

# QUICKSIN™ HFE AND LP LISTS: LEARNING EFFECT, EQUIVALENCE AND SENSITIVITY

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## Introduction

In addition to 18 lists of unfiltered sentences, the Quicksin™ (QSIN) test provides 12 lists of sentences recorded with both high frequency emphasis (HFE) and low pass filtering (HFE-LP). These lists were developed to determine if extended high frequencies improve or degrade understanding of speech in noise. While the 18 unfiltered QSIN lists have been evaluated for list equivalency for normal hearing and hearing-impaired individuals (Killion et al, 2004; McArdle & Wilson, 2006), the filtered lists have not been evaluated in the same manner.

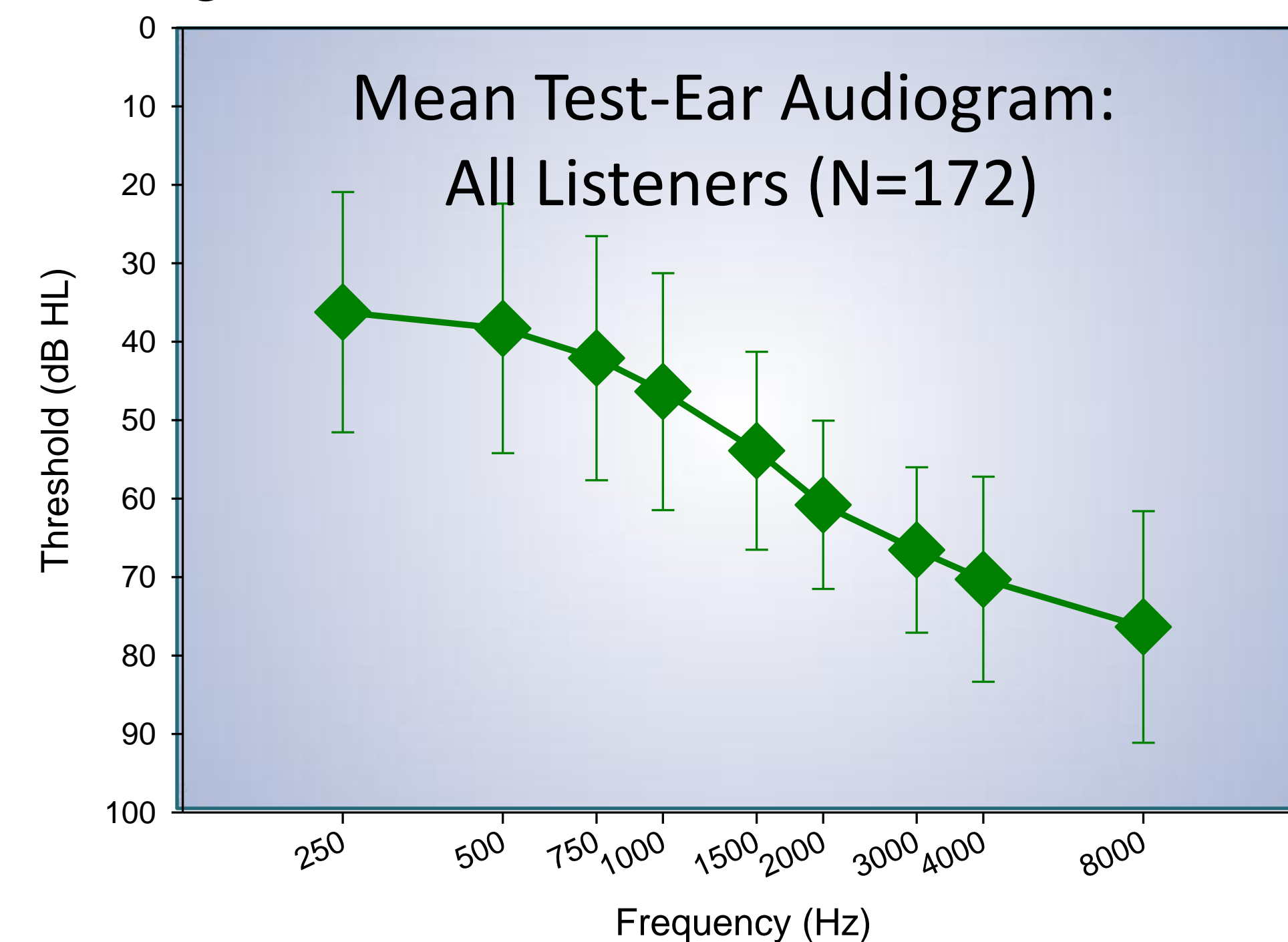
This study was designed to examine three questions. For older listeners with moderate to severe high-frequency sensorineural hearing loss:

