Philippine Clinical Practice Guidelines for Periodic Health Examination: Screening for Hearing Disorders

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ABSTRACT

Objective. These Philippine clinical practice guidelines (CPG) were developed to guide healthcare professionals on screening for hearing disorders among apparently healthy children and adult Filipinos.

Methods. Following the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach to CPG development recommended in the Department of Health Manual, the Task Force Steering Committee developed four key questions. The evidence review experts reviewed existing CPGs and appraised and summarized evidence. The multisectoral consensus panel reviewed the evidence summaries and developed recommendations during the *en banc* meeting. Three independent stakeholders reviewed the draft guidelines on the content, clarity, acceptability, applicability, and

A full copy of the Philippine Clinical Practice Guidelines for Periodic Health Examination: Screening for Hearing Disorders can be found at this link: https://drive.google.com/file/d/1axx5_KDNmYsab-MQg3E1nIeCBnHaoVkV/view

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feasibility of the recommendations. Their feedback was taken into consideration by the steering committee before finalizing the CPG.

Results. This CPG provides 10 recommendations based on four prioritized questions in the screening for hearing and vestibular disorders among apparently healthy children (from prenatal to school age) and adults.

Conclusion. The consensus panel recommended the screening for hearing and vestibular disorders in certain population groups, based on the available evidence, the burden of disease, the cost of the confirmatory testing, and its applicability to the population.

Keywords: practice guidelines, hearing screening, hearing loss

INTRODUCTION

A cross-sectional national survey done in the Philippines in 2011 showed that the prevalence of moderate or worse hearing loss was 7.5% in children <18 years, 14.7% in adults between 18 and 65 years, and 49.1% in adults >65 years.[1] The Global Burden of Disease study reports that the global number of years lived with disability (YLDs) attributable to hearing loss was 43.5 million in 2019, with age-related hearing loss being the third largest source of global YLDs and the leading source for adults more than 70 years of age.[2] Vertigo and dizziness are frequent symptoms in the community, with an estimated lifetime prevalence of 17–30%.[3] In a recent study from the US, dizziness and vertigo were among the most frequently referred neurological symptoms to subspecialty centers and services.[4] In a US national study, 3.9 million emergency care visits due to dizziness in 2011 resulted in 3.9 billion USD total costs, i.e., on average, 1,004 USD per patient and visit.[5]

Hearing loss leads to a substantial impact on the health of children and adults, making it a significant contributor to the global burden of disease. The World Health Organization (WHO) estimates that nearly 2.5 billion people will have some degree of hearing loss by 2050, of whom at least 700 million will require rehabilitation services. The majority of these people live in low- and middle-income countries, where access to ear and hearing care is often limited.[6] This emphasizes the importance of screening individuals for hearing disorders. Early detection encourages early treatment and helps prevent any long-term damage from untreated hearing problems.

For this clinical practice guideline (CPG), the Task Force on the Screening for Hearing Disorders developed four key questions that involve screening for hearing and vestibular disorders among apparently healthy, asymptomatic children and adult Filipinos. This population involves individuals who do not have any signs or symptoms of hearing or vestibular disease, such as decreased hearing, speech delay, imbalance, dizziness, vertigo, and others. At present, no local CPGs are addressing these disorders.

METHODS

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach to CPG development recommended in the Department of Health (DOH) Manual on Practice Guideline Development was followed. The GRADE Adolopment and Evidence-to-decision (EtD) frameworks were utilized in finalizing the recommendations. The guideline development involved four different phases as summarized in Figure 1.

