Abbreviations (in order of appearance): Cumulative Index to Nursing and Allied Health Literature (CINAHL), Hearing Loss (HL), Activities of Daily Living (ADLs), Decibels (dB), Hearing Impairment (HI), Hearing Aids (HAs), History (Hx), Lower Extremity (LE), Eyes Open (EO), Eyes Closed (EC), Center of Pressure (COP), Anteroposterior (AP), Mediolateral (ML), Standard Deviation (SD), Sensory Organization Testing (SOT), Assistive Device (AD) Mini-Mental State Examination (MMSE), Hazard Ratio (HR), Hearing Handicap Inventory for the Elderly (HHI), Likelihood Ratio (LR)

Title/Author/Year and Study Design	***Study Details***
Title: Association of Hearing Impairment With Incident Frailty and Falls in Older Adults **Authors: Kamil RJ,** Betz J, Powers BB, Pratt S, Kritchevsky S, Ayonayon HN, Harris TB, Helzner E, Deal JA, Martin K, Peterson M, Satterfield S, Simonsick EM, Lin FR **Year: 2016** Study Design: (retrospective)	Participants: n=2000 older adults, part of the Health, Aging and Body Composition (Health ABC) study Inclusion (for Health ABC): age 70-79; community dwelling; white or black race; no difficulty walking 0.25 miles, climbing 10 steps without rest, independently performing ADLs. Exclusion (for Kamil 2016): did not complete audiometric testing in year 5 of Health ABC study; cognitive impairment in year 1 of Health ABC; missing frailty data from year 1 Health ABC Method: Analyzed data from Health ABC pertaining to audiometry, frailty, falls, possible confounding variables Tests/Measures: Audiometry: tested in year 5 of Health ABC in sound attenuating booth. Audiometer + headphones measured air-conductive thresholds from 0.25-8kHz for each ear. Pure-tone-average of hearing thresholds at 0.5, 1, 2, and 4kHz was calculated and recorded (in dB) for the better ear. <26dB normal, 26-4-dB mild HI, >40 dB moderate-or-greater HI Frailty data: collected in years 1, 4, 6, 8, 10, 11 of Health ABC. Gait speed from timed 20m walk in hallway (<0.60m/s considered frail). Inability to rise from straight-backed, chair without using arms considered frail. Both criteria->"severely frail" Falls data: self-report. Asked annually "During the past 12 months, have you fallen and landed on the floor or ground?" "How many times have you fallen in the past 12 months?" Analyzed as no falls vs. one or more falls. Analysis: Cox proportional hazard models to find association between HI category and development of frailty in years 1-11; adjusted for age, sex, demographic and comorbidity variables with chi-square, Fisher exact test, and one-way

Longitudinal analysis of observational data Aim: determine whether HI in older adults is associated with the development of frailty and falls	ANOVAs. Linear combination of coefficients for Time and (HI category x Time) interaction to find annual percent increase in odds of having a fall; adjusted for age, sex, demographic, comorbidity data. Sensitivity analyses adjusted for hearing aid use to account for changes in the associations of HI with incident frailty, and HI and falls among those with moderate-or-greater HI using HAs. <u>Results</u>: • 35 participants (1.75%) were frail at baseline. 631 participants (31.6%) developed frailty from year 1-11. 1599 participants (80.0%) experienced at least 1 fall from year 1-11. • Older adults with moderate-or-greater HL had 63% increased risk of developing frailty (Adjusted HR=1.63, 95% CI=1.26-2.12) compared to normal hearing adults. Mild HL adjusted HR=1.12 (95% CI=0.90-1.39). • Loss of hearing (per 10dB) is associated with 11% increased risk of developing frailty (adjusted HR=1.11, 95% CI=1.03-1.19) and with 3.8% increased odds of having a fall (3.8%, 95% CI=1.7-5.9, p<0.001) over time. • Annual percent Increase in odds of falls: normal hearing: +4.4% (95%CI=2.6-6.2); mild HI: +6.3% (95%CI=4.4-8.2); moderate-or-severe HI: +9.7% (95%CI=7.0-12.4). Significant difference between normal and moderate-to-severe (4.4% vs 9.7%, p<0.001). Greater odds of falling if woman vs man, but not significant (p=0.07). <u>Implications</u>: Amount of HI is independently associated with increased risk of frailty and with increased odds of falling over time for older adults. Strengths= longitudinal data, objective measures, large sample size. <u>Limitations</u>: audiometric assessments were performed at year 5 instead of baseline, not reassessed later, decreased longitudinal data for HI; possible confounding variables besides the ones accounted for
Title: Hearing loss and falls: A systematic review and meta-analysis **Authors: Jiam NT**, Li, Agrawal Y	<u>Search Strategy:</u> Databases used: Pubmed, CINAHL, Embase, Scopus, Web of Science, and Cochrane Library. Publication range: Jan 1, 1950-July 9, 2014. Key words used: “fall,” “accidental falls,” “proprioception,” “balance impairment,” “stumble,” “tumble,” “slip,” “trip,” “hearing loss,” “deafness,” “adult,” “aged,” “elderly,” and “senior.” Cross-sectional and longitudinal studies were included, and references of relevant reviews/studies were examined for additional articles for inclusion. N=1277 identified

