Task Force 1:

Standards for Hearing Aids

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Our charge was to identify the major issues with respect to standards. In order to meet this charge, questions with respect to 10 issues were sent by the chairman to the committee members for their reactions. Members were asked to respond to each question and to any additional questions or issues that occurred to them. This report is based on the responses received plus those of an invited respondent, Robert Sandlin. It will also include a summary of the group discussion on April 27, 1973.

1. *Harmonic Distortion.* How should harmonic distortion be measured? At which frequencies? Can we agree on the kind of measurements we want from industry? What are your views with respect to the amount of distortion that should be considered to be "significant distortion?"

Kasten — "There is no good research that relates directly to the question of specific magnitude of distortion. In fact, the existing research that deals with the significance of distortion is in conflict. For several years the Veterans Administration used 10 percent as a figure, but that was not established on the basis of research, but rather on the basis of what made sense. This is a matter of prime concern and should be given priority in our discussions."

MacDonald — "Distortion should be measured at the 2nd harmonic, at all frequencies that the hearing aid reproduces."

"Allowable distortion rate should change with regard to severity of hearing loss of user:
a. less than 10 percent — moderate h. l.
b. less than 12 percent — severe h. l.
c. less than 15 percent — profound h. l."

Rubin — "At our Center harmonic distortion is measured 125, 250, 500, 1000, 2000, 3000, and 4000 Hz. We use a 60 dB input signal and measure distortion when we have 100 dB output. We call this Standard Output. We also measure distortion at another level — Maximum Power Output. At Standard Output an aid is unacceptable if there is above 4 percent distortion at any frequency."

Sandlin — "60 dB input; full gain; total range; 2nd and 3rd harmonic; harmonic distortion at any point on the graph must not exceed 10 percent.

2. *Paper Speed and Writing Speed.* What standards should be set by the hearing aid industry regarding paper speed and writing speed in reproducing frequency response curves with B and K equipment? At present, manufacturer's curves are often not comparable.

Kasten — "It has been my experience that a paper speed of 30 millimeters per second has been quite good. This also means setting the level recorder for a drive shaft speed of 36 revolutions per minute. Using those particular speeds, we appear to get good resolution using a writing speed of 160 millimeters per second. I frankly believe if we can come to some kind of decision regarding a reasonably slow paper speed and a relatively fast writing speed, we can obtain accurate and consistent tracings of frequency response that do not tend to hide or obliterate irregularities in the hearing aid performance."

Rubin — "At our Center we use 10 mm / sec for paper; 120 LPM for drive."

Sandlin — "Suggests: 10 mm per second writing speed; 50 mm per second stylus sensitivity Acceptable: 30 mm per second writing speed; 50 mm per second stylus sensitivity."

3. *Manufacturer Record of Electro-Acoustic Characteristics of Each Aid.* Should manufacturers be asked to keep records on electro-acoustic characteristics of each hearing aid they produce and be expected to restore the aid when sent for repair to those specifications?

Kasten — "I honestly feel that it would be of tremendous value if all manufacturers would keep records on the electroacoustic characteristics of each hearing aid by serial number. If this type of thing were done, the manufacturers would have a basis upon which to compare the performance of instruments when they have been sent back for repair, and also when they have completed their tour in the repair facility. We realize that there is considerable variability in the performance characteristics of instruments within given models, and it would be of value to be able to relate an instrument back to its exact performance when new rather than the average performance for that model."

MacDonald — "This is impractical and may be of little meaning because of response changes due to shipping, heat, humidity, etc. However, all hearing aid dispensers should have their own B and K equipment, or have it available to them."

Rubin — "Yes. We keep a record on each hearing aid in the Center which we use for clinical evaluation. We also keep a record of each community client's hearing aid in the client's folder. Additionally, we have a record going back two years of each Lexington student's aid. We have just started checking aids routinely after repair and we find frequently that they have not been repaired adequately. Frequently an aid is returned two or three times before it is acceptable. Therefore, manufacturers should keep their records to cut down on repair time."