Preparation

The Task Force Steering Committee (SC) set the CPG objectives, scope, target audience, and clinical questions. Three otolaryngologists and one neurologist comprised the SC. They convened the technical working group involved in creating the evidence base and the Consensus Panel (CP) involved in formulating the recommendations for each clinical question. Questions were prioritized using the criteria set by DOH. (Table 1)

Content experts and other key stakeholders were invited to join the CP. The key stakeholders included policymakers, patient advocates, allied medical practitioners such as audiologists and speech pathologists, and physicians from different settings (e.g., public primary care settings, private practice, occupational health settings). The allied medical practitioners are members of the Philippine Association of Speech Language Pathologists (PASP) and Association of Clinical Audiologists of the Philippines (ACAP), while the physicians are members of different medical societies, namely: the Philippine Academy of Family Physicians (PAFP),

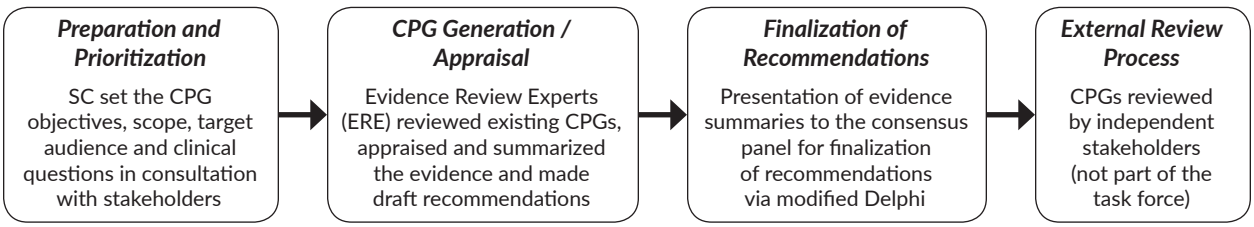

Figure 1. Summary of methodology.

Table 1. List of Clinical Questions for Hearing Screening among Asymptomatic Individuals

Question	Subgroup
Should screening for hearing loss be done in asymptomatic, apparently healthy children?	1.1. High-risk children 1.2. Newborn using OAE or AABR 1.3. School-aged children using PTA 1.4. School-aged children using smartphone-based screening audiometry 1.5. School-aged children using the tuning fork test 1.6. School-aged children using pneumatic otoscopy
Should we screen for hearing loss in asymptomatic, apparently healthy adults?	2.1. Elderly adults (50 years old and above)
Should we screen for vestibular disorders in asymptomatic, apparently healthy children and adults?	3.1. Children and adults (<60 yrs old) 3.2. Elderly (>60 yrs old)
Should prenatal/antenatal hearing screening be done at 21-24 weeks AOG to detect hearing (e.g., increased fetal heart rate)?	4.1. Prenatal/antenatal

OAE – Otoacoustic Emissions, AABR – Automated Auditory Brainstem Response, PTA – Pure Tone Audiometry

Philippine Society of Otolaryngology-Head and Neck Surgery (PSO-HNS), Philippine Academy of Neurotology, Otology & Related Sciences (PANORS), Philippine National Ear Institute (PNEI), and Philippine Society for Developmental and Behavioral Pediatrics (PSDBP). One panelist represents the Department of Labor and Employment (DOLE).

COI Management

All task force members submitted their declaration of conflict of interest (COI) and curriculum vitae. A COI committee reviewed and evaluated the potential conflicts of interest and gave its recommendation on how to manage them. In general, those with financial COI were not allowed to vote on questions related to the COI**.** Those with non-financial COIs (such as authorship related to the CPG topic) were allowed to participate, but COIs were declared during the panel meeting and the final manuscript.

Evidence Synthesis

The evidence review questions were developed using the PICO (population, intervention, comparator, and outcome) format. The evidence review experts (ERE) searched and appraised international practice guidelines related to periodic health screening, including but not limited to those of the Canadian Task Force on Preventive Health Care, the U.S. Preventive Services Task Force, and the National Institute for Health and Care Excellence. If the CPG were of good quality and done within five years, the evidence summaries of the CPG were adopted.

If no updated, relevant, and trustworthy CPG was found, a systematic medical literature search was done using different databases such as MEDLINE (via PubMed), The Cochrane Library, Herdin, clinicaltrials.gov, American Academy of Audiology, Philippine Journal of Otolaryngology Head and Neck Surgery, and Google Scholar. Systematic reviews that met the inclusion criteria to answer the clinical questions were used directly to identify relevant articles and a summary of findings. If no related reviews were found, *de novo* systematic reviews were conducted. The methodological quality of the included studies was critically appraised using standard tools such as the Cochrane Risk of Bias tool (ROB 1.0) for randomized controlled trials (RCTs), the Quality Assessment of Diagnostic Accuracy Studies-2 (QUADAS-2) for diagnostic accuracy studies, and the Newcastle–Ottawa Scale (NOS) for observational studies. The GRADE approach was used to rate the certainty of evidence and the strength of recommendations (Table 2).