- 1) Do significant learning effects occur for the filtered QSIN lists?
- 2) Are the 12 lists equivalent after filtering?
- 3) Are expected differences seen between HFE and HFE-LP list pairs, reflecting sensitivity to the reduction of high-frequency cues?

## Methods

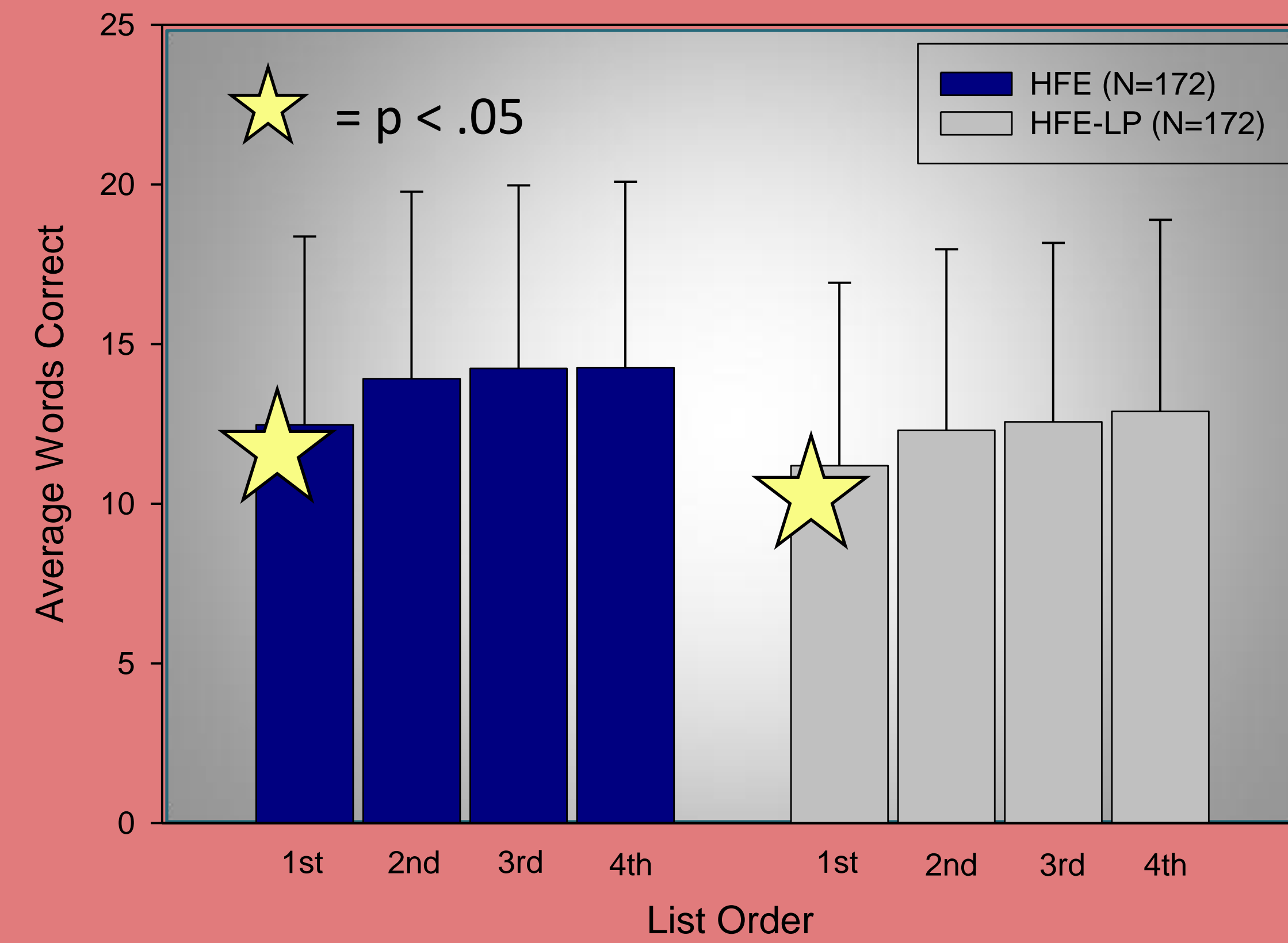
172 elderly hearing-impaired listeners were studied. The test list schedule alternated between four randomly selected HFE lists and four randomly selected HFE-LP lists. As a result, each list was heard by a different group (Ns ranged from 42-72). Mean test-ear audiograms were equivalent for the groups hearing each list.

