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Commentary

Hearing loss patterns throughout life: Insights from Japan

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Hearing loss is a global public health issue that affects people of all ages and backgrounds. Age-related hearing loss is believed to be due to an idiopathic degeneration of the auditory system associated with aging. This condition typically first impairs perception of high-frequency sounds and eventually affects lower frequencies. Given that age-related hearing loss is associated with increased risk of incident dementia [1–3] and depressive symptoms [4,5], prompt diagnosis and intervention is important. In addition, the older population is rapidly growing [6] and better characterization of hearing loss in adults ≥ 80 years old is needed, as public datasets sometimes mask the upper extremes of age to protect anonymity [7]. In this issue, Koichiro Wasano and colleagues descriptively analyze how hearing thresholds, or the softest sound levels an individual can hear, change throughout the lifespan in a large sample of Japanese patients visiting an otolaryngology department [8]. Their findings provide insight on how we can use normative data to better identify those with abnormal changes in hearing.

Koichiro Wasano and colleagues examined pure-tone average hearing thresholds in a retrospective cross-sectional study of over 10,000 Japanese individuals. Participants were native-Japanese speakers 10–99 years old who visited the National Hospital Organization Tokyo Medical Center from 2000–2020. Participants were excluded if they had asymmetric hearing loss or external, middle, or inner ear disease (which may influence hearing thresholds). Exposure variables included participant age and sex. Pure-tone air-conduction hearing thresholds served as the outcome of interest, and mean thresholds were calculated by sex and age category. T-tests were used to compare hearing thresholds by sex and age.

The authors summarize their findings in three main take-home points. The first is that average hearing thresholds for mid-range

frequencies (1000–4000 Hz) progressively worsened with age from 10 to 59 years old in both men and women. For men, hearing thresholds at middle and high frequencies (≥ 1000 Hz) began to worsen in their 20s. While for women, these hearing thresholds did not begin to deteriorate until their 30s. Moreover, starting at age 20 and continuing throughout the lifespan, men displayed significantly worse hearing in this frequency range than women. The second conclusion is that, among older adults (>70 years old), women had significantly worse hearing at lower frequencies than men. In both sexes, lower frequencies (≤ 500 Hz) did not begin to deteriorate until their 40s, but women consistently exhibited worse low-frequency hearing than men as they grew older. Lastly, substantial sex differences in hearing were not observed in the youngest (10–19 years old) and oldest (90–99 years old) groups.

Overall, these results demonstrate how hearing changes across the lifespan at a granular level in men and women. When evaluating a patient with suspected hearing loss, it is useful to compare his or her hearing to normative audiometric data based on age and sex. The authors suggest that these comparisons can facilitate clinical decision-making, including if and when to intervene with hearing aids or other treatments. However, clinicians should be aware that the threshold for hearing loss is typically defined as >25 dB—and hearing loss should be treated, regardless of whether or not it is considered “age-appropriate”. In other words, *the decision to initiate treatment should be objectively based on the individual's absolute hearing thresholds* rather than age-matched normative audiometric data.

In addition to serving as a useful reference for clinicians, patients may wish to know how their hearing compares to other people in their age group. For example, explaining to a patient that their hearing is “50% worse” than other people their age may facilitate patient counseling about possible interventions. Hearing aid compliance is generally poor [9,10], and recent estimates report

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that only 14% of Japanese people with self-reported hearing loss actually use hearing aids [11]. To combat this, multifaceted public health efforts are needed to highlight the high prevalence of hearing loss and demonstrate its progression with age, as in this study.

This investigation has several limitations. For one, this study is a retrospective cross-sectional analysis, rather than a longitudinal cohort study. A cohort study would better demonstrate how hearing changes with age over time and the rate of change. A relative limitation is that the sample is entirely Japanese, which may limit generalizability to other populations. Convenience sampling was also used to recruit patients who visited an otolaryngology department at a major hospital in Tokyo. Therefore, this sample likely has more hearing loss than the general population.

Future research should analyze hearing patterns in diverse prospective cohorts using random community-based sampling. Stratifying the data by race/ethnicity, socioeconomic status, occupation type, and other variables may provide insights on additional factors that affect hearing outcomes. Randomized controlled trials would ultimately be necessary to determine how clinical interventions may influence the progression or effects of hearing loss throughout the aging process.

In summary, this study of a large Japanese population visiting an otolaryngology department demonstrates that hearing thresholds may begin to worsen in the third decade of life, particularly at higher frequencies in men. Women, on the other hand, show worse low-frequency hearing in older age. Prospective studies of diverse populations are needed to validate these findings and better understand the progression of hearing loss over time.

Declaration of Competing Interest

ALI and AC have no conflicts of interest. JSG's conflicts of interest are as follows: travel expenses for industry-sponsored meetings

(Advanced Bionics, Oticon Medical, Alcon), consulting fees or honoraria (Oticon Medical, Auditory Insight, Optinose, Abbott, Decibel, Alcon), department received unrestricted educational grants (Storz, Stryker, Medtronic, Acclarent, 3NT, Decibel).

References

- [1] Livingston G, Huntley J, Sommerlad A, et al. Dementia prevention, intervention, and care: 2020 report of the Lancet Commission. *Lancet*. 2020;396(10248):413–46.
- [2] Golub JS, Luchsinger JA, Manly JJ, Stern Y, Mayeux R, Schupf N. Observed hearing loss and incident dementia in a multiethnic cohort. *J Am Geriatr Soc* 2017;65(8):1691–7.
- [3] Loughrey DG, Kelly ME, Kelley GA, Brennan S, Lawlor BA. Association of age-related hearing loss with cognitive function, cognitive impairment, and dementia: a systematic review and meta-analysis. *JAMA Otolaryngol Head Neck Surg* 2018;144(2):115–26.
- [4] Golub JS, Brewster KK, Brickman AM, et al. Association of audiometric age-related hearing loss with depressive symptoms among Hispanic individuals. *JAMA Otolaryngol Head Neck Surg* 2019;145(2):132–9.
- [5] Brewster KK, Hu MC, Zilcha-Mano S, et al. Age-related hearing loss, late-life depression, and risk for incident dementia in older adults. *J Gerontol A Biol Sci Med Sci* 2020. doi:10.1093/gerona/glaa242.
- [6] US Department of Commerce Economics and Statistics Administration. The next four decades: the older population in the United States: 2010 to 2050. <https://www-census-gov.ezproxy.cul.columbia.edu/prod/2010pubs/p25-1138.pdf>. Published 2010. Accessed March 24, 2021.
- [7] Sharma RK, Lalwani AK, Golub JS. Modeling hearing loss progression and asymmetry in the older old: a national population-based study. *Laryngoscope* 2021;131(4):879–84.
- [8] Wasano K, Kaga K, Ogawa K. Patterns of hearing changes in women and men from denarians to nonagenarians. *Lancet Regional Health - Western Pacific* 2021. doi:10.1016/j.lanwpc.2021.100131.
- [9] Salonen J, Johansson R, Karjalainen S, Vahlberg T, Jero JP, Isoaho R. Hearing aid compliance in the elderly. *B-ENT* 2013;9(1):23–8.
- [10] Chien W, Lin FR. Prevalence of hearing aid use among older adults in the United States. *Arch Intern Med* 2012;172(3):292–3.
- [11] Japan Hearing instruments manufacturers association. Results, JapanTrak 2018. https://www.ehima.com/wp-content/uploads/2018/11/JAPAN_Trak18.pdf. Published 2018. Accessed March 24, 2021.