Sandlin — "Yes. However, five years of maintenance of records is all that we should expect."

4. *Desirable Lower Limit of Frequency Response.* Are there problems with the extension downward of the extended frequency range hearing aid to 50 Hz? Is too much noise being fed in with such low frequency response?

Kasten — "The subject of low frequency emphasis is still one about which we know very little. It is very true that we can process a great deal of additional speech information when we have low frequency emphasis, but at the same time we are also processing a great deal of environmental noise that occurs in these low frequency regions. One other thing that I think we must seriously consider is the fact that much of the equipment that we use to evaluate hearing aids does not have a low frequency cut-off comparable to the low frequency cut-offs on some of these aids. If we are using evaluation equipment that has a low frequency cut-off of 200 to 250 Hz, then we delude ourselves if we think we can show differences between aids that have responses that go all the way down to 50 Hz. This particular aspect of the evaluative scheme we cannot afford to ignore. In terms of the trade off between low frequency speech information and low frequency noise,I know of no specific research that has dealt with this question."

MacDonald — "Yes. I feel that this is true in most cases. This type aid is best used with totally deaf, who make little use of audition."

Rubin — "Yes, we think there is the possibility of too much noise."

Sandlin — "A low extension to 70 Hz is desirable, but not below this."

5. *Need for Better High Frequency Range and Emphasis.* Do you think we should urge the industry to manufacture hearing aids with better high frequency range and better high frequency emphasis?

Kasten — "It would seem reasonable that we could hope for hearing aids with better high frequency range and high frequency emphasis. We are not dealing with an impossibility, but rather we are looking at something that has posed some major technical problems. Presently, the expansion of the high frequency end of the frequency response requires a trade off in terms of power and in terms of signal to noise ratio. I once again have to say that I know of no appropriate research that deals with this type of trading relationship, and we therefore still have another area to investigate.

MacDonald — "yes."

Rubin — "Yes. This may be possible with the Electret microphone."

Sandlin — "Yes. Some manufacturers are currently producing aids with a fairly broad response. For example, there are three or four ear level hearing aids with response to 4000 Hz. Norelco and Oticon produce body aids using dynamic or magnetic microphones with a response out to 5000 Hz.

6. ***Problems with Ear Level Aids.*** What problems do you find with ear level aids as contrasted with body aids? Are the MPO upper limits sufficiently high? Do you find more distortion, more limited frequency range, etc?

Kasten — "In this particular area, I think we are seeing some real improvements in technology. The ear level aids are now being produced with maximum gains in the low 60 dB range and with maximum power outputs in the low to mid 130 dB range. The real trick with this kind of fitting is in the ear mold construction in order to cut down feedback. In general, we tend to find somewhat more distortion in the ear level aids, and the locus of maximum distortion appears to be in a slightly higher frequency range than for body aids. Also, in general, the high powered ear level aids tend to have a somewhat more irregular frequency response than do their equally powered body-type counterparts."

MacDonald — "No really significant problems between ear level and body aids. MPO is sufficiently high. No greater distortion rate, etc."

Rubin — "Ear level aids (prior to the advent of the ear level aid with Electret Mic.) were limited both in frequency

response and maximum power output. The new aids may provide the frequency response desired."

Sandlin "There are exceptions, but in general there is more distortion in ear level hearing aids and a more limited frequency range."

7. and 8. *AVC or Compression Circuits.* How efficient do you find AVC or compression circuits to be on wearable hearing aids? Is clarity being sacrificed when we recommend them? Should there be industry agreement with respect to standards for compression?

Kasten "Present day commercially available compression instruments appear to be functioning quite well. The industry has gotten attack and release times to short enough periods that there appears to be no effect on speech intelligibility. Most compression circuits tend to be functioning as the specifications describe, but there are no good means of checking this. There are no existing standards for the measurement of compression instrumentation. I feel strongly that this is necessary and I think this should be an item for our discussion."