Evidence-to-Decision Consensus Approach

The multisectoral CP was tasked to review the evidence summaries and develop recommendations during the *en banc* meeting. Prior to the meeting, the CP prioritized critical and important outcomes to be considered in the CPG (Appendix).

Table 2. GRADE Table of Strength of Recommendation and Certainty of Evidence

Certainty of Evidence	Description
High	We are very confident that the true effect lies close to that of the estimate of the effect
Moderate	We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low	Our confidence in the effect estimate is limited: The true effect maybe substantially different from the estimate of the effect
Very low	We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect
Strength of Recommendation	**Description**
Strong	Advantages of the intervention significantly outweigh disadvantages or disadvantages of the intervention significantly outweigh advantages
Weak	Advantages of the intervention may outweigh disadvantages, disadvantages of the intervention may outweigh advantages, or the relationship between advantages and disadvantages is not clear

The CP was provided with the evidence base for all the clinical questions and a draft recommendation solely based on the trade-offs between benefit and harm and the certainty of evidence. Each CP member was then asked to complete an Evidence to Decision (EtD) questionnaire. The purpose of this questionnaire survey is for each CP member to explicitly incorporate other important factors, such as cost-effectiveness, patient values and preferences, applicability, feasibility, appropriateness, equity, and resources in their decision-making.

The direction and strength of each recommendation were determined by a formal consensus method. Recommendations were taken to reach a consensus when 75% or more of the voters agreed on the proposed recommendation. For all but one recommendation, consensus was reached after the first round of voting. Regarding the recommendation on hearing screening for adults, the panel deemed the presented evidence lacking and requested an additional search from the ERE.

In general, a strong recommendation means that the panel is confident that the desirable effects of adherence to a recommendation outweigh the undesirable effects, while a weak recommendation means that the desirable effects of adherence to a recommendation probably outweigh the undesirable effects, but the panel is not confident. (Table 2)

Planning for Dissemination, Implementation, and Update

The SC discussed with relevant stakeholders, such as DOH and PhilHealth, to prepare a dissemination plan that will actively promote the adoption of this guideline with strategies for copyrights. The DOH plans to develop a simplified version of this CPG and make it available in a format that will be ready for reproduction and dissemination to patients in different healthcare settings. All recommendations and evidence summaries were posted in a web-based application (htpps://phex.ph). It will also be available for interested parties who might visit the DOH website. The recommendations and the evidence summaries will also be posted in the different societies involved in the consensus panel. Medical societies may also include the guidelines on their own websites.

The recommendations herein shall hold until such time that new evidence on screening, diagnosing, or managing various risk factors and diseases emerges, and contingencies dictate updating this Philippine Guidelines on Periodic Health Examination. This guideline will be updated after three (3) years.

External Review

Three independent stakeholders, including one audiologist/ Ear, Nose, and Throat Doctor (ENT), one rhinologist/ ENT, and one maxillofacial/ENT surgeon, reviewed the draft guidelines on the content, clarity, acceptability, applicability, and feasibility of the recommendations. Their feedback was taken into consideration by the steering committee before finalizing the CPG.

RESULTS

A total of ten (10) recommendations were made for the Hearing Screening CPG. A summary can be found in Table 3.