Lists were presented monaurally through an ER-3A earphone at a level that the participant reported as “loud, but ok”. Two unfiltered practice lists were administered prior to the test lists.



## Results

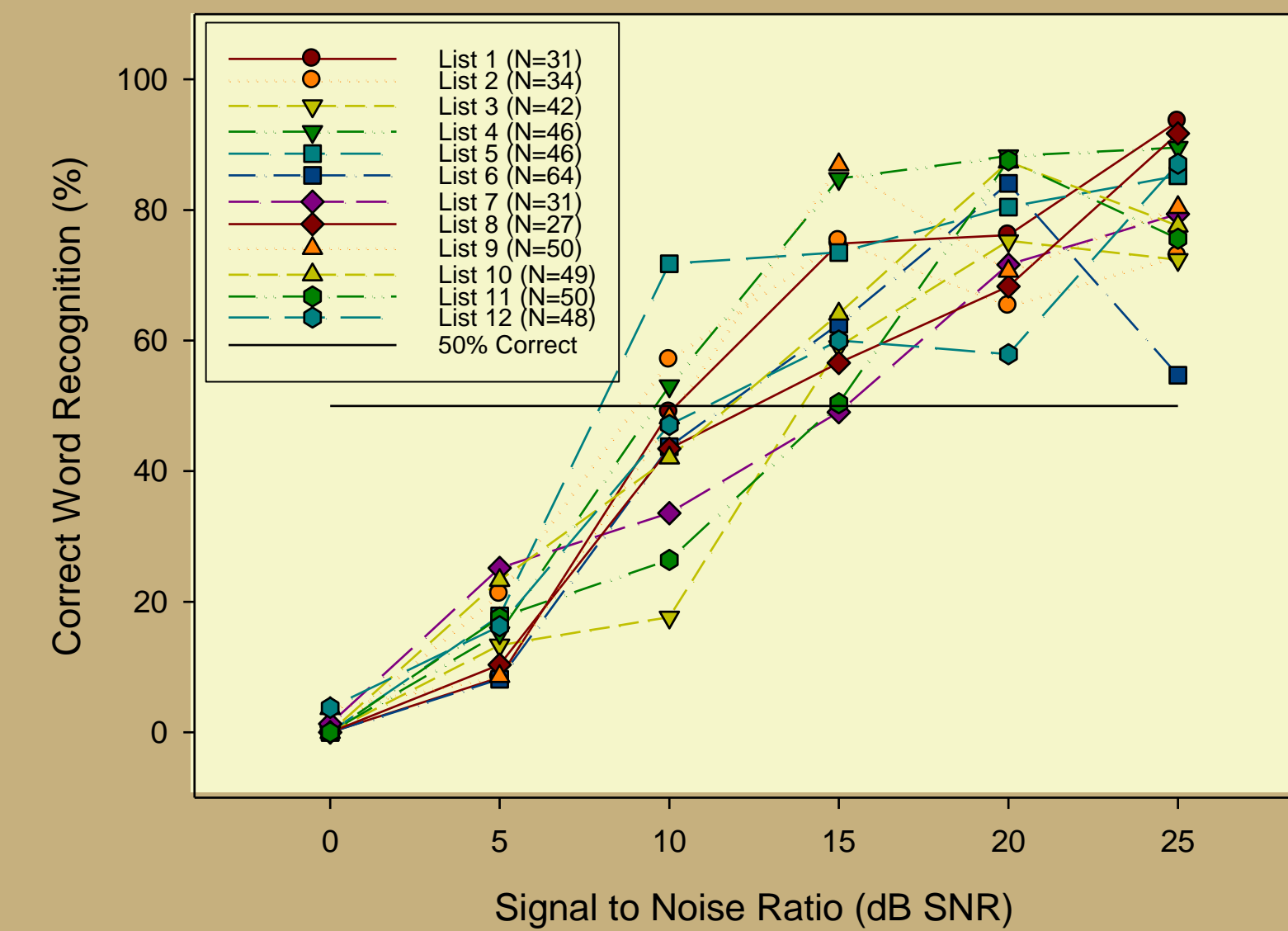
### Learning Effect



- Mean scores for HFE and HFE-LP lists given 1st were significantly poorer than scores for HFE and HFE-LP lists given 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup>.
- Scores for HFE and HFE-LP lists given 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> were not statistically significantly different.
- Subsequent analyses were performed using scores from those lists given 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup>.