Year: 2016 Study Design: Meta-analysis Aim: evaluate the current evidence for as association between hearing loss and falls risk	Inclusion Criteria: population with HL, titles/abstracts used some of the key words above, predetermined definition of HL, fall outcome assessment used. N=44 excluded for not meeting criteria Exclusion Criteria: not relevant to study question, case report/small case series (n<10 subjects), non-English publication, patients do not meet criteria for HL, pediatrics population, not primary research, outcome not of interest, incomplete data, lack of control group. N=1221 excluded for not meeting criteria Method: Two reviewers independently reviewed abstracts for inclusion/exclusion criteria and then independently reviewed all full-text articles who met the criteria. A third author provided input for any disagreements. Quality of studies was assessed with the modified Newcastle-Ottawa Scale (NOS) for nonrandomized studies. Forest plots show study-specific effect sizes; funnel plots show risk of publication bias. Overall effect size was calculated by summing individual studies' effect sizes weighed by sample size. Principal summary measure used: odds ratio of falling with HL. Included Articles: N=13. 8 studies had significant association findings and 5 studies had non-significant association findings between HL and falls in older adults. 10 studies used a cross-sectional study design, and 3 assessed falls prospectively (2 cohort, 1 case-control). NOS scores indicate 8 had low risk of bias (3+ points), and 5 had high risk of bias (<3 points). Results: Overall pooled odds ratio of falling among older adults with HL compared to those without HL: 2.39, 95% CI: 2.11-2.68. Sensitivity analysis for only articles that assessed HL with audiometry (excluding self-reported HL) and that adjusted for potential confounding factors: pooled odds ratio 1.72, 95% CI 1.07-2.37. None of the prospective studies found a significant association between HL and falls. Implications: This study found evidence that HL appears to be associated with a statistically significant increased odds of falling (2.39 times greater odds of falling with HL). Limitations: Majority of included studies are cross-sectional and assessed falls retrospectively, and thus are susceptible to recall bias. Prospective cohort studies are better suited to establish causal associations. High between-study heterogeneity; evidence of positive publication bias for this topic; only 6/13 studies used gold-standard audiometric standards to define HL.

