Introduction
Speech recognition ability is routinely assessed in the clinical evaluation of hearing using open- and closed-set paradigms, typically with recorded word lists spoken by a male talker. Individuals with audiograms of similar severity and configuration can demonstrate varying abilities to extract meaning from speech and environmental stimuli. There is some evidence that recognition performance for speech materials recorded by a female talker are poorer than performance on materials recorded by a male talker. Patients with sensorineural hearing loss report more difficulty understanding female speech. Comparisons are complicated by possible effects of different calibration methods and presentation levels and other acoustic differences in the speech of male and female talkers. A comparison of recognition performance for words recorded by male and female talkers that are carefully matched for level has not been reported. In this study we measured word recognition performance in normal hearing and hearing-impaired listeners for monosyllabic CNC words spoken by a male and a female talker.

Methods
Speech Materials
Monosyllabic words recorded by a female talker (VA recordings) and a male talker (Auditec recordings) were digitally adjusted so the rms level in a 50-ms interval in the central portion of the vowel was identical for each word. Additionally, the overall peak amplitudes of each monosyllabic word for each recording were measured using Adobe Audacity (Figure 1).

Subjects:
One ear of ten normal-hearing subjects was tested. Thresholds at octave frequencies (250 – 8000 Hz) did not exceed 25 dB HL. The average 3-frequency pure tone average (500, 1000, 2000 Hz) was 4.8 dB HL. Subjects were screened with otoscopy and tympanometry and reported no recent signs of otologic disease.

One ear of five subjects with SNHL was tested. The subjects had normal otoscopy and tympanograms and had no recent history of middle ear disease. The audiograms of the test ear of the subjects with SNHL are shown in Figure 2.

Procedures
Speech recognition was tested using recorded monosyllabic words in a four interval forced-choice paradigm. The test word and three rhyming foils were presented on a touch screen. The subjects touched the word they thought they heard. 25 words were presented at five levels (5 – 25 dB re: pure tone average in 5 dB steps). SNHL subjects were tested at two additional levels (up to 35 dB SL).

Results
Normal-Hearing Subjects
Closed-set word-recognition scores were lower for the female speech than for male speech. The performance-intensity function for female speech is shifted toward higher levels by about 4 dB. Error bars are the standard error of the mean.

Table 1. Mean crest factors (difference between the peak amplitude and the rms level of the vowel in dB) and mean peak locations in ms for the female and male recordings.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Crest Factor (dB)</th>
<th>Peak Location (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>6.93</td>
<td>1.87</td>
</tr>
<tr>
<td>Female</td>
<td>6.50</td>
<td>1.87</td>
</tr>
</tbody>
</table>

A difference of 3.34 dB in mean crest factor was seen between the male and female recordings indicating the male recordings have an average of 3.34 dB peak amplitude greater than female recordings.

SNHL Subjects
Subjects with SNHL had higher recognition scores for male speech than for female speech when words were matched based on the rms level of the vowels. Normal subjects had higher recognition scores for male speech than for female speech when word levels are adjusted to equalize the level in the steady state portion of the vowel of monosyllabic CNC words. For normal subjects the difference is equivalent to a shift of approximately 4 dB in the psychometric function.

Conclusions

1. In a closed set paradigm, normal-hearing listeners and listeners with SNHL have higher recognition scores for male speech than for female speech when word levels are adjusted to equalize the level in the steady state portion of the vowel of monosyllabic CNC words. For normal subjects the difference is equivalent to a shift of approximately 4 dB in the psychometric function.

2. The scores of subjects with SNHL were lower than those for normal-hearing subjects. Most approached 100% at the highest levels. In a previous study with a larger sample of subjects with SNHL some listeners achieved significantly reduced scores at high levels.

3. The levels of the words were matched based on the rms level in a 50-ms interval in the central vowel. It is possible that another method for matching the levels of the words would produce equivalent performance.

4. The mean difference of 3.34 dB in crest factor between the male and female recordings accounted for the performance differences seen at low presentations levels. Discrepancies remain in high levels.

5. A larger sample size is needed to understand the performance differences between male and female recordings at high levels.

References
3. Department of Veterans Affairs. Speech Recognition and Identification Materials, Disc 4.4. Produced by Auditory Research Laboratory, VA Medical Center, Mountain Home, Tennessee.

This poster is available at http://audiologyincorporated.com/articles For further information, please contact Robert H. Margolis (fmargoli01@gmail.com).