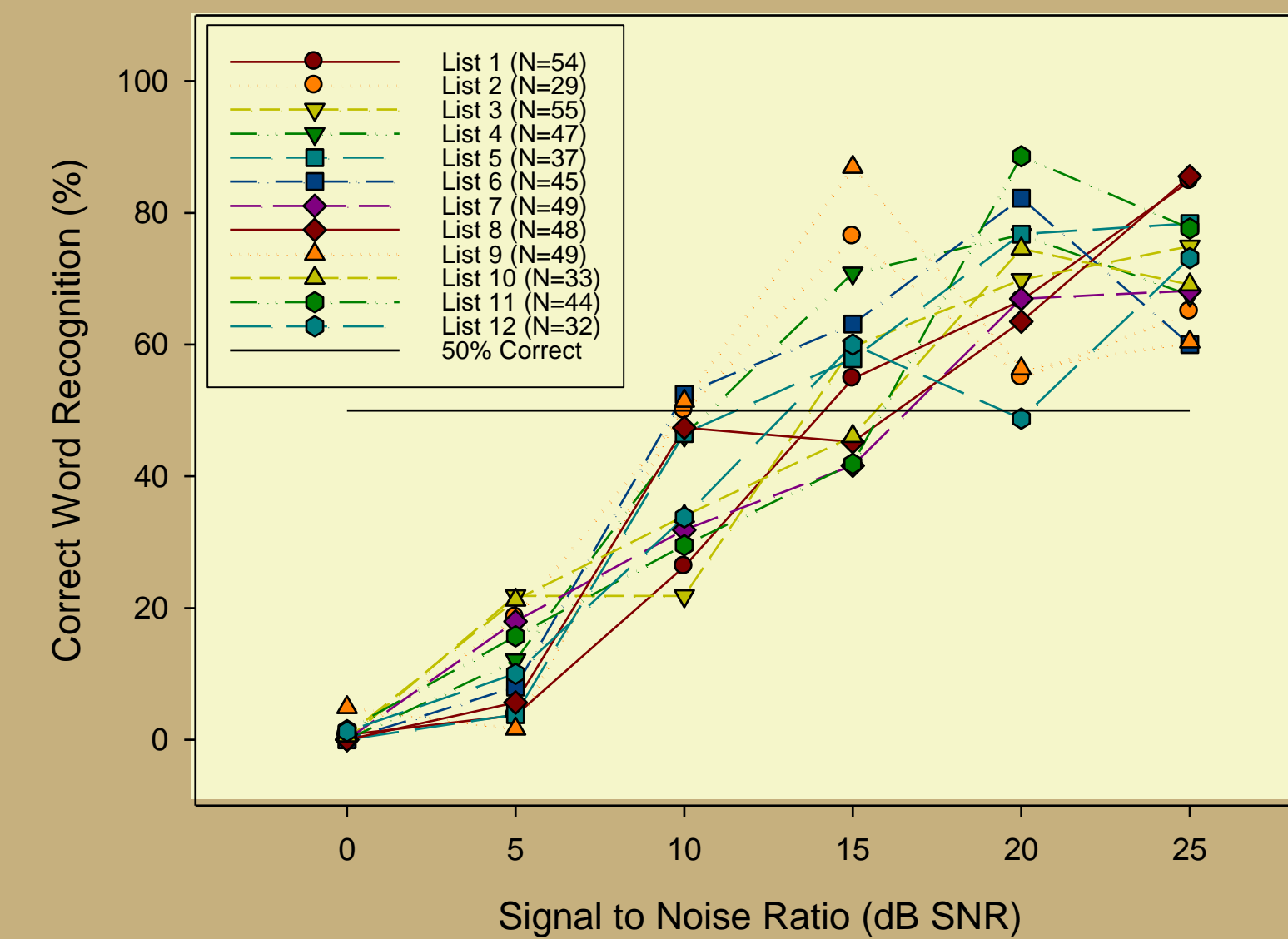
### Equivalence

#### PI Functions for HFE Lists 1-12



- Performance-intensity functions for the 12 lists varied in steepness and shape. This was true for both types of filtering.
- SNR50s varied over an 8.5 dB SNR range for the 12 HFE lists and over a 7.5 dB SNR range for the 12 HFE-LP lists.