Title: Effect of hearing aids on static balance function in elderly with hearing loss **Authors:** **Negahban H,** Bavarsad Cheshmeh Ali M, Nassadj G. **Year: 2017** Study Design: Quasi-experimental, cross-sectional Aim: compare the static balance control of older adults with HL who use HAs versus those with HL who do not use HAs; to compare, within the HAs group, the difference in static balance when their	<u>Participants:</u> N=47 adults (age 60+) <u>Inclusion Criteria:</u> bilateral hearing loss, unaided hearing threshold 40-70dB (moderate to relatively severe HL), HAs users must have used HAs for at least 3 months <u>Exclusion Criteria</u>: Hx of neurologic disease, hx of spine/LE surgery in past 6 months, pain in LE during standing, HL caused by middle ear infection *Aided group*: n=22. 16 male, 6 female; age 67.4 ±3.5 years; average time of hearing aid usage: 33.5 ±16.68 months; mean hearing threshold with their hearing aids turned off: 45.40±4.36 dB; mean hearing threshold with their devices turned on: 23.39 ±4.82 dB (normal hearing to mild HL) *Unaided group (comparison):* n=25. 18 male, 7 female; age 67.1 ±5.4 years; mean hearing threshold 46.32 ±8.52 dB <u>Intervention/Testing Conditions:</u> 3 trials of 30 seconds quiet standing for each condition with ambient sound: 1. EO, rigid surface 2. EC (blindfold), rigid surface 3. EO, foam pad 4. EC, foam pad Aided group was tested with HAs turned on and off <u>Testing Measures:</u> Static postural stability was measured using force platform posturography and COP data: mean velocity, AP SD velocity, ML SD velocity, and sway area. Each participants' mean score of the 3 trials for each condition was considered their final score. Researchers compared scores in 3 separate groups: unaided, aided with HAs off (off-aided), aided with HAs on (on-aided) <u>Results</u>:

HAs are turned on versus off.	• Using variance analysis, the authors found that the interaction of postural condition x group was significant for SD velocity in the AP and ML directions and found significant differences between groups for SD velocity during EO, foam surface standing. • AP and ML SD velocity were greater for off-aided vs on-aided groups ($p < 0.0001$) and for un-aided vs on-aided groups ($p < 0.0001$). No statistically significant difference between off-aided and un-aided groups ($p=0.56$). The standardized effect sizes of HA conditions on AP and ML SD velocity during eyes open-foam surface standing were very large (2.24-3.37). • No statistically significant differences with other measures (mean velocity COP, sway area) or with SD velocity in other testing conditions (EO+rigid, EC+foam, EC+rigid). Implications: HA use improves postural stability for older adults with HL, evidenced by reduced SD velocity of COP with large effect sizes in on-aided conditions. These results support the premise that increased auditory inputs may improve postural control for older adults with HL. Limitations: aided groups' trials were not counterbalanced, possible fatigue or learning effects; inadequate demographic data about participants to control for confounding variables (ie: vestibular deficits, falls hx, visual acuity); no primary outcome measure identified; data for non-significant measures/testing conditions not provided; small sample size, possibly type 2 error.
Title: Effects of bilateral hearing aid use on balance in experienced adult hearing aid users **Authors: McDaniel DM,** Motts SD, Neeley RA. **Year: 2018**	Participants: N=22, 19 male, 3 female Age range: 58-81 years; average age 68.5 years; average duration of HA use 3.5 years (range 3 months-10 years). 7 fell within past 3 years, 5 report balance concerns, none reported vestibular dysfunction. With HAs turned off, the group could intelligibly hear 41% (R ear) and 33% (L ear) of speech signals on average (audibility index). Inclusion criteria: use bilateral at-the-ear HAs for at least 3 months Exclusion criteria: hx of degenerative neurological disease, stroke, spinal stenosis, or total hip/knee replacement. Use of medication that may alter balance. Testing Conditions: SOT protocol completed with HAs on and HAs off with 5 min break between (counterbalanced among group). Quiet standing conditions: 1. EO, rigid surface