Hearing Screening in Asymptomatic, Apparently Healthy Children

Recommendation 1: Among asymptomatic, apparently healthy children with known risk factors for congenital and late-onset hearing loss (such as family history of hearing loss, maternal history of cytomegalovirus and syphilis infections, and culture-positive congenital infection, craniofacial anomalies, and syndromes associated with hearing loss or progressive or late-onset hearing loss), we recommend hearing screening and periodic monitoring for delayed-onset hearing loss. *(Very low certainty of evidence, strong recommendation)*

Key findings: The prevalence of congenital bilateral permanent profound hearing loss in the Philippines is 1.3 per 1000 live births and increases to 22 per 1000 live births for unilateral mild and moderate hearing loss. Even for milder and unilateral forms of hearing impairment, there is a significant delay in mental development during infancy, which encompasses the development of locomotor, personal-social, hearing, and speech skills, hand and eye coordination, and performance tests.[7] Republic Act No. 9709, or the Act that establishes the "Universal Newborn Hearing Screening for the Prevention, Early Diagnosis, and Intervention of Hearing Loss," mandates that all newborns should be screened for hearing loss or impairment before discharge from hospitals or within three months if born in a non-hospital setting.[8]

Family history of hearing loss, craniofacial anomalies, and maternal history of infection (e.g., congenital toxoplasmosis, rubella, cytomegalovirus, herpes, syphilis, and other culture-positive congenital infections) were identified as factors that significantly increased the risk of childhood hearing loss. One meta-analysis showed that congenital cytomegalovirus increased the risk for childhood hearing loss (OR 8.45, 95% CI 3.95-18.10).[9] Two observational studies examined the association between prenatal infection as a risk factor for hearing loss and childhood hearing status. Results were inconclusive for hearing loss (OR 1.12, 95% CI 0.75 to 1.67), while the effect on childhood hearing status was not quantified due to the rarity of the event (<1% cases).[10,11]

Justification: Despite the very low certainty of evidence, the panel strongly recommended hearing screening due to the benefits of screening, its cost-effectiveness, and the strong association between the risk factors and delayed-onset hearing loss. Early detection using a simple, virtually harmless test will allow for early intervention for hearing disorders. This was considered by the panel as cost-effective and can have a positive impact on at-risk individuals and on the socioeconomic status of the community in general. Given

Table 3. Summary of Recommendations on Screening for Hearing Disorders

Recommendations	Strength of Recommendations	Certainty of Evidence
1. ***Among asymptomatic, apparently healthy children with known risk factors for congenital and late-onset hearing loss (such as family history of hearing loss, maternal history of cytomegalovirus and syphilis infections, culture-positive congenital infection, craniofacial anomalies, and syndromes associated with hearing loss or progressive or late-onset hearing loss), we recommend hearing screening and periodic monitoring for delayed-onset hearing loss.***	Strong	Very Low
2. ***Among apparently healthy newborns, we recommend hearing screening using Otoacoustic Emissions (OAE) or Automated Auditory Brainstem Response (AABR).***	Strong	Moderate
3. ***Among asymptomatic, apparently healthy school-aged children, we suggest AGAINST hearing screening using pure tone audiometry.***	Weak	Very Low
4. ***Among asymptomatic, apparently healthy school-aged children, we recommend hearing loss screening using smartphone-based screening audiometry.***	Strong	High
5. ***Among asymptomatic, apparently healthy school-aged children, we suggest hearing loss screening using the tuning fork test.***	Weak	Low
6. ***Among asymptomatic, apparently healthy school-aged children, we suggest AGAINST hearing loss screening using pneumatic otoscopy.***	Weak	Low
7. ***Among asymptomatic, apparently healthy elderly adults (50 years old and above), we suggest hearing loss screening using a portable pure tone audiometer screener or mobile-based audiometric applications.***	Weak	Very Low
8. ***Among asymptomatic, apparently healthy children and adults (<60 years old), we recommend AGAINST screening for vestibular disorders using clinical balance testing (Tandem Walking or Romberg's Test).***	Strong	Very Low
9. ***Among asymptomatic, apparently healthy elderly adults (>60 years old), we recommend AGAINST screening for vestibular disorders using clinical balance testing (Tandem Walking or Romberg's Test).***	Strong	Very Low
10. ***Among asymptomatic, apparently healthy pregnant women, we recommend AGAINST prenatal/antenatal screening for hearing loss using fetal heart rate monitoring.***	Strong	Very Low

that risk factors are well-established, the consequences of missing delayed-onset hearing may be detrimental to a child's development. The panelists also deemed that monitoring for delayed-onset hearing loss, not just baseline hearing screening, is important for the high-risk population.

