For Speech Sounds, 6 Feet With a Mask Is Like 12 Feet Without

Social distancing and masks protect against COVID-19—but add another layer of difficulty for audiologists treating patients with hearing loss.

BY NICHOLAS GIULIANI

Ever recorded a standard passage to use for hearing aid verification while using a face mask over a loudspeaker and a mannequin with an ill-secured skull? I have. But that is probably the least surprising thing you have heard this week.

As is well-known by now, face masks and six-foot distancing are recommended (CDC, **bit.ly/cdc-covid19-guide**) to limit the spread of COVID-19. However, audiologists typically provide services to patients at distances of less than three feet. Further, routine ear impressions can evoke Arnold's reflex and a resulting cough that discharges aerosols. This increases our and our patients' exposure risk to the virus.

For these reasons, most practices consider facial coverings and other protective gear essential for risk mitigation. Unfortunately, these important precautions make communication harder for people with hearing impairment because they impede speech intelligibility and obscure facial cues.

I've been seeking new creative ways to meet patients' hearing and communication needs despite masking and physical distancing. This is why I spent an afternoon putting face masks on a loudspeaker.

Filtered frequencies and doubled distance

Face masks filter out high-frequency speech information, resulting in a now all-too-familiar muffled sound quality. They also obscure visual cues that people use to fill in information their ears may have missed. Typically, this information provides articulation clues that help us discern between a /p/, /d/, or /g/.

Wearing even a thin procedure mask at three feet is like speaking without a mask at six feet.

Additionally, social distancing decreases the intensity of the sounds reaching the listener. Remember the inverse square rule? As you double the distance from the sound source, the intensity is reduced by half. This means that the recommended social distancing guideline of six feet between individuals results in sound that is roughly half the intensity that it would be in a pre-COVID social situation.

The masked effect

A particular conundrum for audiologists is not only how to safely conduct probe microphone measurements, but also how to counteract the effects of masks and social distancing while programming hearing aids. To continue delivering quality—yet safe—care, we need to gain a better understanding of how to ensure effective hearing aid fittings with the added burdens of facial coverings and physical distancing.

To illustrate the effect of masks on speech, I took measurements in a sound booth using probe microphones placed in the "ear canals" of a KEMAR mannequin. A standard, recorded speech passage was played through a loudspeaker at two different distances—3 feet (0.91 m) and 6 feet—(1.83 m), while obscured by four different facial coverings: a procedure mask, a procedure mask with face shield, a cloth mask, and an N95 respirator.