Study Design: non-experimental, pre-post, cross-sectional Aim: evaluate and compare the static balance of experienced adult HA users with versus without their HAs.	2. EC, rigid surface 3. EO, rigid surface, walls move 4. EO, ground sways 5. EC, ground sways 6. EO, ground sways, walls move Multibabble background noise at 65 dB <u>Testing Measures</u>: Using NeuroCom Balance Master during SOT, postural sway and COP were measured and participants were given an equilibrium score for each standing trial to quantify balance. 100=perfect stability, 0=loss of balance, lower scores indicate greater sway/poorer static postural control. <u>Results</u>: • The groups' average equilibrium scores for the 6 SOT conditions with HAs on vs HAs off were compared using two-by-six repeated-measures analysis of variance: F(5)=1.43, p=0.218 indicates no significant differences between or among variables. • Paired t-test comparing the mean composite equilibrium scores for aided vs unaided SOT results: t(21)=-1.6, p=0.124. Therefore, no significant differences observed in static postural control between HA on and off conditions. <u>Implications</u>: HA use did not improve static balance during SOT for older adults with HL. Authors assert that claims that HA use can improve balance are premature and require verification from large, randomized control trials. <u>Limitations</u>: no control/comparison group; small sample size, possible type 2 error; ceiling effect on SOT; high balance function of group
Title: Hearing Acuity as a Predictor of Walking Difficulties in Older Women	<u>Participants</u>: n=434 women aged 63-76 drawn from the Finnish Twin Study on Aging. 434 measured at baseline, 419 participated in 3-year follow-up. <u>Inclusion</u>: same-sex twins born in Finland before 1958, both twins still alive in 1975, both agree to participate in the study <u>Exclusion</u>: major difficulties walking 2km at baseline

Authors: Viljanen A, Kaprio J, Pyykko I, Sorri M, Koskenvuo M, Rantanen T **Year: 2009** Study Design: Prospective Follow-up Aim: determine if hearing acuity correlates to walking ability (cross-sectionally) and whether impaired hearing at baseline predicts new self-reported walking difficulties after 3 years	<u>Tests/Measures:</u> *Baseline:* Hearing: audiometry using clinical audiometer. Air-conduction pure-tone hearing thresholds were measured at 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, and 8000 Hz for each ear separately. Analysis used the mean threshold level for 500-4000 Hz of the better ear. 21+ dB indicates at least mild HI. Gait: max walking speed (m/s) from 2 trials of 10m walking speed, higher speed recorded, use of AD allowed. 6MWT for gait endurance, AD allowed. Self-rated walking difficulty question: “Do you have difficulties in walking 2 kilometers without resting?” Answer choices: no difficulties, minor difficulties, major difficulties, unable to walk 2km. Habitual physical activity: self-report. Sedentary=no activity to light walking 2 or fewer times per week. Moderate=walking/other light exercise at least 3x/week. Physically active=moderate or vigorous exercise at least 3x/week. Cognition: MMSE. Other: BMI, total blood cholesterol, blood pressure *Follow-up*: self-rated walking difficulties *Analysis*: Mean differences between group with HI and group without HI using Wald tests with within-pair dependency for max walking speed, walking endurance, proportion with self-reported walking difficulties, comorbidities, physical activity level. Logistic regression models to determine association between HI and baseline walking difficulties and between baseline HI and onset of walking difficulties at follow-up. The logistic models were adjusted for age, comorbidities, education, physical activity level. <u>Results:</u> Baseline: 41.2% had impaired hearing at baseline. • HI group: slower max walking speed (1.7 ± 0.3 vs 1.8 ± 0.3 m/s p=0.007), lower walking endurance (520 ± 75 m vs 536 ± 75 m, *P*=.08), greater proportion self-reported major difficulties in walking (12.8% vs 5.5%, *P*=.02) vs. those without HI. • Adjusted odds ratio: 2.09 (95% confidence interval (CI)=1.01–4.33, *P*=.046) increased odds for having major walking difficulties at baseline for those with HI vs. without. At 3-year follow up: 33 of the total 434 women reported new major walking difficulties. • Adjusted odds ratio: 2.04, 95% CI=0.96-4.33 increased odds for women with HI at baseline to develop *new* walking difficulties compared to no HI at baseline.