Recommendation 2: Among apparently healthy newborns, we recommend hearing screening using Otoacoustic Emissions (OAE) or Automated Auditory Brainstem Response (AABR). *(Moderate certainty evidence, strong recommendation)*

Key findings: Five observational studies on the impact of universal newborn hearing screening (UNHS) were included in a systematic review and meta-analysis.[12-16] Screening tests used in the intervention group were OAE, AABR, or both. UNHS, compared to no UNHS, increased the proportion of infants diagnosed with permanent bilateral hearing loss by nine months of age (RR 3.28, 95% CI 1.84, 5.85) and decreased the mean age of diagnosis by 13 months (95% CI -26.3, -0.01).

The pooled sensitivity (Sn) of OAE is 96.3% (95% CI 81.0, 99.9%), and the pooled specificity (Sp) is 92.5% (95% CI 92.2, 92.9%). The pooled Sn of OAE+ABR is 95.1% (95% CI 86.3, 99.0%) and the pooled Sp is 98.6% (95% CI 98.7, 98.5%). Some studies reported on harms from UNHS, such as parental anxiety and stress from waiting times for definitive testing and amplification, and false-positive results.[17]

Justification: The consensus panel recognized that hearing screening with OAE and AABR is beneficial in terms of quality of life, speech development, and school performance. The recommendation made by the CP is consistent with the existing Newborn Hearing Screening Act.

Recommendation 3: Among asymptomatic, apparently healthy school-aged children, we suggest AGAINST hearing screening using pure tone audiometry. *(Very low certainty evidence, weak recommendation)*

Key findings: One systematic review that included eight studies on the accuracy of pure tone screening in preschool- and school-aged children was found; however, a wide range of accuracy values was noted.[18] Sensitivity values for PTA ranged from 50 to 100%. Specificity values ranged from 50 to 99%. Positive and negative likelihood ratios ranged from 2.2-81 and 0-0.9, respectively.

To perform conventional PTA, a trained audiologist or audiometrician and a standard device are necessary. As of 2020, there are approximately 120 audiologists in the Philippines, with less than 10% practicing outside Metro Manila.

Justification: Screening children before school entry may contribute to detecting educationally significant hearing loss, which affects the academic performance of the child. The panel considered that the number of audiologists in the Philippines is lacking, which may affect the feasibility of conducting nationwide screening for all school-aged

children. Although there is an adequate number of hearing testing centers with audiometricians who can perform the test, these audiometricians cannot interpret data. The feasibility of screening may be increased with some guideline modifications and health systems improvement. However, given the issues of training costs, machine availability, and logistical constraints, the panel recommended AGAINST screening using PTA.

Recommendation 4: Among asymptomatic, apparently healthy school-aged children, we recommend hearing loss screening using smartphone-based screening audiometry. *(High certainty of evidence, strong recommendation*

Key findings: A meta-analysis evaluated the diagnostic accuracy of smartphone-based applications as audiometry tools to screen for hearing loss. Conventional PTA was used as the reference test. Five out of 25 studies involved the pediatric population (n=1721), with a pooled Sn of 85% (95% CI 69 – 100%) and Sp of 96% (95% CI 89-100%).[19]

Justification: The consensus panel formulated a strong recommendation for phone-based screening audiometers, considering the high certainty of evidence and the universal availability of mobile phones. The panel recognized that phone-based hearing tests may assist in large-scale hearing screening. However, the panel noted the need for protocol standardization of the application and equipment to be used, as well as the testing environment. Phone-based applications may also need regular updating and calibration to produce reliable results.

Recommendation 5: Among asymptomatic, apparently healthy school-aged children, we suggest hearing loss screening using the tuning fork test. *(Low certainty of evidence, weak recommendation)*

Key findings: A systematic review on the Rinne test using a 256 Hz fork resulted in sensitivity values ranging from 76.7% to 82%, and specificity values ranging from 66.0% to 98.9%. The 512 Hz fork resulted in sensitivity values ranging from 64.0% to 87%, and specificity values ranging from 55.0% to 85.0%.[20] More studies are needed to determine the reliability of tuning fork tests in screening for hearing loss among children.