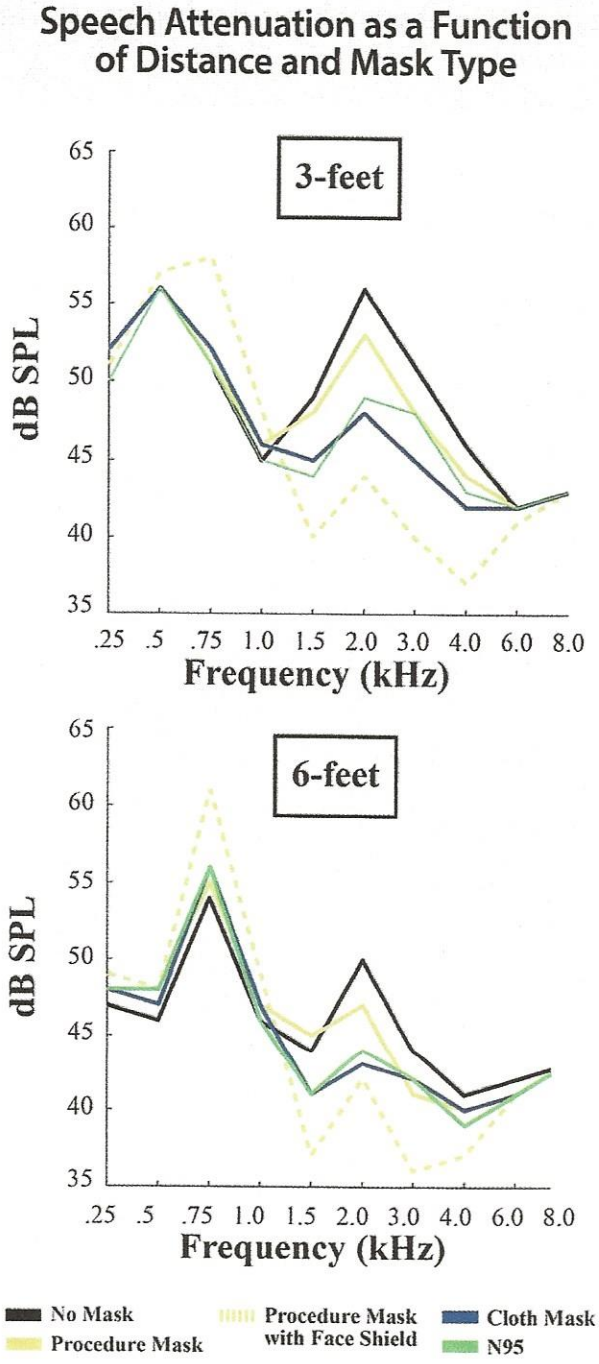
All masks acted as a lowpass filter, meaning that the intensity of high-frequency sounds was reduced, but not low-frequency sounds. The chart at right illustrates this point for each of the face coverings as a function of distance.

The black line represents the raw speech recording with no obstruction. The procedure mask (solid yellow line) resulted in the least reduction of high-frequency information, with only 3–4 dB of reduction for frequencies beyond 1500 Hz.

Now to illustrate how distance affects speech sounds, compare the black line in the bottom chart (no mask) to the yellow line in the top chart: Wearing even a thin procedure mask at three feet is like speaking *without* a mask at six feet.

At three feet and at six feet, the cloth mask (blue lines) and N95 respirator (green lines) reduced the intensity by approximately 3–10 dB for sounds higher than 1000 Hz.

Many of us now wear face shields and masks during certain higher-risk procedures. The dashed yellow lines show how at both distances, adding a face shield to a paper procedure mask dramatically decreases speech intelligibility by an additional 6–10 dB for frequencies greater than 1000 Hz.



Suggestions for audiologists

What options does that leave for serving people who have hearing loss? I offer some suggestions I have found helpful.

- **Wear a procedure mask** for less attenuation of speech sounds and, if possible, use a transparent mask. Doing so will still attenuate your speech, but your patients will receive visual cues to help supplement what their ears miss.
- **Wear goggles with a face mask** instead of a face shield during routine procedures, as a face shield further reduces speech intensity.
- **Add a manual hearing aid program.** Consider adding one with an additional 3–6 dB of gain for frequencies including and beyond 1500 Hz.
- **Revisit adding a telecoil program** for patients to better communicate with workers in places such as fast-food drive-thrus that may be equipped with an induction loop.
- Recommend that patients with newer hearing aid technology **use smartphone apps to adjust high-frequency output and volume.**
- **Use hearing assistive technologies, such as remote microphones,** to compensate for sound lost due to social distancing.
- **Schedule appointments** to allow sufficient space in waiting areas and time to clean exam rooms.
- **Explore remote programming options,** which allow you to make adjustments without the patient physically coming to the office.
- **Provide additional written instructions on improving communication while wearing a mask and social distancing** to patients, family, and caregivers.

COVID-19 social distancing and facial covering precautions pose significant communication obstacles for people with hearing loss—as well as assessment and treatment obstacles for audiologists.

With these suggestions, audiologists can help relieve these added communication burdens—and safely fit patients for hearing aids. The next time you don your protective gear, I offer a phrase to remind you of these new communication burdens: For speech sounds, six feet with a mask is like 12 feet without.

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