#### PI Functions for HFE-LP Lists 1-12



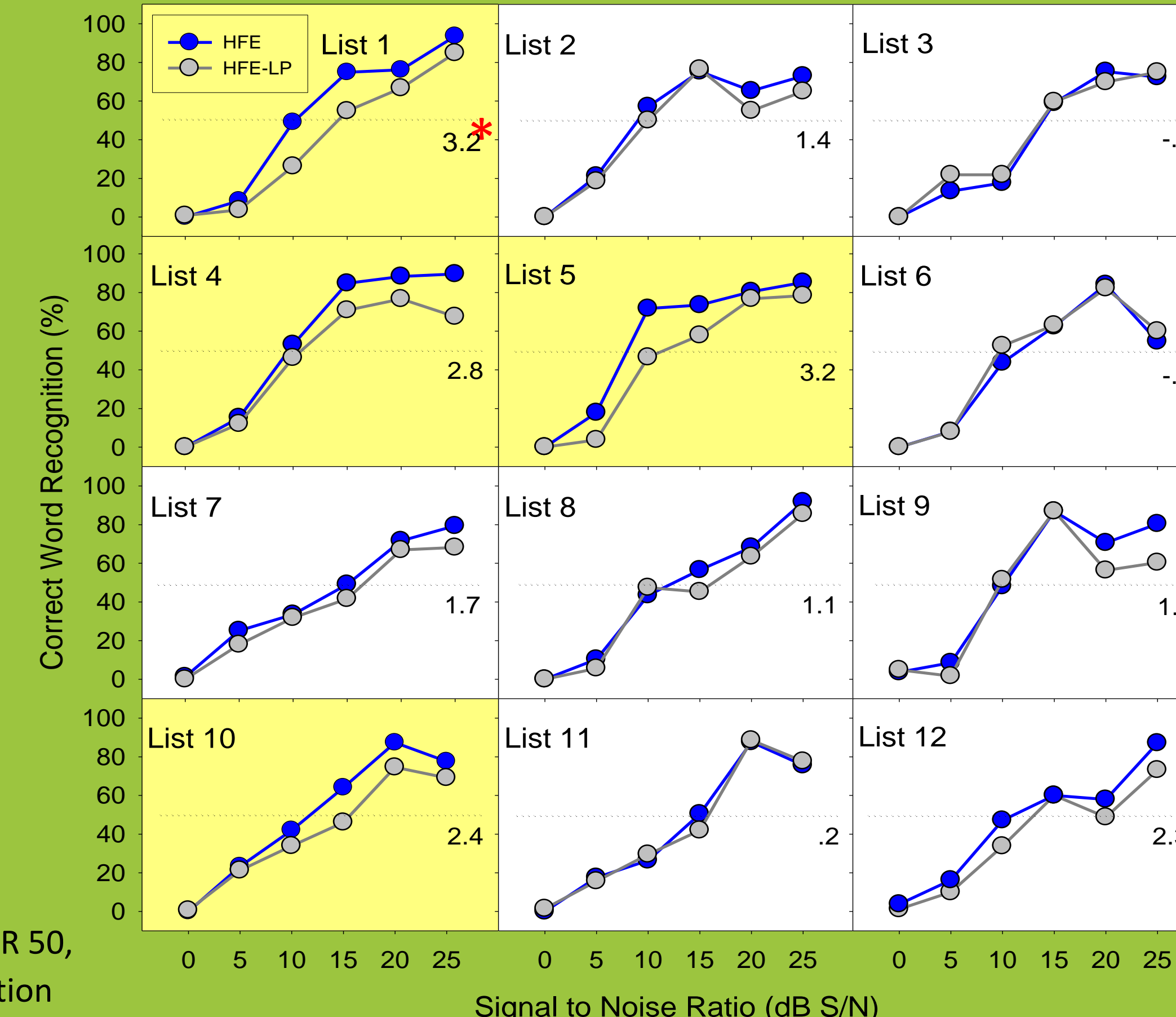
- Many of the lists were non-monotonic.
- Differences in SNR50s were greater than those reported for hearing-impaired individuals using unfiltered lists (McArdle & Wilson, 2006).