Justification: The panel voted for a weak recommendation on screening using a tuning fork test due to the low certainty of evidence. The panel recognized that tuning fork tests have low resource requirements. From 2004-2007, training workshops in screening school-aged children using 512 Hz tuning forks were held for school nurses. However, there is no evidence that this is being practiced currently.

Recommendation 6: Among asymptomatic, apparently healthy school-aged children, we suggest AGAINST hearing loss screening using pneumatic otoscopy. *(Low certainty of evidence, weak recommendation)*

Key findings: One study on pneumatic otoscopy showed a sensitivity of 80% and specificity of 92%, respectively.[21] More studies are needed to determine the reliability of pneumatic otoscopy in screening for hearing loss among children.

Justification: The panel voted AGAINST the use of pneumatic otoscopy, considering (1) the low certainty of evidence, (2) training requirements, (3) cost, and (4) limited availability of pneumatic otoscopes in primary health care settings.

Hearing Screening in Asymptomatic Apparently Healthy Adults

Recommendation 7: Among asymptomatic, apparently healthy elderly adults (50 years old and above), we suggest hearing loss screening using a portable pure tone audiometer screener or mobile-based audiometric applications.* *(Very low certainty of evidence, weak recommendation)*

** This recommendation applies to the general population; however, for specific at-risk populations, screening recommendations as provided by existing guidelines will apply.*

Key findings: In the Philippines, moderate to severe hearing loss has an estimated prevalence of 15%. Of these, 14.7% are adults between 18 and 65 years old, and 49.1% are adults older than 65 years old. Increased age, presence of an outer or middle ear condition, and higher income are associated with increased risk of moderate hearing loss in the Filipino population.[1] The WHO report on hearing loss, on the other hand, highlights three specific factors leading to hearing loss: otitis media, exposure to loud noise, and age-related hearing loss.[6] The Global Burden of Disease study reports that the global number of years lived with disability (YLDs) attributable to hearing loss was 43.5 million in 2019, with age-related hearing loss being the third largest source of global YLDs and the leading source for adults more than 70 years of age.[2]

One RCT investigated the effectiveness of hearing screening on the long-term outcomes of old veterans.[22] Hearing screening using the combination of tone-emitting otoscopy (AudioScope) and Hearing Handicap for the Elderly-Screening Version (HHIE-S) questionnaire resulted in significant benefits in terms of hearing aid use among screened patients compared to those unscreened. When used alone, the AudioScope also increased hearing aid use among those screened compared to unscreened (absolute risk reduction [ARR] 3.1% (95% CI 0.7, 5.8), number needed to test [NNT]=33). However, no increase in hearing aid use was seen in the group that was administered the HHIE-S alone. There was an inconclusive effect on quality of life between the

screened and unscreened since the study was underpowered for this outcome. Data on clinical outcomes for screening other subpopulations, such as industrial workers, were not found.

Justification: The consensus panel formulated a weak recommendation for screening asymptomatic, apparently healthy elderly adults, taking into consideration the cost-effectiveness and feasibility of screening and its consequent treatment, the study population involved in the evidence base, and the very low certainty of evidence. The primary outcome in the cited RCT was hearing aid use. In terms of cost-effectiveness, hearing aids are costly and are not fully subsidized by the government. Many Filipino patients experience financial difficulties with device procurement. Aside from hearing aid use, other treatments for hearing loss include sign language, counseling on behavioral modifications (such as changes in body position when communicating, avoiding conversations in noisy environments), and occupational therapy. Proper counseling can also prevent further deterioration of hearing in affected individuals.

Issues on feasibility include the lack of trained professionals to perform proper audiometry and the uncommon use of tone-emitting otoscopes in the Philippines. However, screening audiometers are already being used for hearing screening in some industries. Some phone- or tablet-based audiometric applications for screening audiometry are free, intuitive, and can be used by primary health care physicians.

