td>0.66</td>
<td>↑</td>
</tr>
<tr>
<td>Understanding a lecture in a large public place</td>
<td>0.65</td>
<td>↑</td>
</tr>
<tr>
<td>Use in noisy situations</td>
<td>0.64</td>
<td>↑</td>
</tr>
<tr>
<td>On the telephone</td>
<td>0.55</td>
<td>↑</td>
</tr>
</tbody>
</table>

| Listening situation                             |                                         |                     |
| Clearness of tone and sound                    | 0.79                                     | ↑                   |
| Natural sounding                               | 0.78                                     | ↑                   |
| Richness or fidelity of sound                  | 0.76                                     | ↑                   |
| Comfort with loud sounds                       | 0.69                                     | ↑                   |
| Overall fit/ Comfort                           | 0.72                                     | ↑                   |
| Reliability                                    | 0.71                                     | ↑                   |
| Visibility to others                           | 0.64                                     | ↑                   |
| Managing whistling/feedback/buzzing            | 0.62                                     | ↑                   |
| Value (performance versus money spent)         | 0.61                                     | ↑                   |
| Ease of changing battery                       | 0.56                                     | ↑                   |
| Battery life                                   | 0.47                                     | ↑                   |

*The Influence has been calculated with a correlation: 0 means no relation between a criterion and overall satisfaction; 1 means a maximal relationship. Read: clearness of tone and sound is the most important criterion for satisfaction.
Validation

**ASHA Practice Policy**

Validation stage the audiologist determines the impact of the intervention on the perceived disability attributable to the hearing loss.
Validation we generally use a questionnaire subjective based measure of

Acceptance

Benefit

Residual disability

Satisfaction
Gudrun 63, in the newspaper

“Tricky questions gave me my hearing back. I had not verified my hearing in that way before, but after doing so I notice that I hear better with my hearing aids than without them.”
In between the process of verification and the subsequent validation there is another process happening.

This is a process where the patient is evaluating and verifying for themselves that the intervention has achieved the benefit they were expecting.
Between Verification and Validation is a period which ASHA defines as Orientation.

Orientation stage, the audiologist counsels the client on the use and care of the hearing aids, fosters the client's realistic expectations of performance from the hearing aids, and explores the candidacy for assistive listening devices and audiologic rehabilitation assessment and treatment.
We have all come across the patient that says everything is good with their new hearing aid it ‘sounds natural’. Then we find the patient has turned the hearing down to minimum and when we measure its gain we discover it is virtually zero.

Verification and validation may be put as:

to verify is to check that one is doing things right

to validate is to check that one is doing the right things.

When looking at the quality of our services are we doing the right things?
Somewhere between these processes is the patients own verification based on what they know!!!
Verification and/or Validation

Speech Mapping can be a very useful tool in this orientation stage.

For some patients a visual representation of what they are hearing can help them with their expectation levels.

**BCJ Moore** - The Hearing Journal, 2006 - LWW

Speech Mapping can be used as a counselling tool. Speech mapping is a valuable tool for fitting and counselling patients.
Speech mapping can help you and your patient identify areas of concern that may need adjustment such as unwanted peeks.

Use sound examples
A new development in speech mapping

A technique has been developed where a hearing aid fitting can be evaluated for pitch and loudness, based on research from what normal and hearing impaired listeners find best.

This is being incorporated into speech mapping and is not dependant on any particular fitting formula.

It is Called Comfort Optimiser and is being developed by Primus from Auditdata from work done by Dr Jorg Haubold
How does it work?
It looks at the input signal at the ear and its characteristics and compares it to the processed signal in the ear.

It can do this for different types of sounds, speech, speech in noise, music, in fact any input signal.

It compares a patents results to the best fit found in a large cohort of listeners it gives an indication of how an individual fitting compares what is considered beneficial compared to 1000 other users.

This may be a way we can validate if we are doing thing right! Or at least be a method where we can predict for some patients where extra fine tuning is required to achieve a satisfactory result.
Verification and/or Validation

Comfort Optimiser

Hearing loss

Processed signal

Original

Speech intelligibility

Model of hearing impairment

Model of normal hearing

Input

Specific business calculations

Sharpness

Loudness

Speech range presence

Sharpness

Loudness

Speech range presence

Specific frequency weighting

Statistics/Dynamic analysis

Specific frequency weighting

Statistics/Dynamic analysis

Specific frequency weighting

Statistics/Dynamic analysis

Sensation mapping

Mapping of sensation

Sensation mapping

Mapping of sensation

Sensation mapping

Mapping of sensation

Combining and mapping of predictors

Speech intelligibility in % or verbal categories

Loudness

Sharpness

Overall quality

Listening effort

Fig. 2: Model scheme of MCHI
Loudness correlation coefficients 93% & Sharpness 89%

Fig. 4: Results of MCHI verification for loudness (left) and sharpness (right), Second study example.

For loudness the final correlation coefficients were found with 93 % or higher and for sharpness with 89 % or higher, which means for a prediction model for complex hearing impression a high correlation level.
Comfort Optimiser MCHI

The method is based on a psychoacoustic model developed from 3470 combined judgements of loudness, brightness, noise and distortion.

Research is suggesting you can now measure what is normally subjective, objectively.
A normal hearing subject listening to speech in quiet

A very useful reference point!
A person with a moderate hearing loss listening to speech in quiet
For this signal the person is hearing on the louder and sharper side of what is considered comfortable.
Speech input left graph amplified output right graph
Output left graph

gain right graph
With the optimiser a history can be made to review progress.
- evaluate pre-settings of the hearing aid,
- support fitting with subjects with restricted capabilities to communicate hearing impressions. If the professional sees inconsistencies between the customer descriptions and the hearing dimension predictions, he/she is immediately able to correct the hearing aid setting before the customer would get in trouble with the uncorrected setting.
- support fine-tuning by controlling setting changes,
- match basic hearing impressions for device comparison,
- verify and demonstrate hearing aid processing by comparison of the client's own device with the normal hearing impression for specific sound situations,
- explain the hearing aid processing in a more customer understandable manner the current status of hearing aid fitting, additional necessary changes or essential tasks of hearing training by the customer.
Model of Comfort for Hearing Impaired persons

- determine individual listening preferences by comparing predicted hearing impressions to references for an accepted hearing aid setting,
- check hearing impressions independent of client's mental state (e.g. dependencies on daytime),
- maintain basic hearing impressions when activating enhanced features (e.g. algorithms with frequency transposition),
- represent differences or improvements of acclimatization aspects. By presenting loudness/sharpness predictions measured at different times or sessions the customer will/can be informed about the degree of acclimatization, the success of acclimatization or additional tasks of the hearing training.
- solve hearing problems with the hearing aids or trade-offs (e.g. balance between loud sound too loud vs. soft sounds too soft).
- keep records of the existing fitting success for each session or over time additionally to physical measurements.
- faster fitting multiple programs, and
- finally for objective documentation of subjective fitting results.
How speech mapping can be a valuable tool.

A new method speech mapping MCHI based on a psychoacoustic model

With new and developing technologies we may be able to be more effective.

Speech mapping can be a quick and useful tool in orientation process and helping the patient to understand.

The MCHI-s model may give us a quick and simple and effective way of verifying and or validating hearing aid fittings.