	<u>Implications</u>: HI correlates with poorer current walking ability, increased odds of major walking difficulties at baseline (OR: 2.09). HI at baseline may also precede/increase odds for mobility decline in older women over 3-year follow up (OR: 2.04). <u>Limitations</u>: High reliance on subjective self-reporting for physical activity, walking difficulties; classifications on HI or no HI, not larger groups based on severity; small group of newly reported walking difficulties can lead to increased risk of chance/decreased power; exclusion of those with major walking difficulties at baseline/those who could not travel to research lab excludes those with severe health problems; relatively high hearing and mobility functioning participants at baseline; no follow-up in hearing acuity measures.
Title: Can Hearing Aids Delay Time to Diagnosis of Dementia, Depression, or Falls in Older Adults? **Authors: Mahmoudi E,** Basu T, Langa K, McKee MM, Zazove P, Alexander N, Kamdar N **Year: 2019** Study Design: Retrospective cohort study	<u>Participants</u>: n=114,862, mean age 75.8 (5.8) years. HA users n=14,109 (12.3%). HA non-users n=100,753 (87.3%). <u>Method</u>: The authors used Clinformatics DataMart Database, a national database that contains de-identified claims for every emergency, outpatient, and inpatient encounter insured by an (undisclosed) large, US private payer company. All claims for over 79 million adults and children between Jan 1, 2008 and Dec 31, 2013 were considered. Demographic data (sex, age, race, ethnicity, US census geographical division) and presence of comorbidities (hypertension, diabetes, obesity, cardiovascular conditions, hypercholesteremia) were collected for participants who met the study's criteria. <u>Inclusion Criteria:</u> adults with ICD-9 codes for HL, age 66 and older, seen in any patient care setting <u>Exclusion Criteria:</u> less than 12 months of enrollment in the payer company prior to HL diagnosis; pre-existing hx of dementia, AD, anxiety, depression, or fall leading to injury within 12 months prior to HL diagnosis; were not continuously enrolled with the payer company for 3 years after HL diagnosis. <u>Measurements:</u> Number of days between HL diagnosis and first claim service date with AD/dementia, anxiety/depression, or injurious falls ICD-9 or ICD-10 codes within 3 years of HL diagnosis. *Statistical analysis*: Bivariate analyses were conducted for baseline demographic and comorbidities for HA users and non-users. Kaplan-Meier product-limit survival curves for HA users vs HA non-users for each outcome.

Aim: examine the association between HA use and time to diagnosis of AD/dementia, anxiety/depression, and injurious falls among adults age 66+ within 3 years of HL diagnosis	Differences in survival curves was determined using log-rank tests. Cox proportional hazards regression models were used to calculate unadjusted and risk-adjusted HRs for impact of HA use. <u>Results:</u> • 12.3% of those with HL used HAs. Sex disparities of HA use: 11.3% females vs. 13.3% males (difference 2.0%; 95% CI=-0.0237 to -0.0151; p<0.0001). Racial/ethnic disparities of HA use: 13.6% of white vs 9.8% of Black (difference=3.8%; 95% CI=0.03000 to 0.0451; p<0.0001) 13.6% white vs 6.5% Hispanic (difference=7.1%, 95% CI=0.0653 to 0.0760; p<0.0001). • HRs for new diagnoses within a 3-year period adjusted for age, sex, comorbidities, US census geographical division were all lower for HA users than HA non-users. For developing AD/dementia: HR 0.82 (95% CI=0.76-0.90); for depression/anxiety: HR 0.89 (95% CI=0.86-0.93); for injurious falls: HR 0.87 (95% CI=0.80-0.95). • 2008-2016 incidence of dementia: 13.9%; depression: 35.6%; injurious falls: 12.7% for older adults with HL as a whole. <u>Implications</u>: Use of HAs among adults with HL is associated with a significantly lower risk of being diagnosed with AD/dementia, depression/anxiety, and injurious falls. Early diagnosis and intervention for HL in older adults may delay diagnoses of cognitive decline and reduce risk of injurious falls. Significant racial/ethnic, sex, and geographic location disparities exist for use of HAs. <u>Limitations</u>: Lack of information about other factors that could influence outcomes (ie: socioeconomic status, education level); patients with undiagnosed HL are not included; could not determine HL severity from insurance claims (ie: for how many with HL are HAs indicated); unable to measure duration/frequency/consistency of HA use; possible bias from using a private insurance database
Title: Effective Hearing Loss Screening in Primary Care: The Early Auditory Referral-Primary Care Study	<u>Participants:</u> N=14,877 eligible patients (age 55+ at any of the 10 included clinics) Inclusion criteria: aged 55+, seen by any of the 10 included clinics, consent to study, completed HHI N= 5,893 study participants <u>Methods:</u>