With the evidence available being limited to the population 50 years old and above, the panel decided that there is insufficient evidence to screen healthy asymptomatic adults below 50 years old, but existing laws and guidelines will apply to specific high-risk populations. Furthermore, the panel recognized that the population to be screened should not be limited to "industrial workers." This is because all types of workers are exposed to occupational noise.

Finally, the panel recognized that baseline hearing screening is lacking, especially in high-risk industries, and should be advocated. The promotion of hearing health awareness and hearing conservation programs should also be prioritized. Currently, there are safety and health laws mandating companies to have hearing conservation programs and provide employee compensation for any hearing loss caused by or aggravated by the workplace.

Tandem Walking and Romberg's Test as Vestibular Testing in Asymptomatic, Apparently Healthy Adults and Children

Recommendation 8: Among asymptomatic, apparently healthy children and adults (<60 years old), we recommend AGAINST screening for vestibular disorders using clinical balance testing (Tandem Walking or Romberg's Test). *(Very low certainty of evidence, strong recommendation)*

Recommendation 9: Among asymptomatic, apparently healthy elderly adults (>60 years old), we recommend AGAINST screening for vestibular disorders using clinical balance testing (Tandem Walking or Romberg's Test). *(Very low certainty of evidence, strong recommendation)*

Key findings: Vertigo and dizziness are frequent symptoms in the community, with an estimated lifetime prevalence of 17–30%.[23] In a German study, the 1-year prevalence of vertigo was 1.6%, and the 1-year incidence was 0.6%.[24] A systematic review looked at the etiology of vertigo in the primary care setting. Benign paroxysmal positional vertigo (BPPV), vestibular neuritis, and Meniere's disease were listed as the most common causes of vertigo.[25] Among vestibular disorders, BPPV is the most common vestibular disorder across all ages.[26] Overall, the prevalence of BPPV ranges from 10.7 to 140 per 100,000 population.[27,28] Women are affected more than men, with a female: male ratio of 2.2 to 1.5:1.[26]

No direct evidence that evaluated screening versus non-screening of asymptomatic individuals for vestibular disorders was found. For cost-effectiveness, it is unclear if the benefits of early screening would translate to cost savings or if screening would lead to higher costs from unnecessary confirmatory tests or referrals to subspecialists.

For diagnostic accuracy, nine case-control studies compared the sensitivity and specificity of Tandem walking or Romberg's test among patients with vestibular disorders.[29-38] The pooled sensitivity of tandem walking with eyes open was low (17%), but the specificity was high (97%). The sensitivity of the tandem walking test with eyes closed was higher (69%), but the specificity was lower (51%) compared to performing the test with eyes open. Subgroup analysis among the elderly population showed that the sensitivity of tandem walking with eyes closed was 68%, with a specificity of 62%. For the Romberg's test, using a cut-off of 20-30 seconds, the pooled sensitivity was low (16%), but the specificity was high (99%).

Justification: The panel opted NOT to recommend screening for vestibular disorders among asymptomatic, apparently healthy children and adults (younger than 60 years of age), and elderly patients (older than 60 years of age) using clinical balance testing (Tandem walking and Romberg's test). This was due to the lack of direct evidence of the effect of screening versus non-screening of vestibular disorders

on health-related outcomes, and the very low certainty of evidence of the diagnostic accuracy studies found.

The consensus panel voted AGAINST adult and pediatric screening for vestibular disorders since these conditions usually present with drastic symptoms, which lead to physician consultation. Screening for vestibular disorders may not be a practical utilization of patient and physician resources because these conditions are rarely occult. Moreover, the screening tests do not differentiate between central and peripheral causes of vestibular disease. Unnecessary referrals and overdiagnosis may also occur due to the tests' wide confidence intervals and variable specificity.

The panel recognized that for the geriatric population, there may be a lack of awareness of symptoms of vestibular disorders (e.g., occasional falls). Screening for this group may be considered in the future, provided: (1) more studies are done, and (2) a more reproducible screening test becomes available.

