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Materials adapted in-part from Council for Atherosclerosis Risk in Communities, Accreditation in Occupation Hearing Conservation, and National Health and Nutrition Examination Survey hearing study materials
1. Required Instrumentation and Maintenance

1.1. Instruments

- Portable ShoeBox Audiometer (iPad based system)
- Calibrated TDH 59 Supra Aural Headphones
- Audiologist’s Choice Brand Audio Wipes (cleaning wipes)

1.2. Maintenance

- TDH 59 Headphones should be calibrated on an annual basis to ensure acoustic, electric, and mechanical properties meet ANSI standards.
- Avoid placing instruments near significant heat sources and avoid ANY liquids on/near the equipment.
- Equipment should be stored in cool, dry location within the provided bag.
- Should equipment be contaminated, it can be cleaned with a dry microfiber cloth and approved electronic cleaning solutions (Audiologist’s Choice Audio Wipes). Please avoid organic solvents and/or aromatic oils.
- Ensure that iPad is charged prior to testing.
- Clean headpones with Audio Wipes between participants (regardless of contaminations) to maintain sanitary standards.
- PDF Versions of SHOEBOX equipment manual can be accessed on provided iPAD or at www.shoebox.md/support. Equipment manual for iPad can be found at apple.com.

2. Questionnaire

One questionnaire will be administered during hearing data collection. The Hearing questionnaire (HQ) has two parts: Self-Reported Hearing and Medical History, and Hearing Health Care Utilization. Administration of the questionnaire should be completed prior to any audiometric testing.

The questions should be delivered to the participant verbally. Please ensure that the participant can see you clearly as you explain the questions and ensure that they are wearing any hearing devices that they regularly use.

2.1. Prior to Testing

- Ensure the room is relatively quiet and encourage the participant to wear any hearing devices they may regularly use.
- Ensure the participant is seated across from the technician so that they can see technician’s face for visual communication cues.
• Express to the participant that all information will be kept private.

2.2. General Instructions

• Speak clearly and at a normal, businesslike pace so that participants can fully understand questions without extending the time needed to administer the questionnaire by constantly repeating the questions.
• Have participants read questions when they have trouble following oral exam administration.
• Consider modifying the pace if the participant shows frustration and/or a lack of understanding (i.e. slow down pace and increase volume of voice if necessary) or if the participant shows annoyance and consistently jumps ahead (i.e. increase pace of questions to match their pace).
• Have a relaxed and friendly manner.
• Maintain a neutral, but conversational, tone when asking questions. Please attempt to sound natural and enthusiastic about the questions regardless of how many times one has already asked the questions (i.e. it is difficult to consistently administer the same questionnaire but please avoid sounding robotic in questioning).
• Maintain a neutral response to participants’ answers – do not indicate any reaction (e.g. surprise, disapproval).
• A short break is discouraged but may be necessary if the participant becomes fatigued.
• No questions should be skipped during the form. Please be familiar with all questions prior to administering the questionnaire.
• If the participant displays difficulty answering the question, repeat the question more slowly and slightly louder (if appropriate).
• Minimize missing data as much as possible by encouraging the participant to respond with their best guess or most appropriate answer if they respond “I don’t know”.

2.3. Hearing Questionnaire

All questions on this form are multiple choice and the response should be selected using a check mark in the appropriate box.

Some answers will trigger skipping ahead in questioning. For example, question 3 “3. Have you ever had surgery on your ear(s), aside from ear-tube placement?” has two possible answers ‘No’ or ‘Yes’. If ‘No’ is selected then question 4 is skipped while if ‘Yes’ is selected then question 4 is administered as it is directly related to question 3. Please keep this potential pattern in mind as the form is completed.
Please be familiar with all questions prior to administering the questionnaire.

1. Begin with the following instructions: I am going to ask you a series of questions with mostly multiple-choice answers about your hearing. I will read you the question and the list of answers. Please wait until all answers have been read aloud before answering. Please select the most appropriate answer for you. Please let me know if you do not understand the question or could not hear me and I will re-read it and let you read it. As always, all of your answers are kept confidential. Do you have any questions before we begin?
2. Answer any participant questions and continue.
3. Read each statement to the participant.
4. For each question, check the box that corresponds to the answer the participant provides on the HQ Form. Some questions allow for multiple responses, please score according to the question.
3. Audiometric Room and Participant Preparation

All testing should be conducted in a quiet room – this will be assessed prior to actual audiometric testing and will affect ability to conduct data collection (See section 7 for running the ambient noise analyzer in the ShoeBox audiometer). Please ensure room has limited noise from nearby sources such as conversations, ventilation systems, and electronic equipment.