Authors: Zazove P, Pleque MA, McKee MM, DeJonckheere M, Kileny PR, Schleicher LS, Green LA, Sen A, Rapai ME, Mulhem E **Year: 2020** Study Design: Multiple baseline design Aim: Determine the effectiveness of a HL screening program on identifying and referring patients aged 55+ years at 10 family medicine clinics	Best Practice Alert (BPA) in Epic System prompted clinicians to ask: "Do you have any difficulty with your hearing?" at all visits of patients aged 55+ from July 2016-February 2019 at 10 family medicine clinics in Michigan (2 healthcare systems). Possible responses to the HL alert: 1. known hearing loss, 2. Suspected HL (answered yes to Q) and referred, 3. Suspected HL (answered yes) and declined referral, 4. No HL (answered no to Q), or 5. Clinician did not ask. Alert reappeared at every visit until addressed and recurred based on physician's response (ie: re-alert after 1 year if declined referral). Clinicians were blinded to HHI results. Referrals were to audiologists in the healthcare system. Audiograms performed on the referred patients were obtained when available. Audiologists answered Qs about referral appropriateness, HL severity, is HA evaluation appropriate? *Statistical analsysis*: Pearson's χ**2** tests at each institution to compare percentage of patients referred to audiology baseline to after BPA implementation. Cochran-Mantel-Haenszel test to compare change in referral rates across the 10 clinics, adjusted for months since BPA implementation. Pearson's χ**2** tests to compare referral rates for those with probable HL (HHI score 10+) vs unlikely HL (HHI<10). Clustered logistic regression for associations among demographic/comorbidity data. Adjusted likelihood of referral for probable HL (HHI 10+) adjusted for demographic confounders. Results: • The alert was addressed for 10,567 of all 14,877 eligible patients (71.02% of alerts were addressed). • 1,660 patients were referred for hearing testing. Referral rate increased from 2.2% to 10.7%. • 717 (43.2%) of those referred were seen by audiologists in the system (data available). 93.3% of referrals seen were deemed appropriate; 0.8% not appropriate; 5.9% not rated. • 717 audiograms done: 85% had HL (mostly mild); 31.8% asymmetric HL present; 58.7% were HA candidates. • Mean Pure Tone Average of those with audiograms: 25 dB loss in better ear, 30.7 dB loss in worse ear=early identification. • 25.2% of the 5893 patients who filled out the HHI had significant scores of 10+. Those with HHI scores 10+ had referral rate of 28%. HHI scores <10 referral rate: 9.2% (p<0.001). Clinicians were blinded to HHI results, made referral based on the 1 question only, indicates that question is appropriate as screening tool.