MacDonald "Find them, depending on manufacturer, very efficient. Have no complaints re clarity. Yes, there should be industry agreement with respect to standards."

Rubin "AVC seems fairly efficient. There can be and should be standards with regard to compression."

Sandlin "AVC circuits are satisfactory today. There is no sacrifice in clarity. Industry can control for as low an MPO as 95 dB; should not use linear limiting, i.e., peak clipping; should use AVC—linear compression or fixed ratio compression. In our standards we should specify the attack and recovery time and also the release time.

Attack and recovery	10 msec or less
Release time	50 msec or less

9. *Variable MPO.* Should we ask the industry to provide hearing aids that can be increased in power during their lifetime in order to take care of the problem of the child with increasing hearing loss?

Kasten "There are presently very few instruments on the market that are capable of this type of adjustment. I believe it would be highly advantageous if we could influence the industry to produce more of this kind of equipment."

MacDonald "There are some aids already on the market that do this."

Rubin "No."

Sandlin "There should be a variable MPO on all body hearing aids from 128 dB to 135 dB."

10. *Small Body Type Aids—Moderate Gain.* Should we ask the industry to provide a body type hearing aid suitable for the 18 month old or younger child with a moderate hearing loss? (Problem of having to use a head band to keep ear level aids in a child's ears).

Kasten "This item is extremely important. For the most part, we simply take the standard adult body-type aid and strap it on to the very young child. It would be helpful if we could work with the industry to develop some type of amplification that would be uniquely appropriate to the extremely young child who has only a moderate hearing loss. In addition, we should take into consideration that portion of the geriatric population who have only mild to moderate hearing losses, who are physically unable to manipulate the small ear level aids appropriate for this type of hearing loss. These people need a mild to moderate powered body aid that has large conspicuous controls that can be handled easily. As you look through the market of commercially available instruments you find that this kind of commodity is almost impossible to purchase. It is needed in order to meet the needs of this unique population."

MacDonald "Check Omnitone D.C. 11 and Audiotone 'Junior'."

Rubin "Most assuredly yes. We currently have 28 impaired children enrolled in our Center. We have been using ear level aids worn on the shoulder for the infant under 6 months and regular body aids for infants from 7 to 18 months. We urge industry to come up with innovative aids."

Sandlin "Yes, if demand is great enough. Better yet, improve the headbands."

In the group discussion it was decided to organize our discussion with respect to: A) Physical Configuration, and, B) Electro-Acoustic Standards. Two main problems under (A) emerged. They were: 1) The problem the geriatric population has in using hearing aids because of small battery size and battery compartments and small volume control size and availability, 2) The problems audiologists have (time consuming) in adjusting hearing aids when minute screws are used. It was suggested that larger controls be made available on ear level aids for the geriatric population. A possible solution to the latter problem would be the use of push buttons instead of screws. It was pointed out that there

needs to be research done in human engineering on minimum knob size as a function of age.

The main problems with respect to electro-acoustic standards that were discussed were the need for not just one frequency response curve on each but a family of curves, the need for better quality control, the need for greater flexibility with respect to modification of response, (more aids providing sharp—18 dB per octave reduction of gain), the need for more precise information of the effect of tubing and molds on frequency response, and the need for some sort of marking on volume controls to indicate ¼ gain, ½ gain, etc. It was pointed out that the problem of quality control was directly related to the delivery system. The electro-acoustic characteristics of hearing aids are often altered in shipment despite the great care that is taken in packaging. A possible solution to this might be local assembly points.

The value and possible impact of this committee was discussed. It was pointed out that there was sometimes highly effective communication between audiologist and industry at the present time, but on an individual basis. It was agreed that even greater impact could be made if we made our requests as a group through the Academy.

Finally, it was decided to continue this committee to insure that some of its ideas reach fruition and to open a professional dialogue between the Academy and industry. The Committee plans to meet for an entire day prior to the ASHA Convention this Fall. The size of the committee will be increased through invitation. A representative of the hearing aid industry will be asked to join us in our deliberations.