Participant should be seated in a chair facing away from the tester to avoid participant’s ability to visualize test administration which may possibly contribute to false positive responses. **However, please always speak to the participant face to face to ensure proper understanding of instructions.**

Specifically ask if participant wears hearing aids, an amplifier, a BAHA (bone anchored hearing aid), or a cochlear implant. **Please note, hearing cannot be tested on participants with Cochlear Implants.**

Instruct participant to remove earrings, hearing devices, and glasses prior to headphone placement. Instruct participant that you will place the headphones on them and they should inform you if headphones are uncomfortable to a point where they could not wear them for more than ~10-15 minutes (See Section 4).

Instruct participant that during testing they will hear a tone that will vary in pitch in either ear; they should raise their hand whenever they hear the tone, no matter how soft it is and then lower their hand to wait for the next tone. Always verify that the participant understand the instructions prior to proceeding with testing.

Please note that instructions are often repeated throughout the testing to ensure proper understanding.

Suggested Instructions:

“We are going to measure how well you can hear certain sounds. When ready, I would like you to remove any earrings (and hearing devices) and remove your glasses. Then, I am going to put headphones over your ears and you will hear beeping sounds of different pitches through them. If the headphones are uncomfortable to a point where you cannot wear them for more than 15 minutes please let me know.

I will sit behind you throughout the test. When you hear a beep or tone, no matter how soft the sound is, please raise your hand and then lower it to indicate you heard it. It is important that you sit still and quiet for the test. Do you have any questions for me?”
4. **Headphone Placement**

4.1. Wash hands

4.2. Red – Right ear, Blue – Left ear

4.3. Stand behind participant

4.4. Ensure that the participant has removed earrings (and hearing aids if applicable) and taken off their glasses

4.5. Say to the participant: “I am going to put headphones over your ears and you will hear beeping sounds of different pitches through them. Remember to tell me if the headphones are too uncomfortable to wear for more than 15 minutes. When you hear a beep or tone, no matter how soft the sound is, please raise your hand and then lower it to indicate you heard it. It is important that you sit still and quiet for the test. Do you have any questions for me?”

4.6. Use fingers to pull back slightly on upper ear (Helix) to open the ear canals (Figure 1 – First Picture)

4.7. Place headphones over ears so that the speakers are over the opening of the ear and ensure that red is over right ear and blue is over left ear (Figure 1)

4.8. Adjust headphone so that headband is flush along participant’s head and to ensure there is no space between headphone couplers and skin to ensure proper attenuation (Figure 1 – Middle Picture)

4.9. Headphones should sit tightly but comfortably on participant’s head (Figure 1 – Final Picture)

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*Figure 1.* Headphone placement example. *ALSO NOTE THAT GLASSES SHOULD BE REMOVED PRIOR TO HEADPHONE PLACEMENT*
5. Set up the ShoeBox Audiometer

5.1. Start the iPad and enter the passcode. NOTE: iPad is touch screen
5.2. Select the ShoeBox Pro App (Figure 2)
5.3. Enter the passcode to begin (Figure 3)
5.4. From the start up screen, select “manual test” (Figure 4)
5.5. Ambient Noise Check

The ShoeBox software allows the user to analyze room ambient noise levels. Ensure the room is quiet and all noise sources are quelled as much as possible and proceed as prompted. Ambient noise testing should be completed prior to audiometric tests and repeated during testing if new permanent sound sources appear.

5.5.1. Select the blue button in the top right corner of the screen to show the drop down menu (Figure 5)

5.5.2. From the drop down menu select “Room Background Noise Test” (Figure 6)

5.5.3. The ambient noise test will automatically run (Figure 7)

5.5.4. The device will tell the user whether the ambient noise levels are appropriate or not (Figures 8 and 9)

5.5.5. If ambient noise levels are above moderate level, attempt to identify and neutralize or move away from the source of sound. This may mean moving to another room, closing doors to the hallway, moving to another location in the test room, or adjusting the heating/air flow to the room. Common sources of noise include heating and air conditioning systems, ambient noise from people talking in the hallway, traffic noise from the outside, and electrical noise. Once you have re-evaluated and adjusted as necessary, re-test ambient noise.