	Implications: Using an electronic alert to prompt primary care clinicians to ask the single question, "Do you have difficulty with your hearing?" significantly increased identification and referral of patients at risk for HL. The increased referrals corresponded to positive HHI scores and audiologists deemed 93% of referrals seen appropriate, so the question is good screening tool for identifying potential HL. This screening is feasible, allows earlier detection and treatment of mild HL, which can reduce sequelae and improve outcomes. Limitations: Electronic health record alerts' effectiveness can be reduced by difficulty to use, lack of clinician time, clinicians uncomfortable addressing HL; majority of participants were white and middle class, which may bias results; full data not available for each participant
Title: Screening for Hearing Impairments in Older Adults by Smartphone-Based Audiometry, Self-perception, HHIE Screening Questionnaire, and Free-Field Voice Test: Comparative Evaluation of the Screening Accuracy With Standard Pure-Tone Audiometry **Authors: Li LYJ,** Wang SY, Wu CJ, Tsai CY, Wu TF, Lin YS	Participants: n=41, 27 men, 14 women. Mean age 73.32 (6.81) years. Mean hearing thresholds (PTA) was 36.29 (15.57) dB. Inclusion criteria: age >65 years, no diagnosed HL Exclusion criteria: active otorrhea, cognitive impairments, Parkinson disease, clinically diagnosed dementia, hand action tremor; received a standard pure-tone audiogram evaluation in past 24 months, use HAs; unable to complete questionnaires Methods: 5 hearing tests were performed for each patient in randomized order during a single visit in the same soundproof room with ambient noise level 38-39dBA. All tests were conducted by the same audiologist. 1. Self-perception hearing screening test: "Do you have a hearing problem now?" Yes/No. "yes" is positive screen for moderate HL 2. HHI: 10-item questionnaire, score of 10+ is positive screen for mod HL 3. Free-field voice test: requires sound level meter, consistency of tester's voice levels at 30-45dB (whisper), 45-60dB (conversational), 60-80dB (loud voice). Tester stands 0.6m away, says letters/numbers and participant has to repeat it back (ex: 2-R-9), performed independently on each ear. Pass whisper=normal; don't pass whisper=mild HL; don't pass conversational=mod HL; don't pass loud voice=severe HL; can't hear anything=profound 4. Smartphone-Based Audiometry: downloaded uHear (free) from app store on iPhone 4S, turned off Wi-Fi and 3G during testing. Participants used Sennheiser HD201 headphones. Participants instructed to press large button on touch screen when a sound is heard. The app determines the air-conducted sound at 250,

Year: 2020 Study Design: Cross-sectional Aim: Evaluate/compare the accuracy of 4 different tests for moderate hearing impairment in older adults compared to the standard pure-tone audiometry test	500, 1000, 2000, 4000, and 6000 Hz in both the left and right ears using 10 dB down, 5 dB up approach. Used better ear results for HL definition. 5. Standard pure-tone audiometry: uses calibrated clinical audiometer and audiometric headphones. Used better ear results for HL definition. Analysis: Moderate hearing impairment was defined as having a pure tone average (PTA) > 40dB hearing loss. PTA comes from averages of hearing thresholds at 500, 1000, 2000, and 4000 Hz. Results of hearing tests 1-4 were put into 2x2 tables with the standard pure-tone results, and sensitivity, specificity, negative LR, positive LR were calculated for each. <u>Results</u>: • Self-perception test: Sensitivity 0.58 (95% CI=0.29-0.84); Specificity 0.34 (95% CI=1.9-0.54); Positive LR 0.89 (95% CI=0.52-1.54); Negative LR 1.21 (95% CI 0.54-2.68). • HHI questionnaire: Sensitivity 0.67 (95% CI=0.35-0.89); Specificity 0.31 (95% CI=0.316-0.51); Positive LR 0.97 (95% CI=0.60-1.54); Negative LR 1.07 (95% CI=0.42-2.78) • Free-field voice test: Sensitivity 0.83 (95% CI=0.51-0.97); Specificity 0.41 (95% CI=0.24-0.61); Positive LR 1.42 (95% CI=0.96-2.11); Negative LR 0.40 (95% CI=0.10-1.57). • Smartphone-based audiometry test: Sensitivity: 0.92 (95% CI=0.60-0.99); Specificity 0.76 (95% CI=0.56-0.89); Positive LR 3.80 (95% CI=1.97-7.4); Negative LR 0.11 (95% CI=0.02-0.73)***most clinically useful <u>Implications</u>: Smartphone-based audiometry using the uHear application can be a dependable screening test to screen for moderate HL for older adults. The authors' purpose was to find dependable HL screening tools for low-income countries that have limited audiological services and equipment; however, these results can also be applied to HL screening in PT clinics where audiology equipment is also not available. <u>Limitations</u>: Subjective testing appear inferior to objective testing for early HL screening; smartphone audiometry tests do not have as reliable calibration compared to professional audiology equipment; the older adult population may have difficulty operating a smartphone, which can impact results.

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