### Sensitivity

- Theoretically, we would expect that the access to high-frequency cues provided by HFE lists would result in steeper PI functions than the HFE-LP lists.
- Using the difference between HFE and HFE-LP SNR50s as a measure of sensitivity to high-frequency cues, list sensitivity ranged from -.6 to 3.2.
- This finding suggests that several lists were not sensitive to the loss of high frequency cues.

\* dB difference between HFE and HFE-LP SNR 50, calculated using the Spearman-Kärber equation

#### Mean HFE and HFE-LP Lists 1-12



## Q & A

- Q. Do significant learning effects occur for the filtered QSIN lists?  
A. Yes. Despite exposure to two unfiltered practice lists, the first filtered lists resulted in significantly poorer word recognition performance than subsequent lists.
- Q. Are the 12 lists equivalent after filtering?  
A. No. At a given SNR, lists produced a wide range of word recognition scores. This was true for both HFE and HFE-LP filtered lists.
- Q. Does it matter if lists are nonmonotonic?  
A. Maybe. If SNR50 is computed using the Spearman-Kärber equation, a nonmonotonic function will produce a poorer (higher) SNR than if you plot the function and visualize the SNR50.
- Q. Can I use QSIN lists to find out something about sensitivity to high frequency information for my patient?  
A. Yes. Lists 1, 4, 5 and 10 were the most sensitive to reduction of high-frequencies and should give valid information about benefit from high-frequency cues in a clinical setting. Lists 3, 6, 8 and 11 should not be used to determine benefit from extended high-frequency amplification.

## Conclusions

These results have implications for research and clinical use with regard to HFE and HFE-LP QSIN list selection to validly determine benefit from high-frequency cues.

## References

- Killion, M.C., et al., (2004). Development of a quick speech-in-noise test for measuring signal-to-noise ratio loss in normal-hearing and hearing-impaired listeners. *JASA*, 116 (4), 2395-2405.
- McArdle, R.A., & Wilson, R.H. (2006). Homogeneity of the 18 Quicksin™ Lists. *JAAA*, 17, 157-167.

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