5.5.6. If noise levels are still above the moderate level, then cease testing
Figure 8. Example of a room that is too noisy

Figure 9. Example of a room with appropriate noise level
5.6. The screen will now display two charts labeled “right ear” and “left ear” – note that frequency is along the x axis and sound level along the y-axis (Figure 10)

5.7. Ensure that TDH-50 headphones are selected on the transducer indicator (Figure 10)

5.8. Overview of controls (Figure 11)

5.8.4. Press “left ear” or “right ear” [1] to select the test ear

5.8.5. Keep “TDH-50” [2] selected to ensure tone is presented via the headphones

5.8.1. Click on the arrows [3] to change the frequency (Hz) or pitch

5.8.2. Click on the +5 and -10 [4] to change the intensity (dB) or volume

5.8.3. Press “tone” [5] to present the tone/signal

5.8.6. Record threshold by selecting “select” button [6]

5.8.8. Save patient (if desired) by selecting save button in upper right corner [7]

5.8.9. Note: intensity and frequency can also be changed by using your finger via the touch pad and selecting anywhere within the audiogram
6. Pure-tone Air Conduction Test Protocol

6.1. Repeat instructions from before (if necessary) “Now I’m going to measure how well you can hear certain sounds. I will sit behind you during the testing. When you hear a beep or tone, no matter how soft the sound is, please raise your hand and then lower it to indicate you heard it. It is important that you sit still and quiet for the test. Do you have any questions for me?”

6.2. Ensure you are seated behind the participant and out of their field of vision

6.3. Begin with right ear if last digit of ID NUMBER is odd, left ear if digit is even. Ensure the correct ear is selected prior to beginning

6.4. Utilize buttons or finger to select 1000 Hz (x-axis) at 50 dB (y-axis)

6.5. Present 1000 Hz tone at 50 dB
6.5.1. If participant does not respond, increase presentation level by 20 dB (i.e. 70 dB) until participant responds.

6.6. After participant responds (i.e. raises hand), decrease the tone by 10 dB (y-axis) and present. Continue this pattern of decreasing in 10 dB increments until there is no response.

6.7. When there is no response, increase tone in 5 dB (y-axis) steps until participant responds.

6.8. When patient responds, repeat the pattern of decreasing by 10 dB (y-axis) until another no response and increase by 5 dB until participant response.

6.9. Threshold is defined as when there are 2 responses at the same level in response to + 5 dB (y-axis) ascending presentations (Note: threshold is defined as 2 responses out of no more than 4 presentations at that level.)

6.9.1. Example sequence of threshold determination:

Present 1000 Hz at 50 dB – Participant responds
Present 1000 Hz at 40 dB – Participant responds
Present 1000 Hz at 30 dB – Participant responds
Present 1000 Hz at 20 dB – Participant does not respond
Present 1000 Hz at 25 dB – Participant responds
Present 1000 Hz at 15 dB – Participant does not respond
Present 1000 Hz at 20 dB – Participant does not respond
Present 1000 Hz at 25 dB – Participant responds

THRESHOLD IS RECORDED AS 25 dB in this example.

6.10. Record the threshold on the screen by selecting the check mark button (Figure 8 - #6) and be sure to record the value on the AUD form.

6.11. Proceed to the next frequency along x-axis (see CRF – 250-500 Hz) using the arrow keys or figure via touch pad. Repeat steps 6.5-6.10 (i.e. using the decrease by 10 dB and increase by 5 dB pattern to find threshold) using next frequency.

6.12. Repeat testing procedure at 1000 Hz to confirm threshold by repeating steps 6.5-6.10.

6.12.1 If the difference is 5 dB or less, move on to the other ear. If difference is ≥ 10 dB, repeat the test at further frequencies in the same order until agreement to 5 dB or less has been obtained.

6.13. Proceed to the next frequency along x-axis (see AUD form – 2000-8000 Hz) using the arrow keys or figure via touch pad. Repeat steps 6.5-6.10 (i.e. using the decrease by 10 dB and increase by 5 dB pattern to find threshold) using next frequency.

6.14. When all thresholds have been obtained in the right ear, select the left ear. Repeat steps 6.5-6.13

6.15. Record all frequencies on the AUD form

6.16. Remove headphones from participant.
6.16.1. You may say “Now I’m going to remove the headphones, please remain still for a second.”

6.16.2. After headphones are removed, you should thank the participant for their time and patience and ask them to wait for a copy of their results

6.17. Results (if desired)

8.17.1. Fill in the thresholds from the corresponding frequencies (500, 1000, 2000, 4000, 8000Hz) on the take home form

6.17.2. Give a copy of the take home form to the participant

9. FAQ

9.1. Participants may ask questions during the testing about the nature of the exam or protocols as it can be unfamiliar and different from previous testing they have completed. It is appropriate to assure participants that the test protocols are normal and for research purposes only. Encourage participants to consult their healthcare professional if they have more questions.

9.2. Participants may fatigue during testing or stop raising their hand. Keep participants on task by offering encouragement (i.e. “you’re doing great, just a few more) or reminding them to raise their hand.

9.3. Participants may inquire about their results. Please encourage them to follow-up with a healthcare professional (physician or audiologist) to have their hearing clinically tested/evaluated. You may provide the following information about prevalence of hearing loss in their age group:

In the United States, adults age 70 years or older:
36.9% have normal hearing
36.6% have mild hearing loss
25.9% have moderate hearing loss
0.6% have severe hearing loss