Fetal Heart Rate Monitoring for Prenatal/Antenatal Hearing Screening

Recommendation 10: Among asymptomatic, apparently healthy pregnant women, we recommend AGAINST prenatal/antenatal screening for hearing loss using fetal heart rate monitoring. *(Very low certainty evidence, strong recommendation)*

Key findings: Structural parts of the ears develop in the first 20 weeks of gestation, while the neurosensory part of the auditory system develops primarily after 20 weeks of gestation. The period from 25 weeks of gestation to 5 to 6 months of age is most critical to the development of the neurosensory part of the auditory system.[39] Available literature has also shown that the human fetus can hear and respond to stimuli with fetal movements.[40-42] However, there are very few studies aimed at the application of fetal heart rate response to screen fetal hearing status.

Two observational studies investigated the use of prenatal/antenatal ultrasound as a form of hearing screening. Results showed significant fetal acceleration response starting from the 26th week of gestation, with an increasing response rate from the 28th to 37th weeks of gestation. One study had a 100% positive rate on the 28th and 34th-37th week of gestation, with all babies having normal hearing upon screening at birth.[43,44] Studies report that routine fetal and umbilical Doppler ultrasound examination in low-risk populations was not associated with increased antenatal, obstetric, and neonatal interventions.

Justification: The CP considered the cost-effectiveness, benefits, and harms of screening in formulating the recommendation. Screening at a very early stage may entail additional costs on top of newborn hearing screening. Prenatal/antenatal screening would not have additional benefit due to the absence of evidence-based interventions available for the antenatal stage. The potential harm of early detection, such as parental anxiety, was also considered.

Members of the panel recognized that the accuracy of fetal heart rate monitoring is higher compared to newborn hearing screening tests based on the evidence, so prenatal/antenatal screening may have potential in the future. Advances in technology may allow for early intervention in the antenatal stage.

DISCUSSION

Four key questions were formulated by the task force SC, and a total of ten (10) recommendations were formulated by the CP for this CPG. The CP took into consideration the evidence presented, the burden of disease, the cost of the confirmatory testing, and its applicability to the population.

The role of other tests, such as Auditory Steady State Response (ASSR), Behavioral Observation Audiometry (BOA), genetic testing, and tympanometry for hearing screening, was also explored in the evidence synthesis, but no recommendation specific to the use of these tests was made due to insufficient evidence. There was also no recommendation made for hearing loss screening among apparently healthy adults less than 50 years old due to a lack of sufficient evidence.

Strengths and Limitations

This is the first developed local guideline for periodic hearing screening across all ages (prenatal to elderly). To ensure evidence-based best practice, standardized implementation of hearing screening, and optimal quality of screening, guidelines should be reviewed and updated regularly. Formulated recommendations from these guidelines may reaffirm the Newborn Hearing Screening Act or may serve as a basis for modification of currently implemented laws.

Most newborn hearing screening studies were published before the year 2000 and were not included in the evidence base. This may have contributed to why the quality of evidence available was very low. Moreover, the limited evidence found on the high-risk adult population may be due to the use of "industrial workers" in the search strategy, which may have excluded studies on other noise-exposed workers.

Research Gaps

Most of the available evidence gathered had very low to low certainty of evidence. This suggests a paucity of high-quality studies, such as RCTs and diagnostic accuracy tests. Furthermore, data is lacking in terms of cost-effectiveness, equity, values, applicability, and feasibility across all clinical questions identified in this CPG.

There is a lack of direct evidence available across all tests. Specifically for vestibular testing, no direct evidence was found that favors screening or non-screening among asymptomatic individuals for vestibular disorders. The diagnostic performance of tests was established using indirect evidence.

At present, a nationwide prevalence study, risk factors, and social determinants of hearing loss among the different subgroups of the pediatric population are lacking. There is also a need to evaluate the effectiveness of the universal newborn hearing screening program in the Philippines. Longitudinal research on the effectiveness and quality of early detection and intervention strategies to assure optimal outcomes (developmental and quality of life) for newborns diagnosed with hearing loss is suggested.

There is currently no standard timing of follow-up or specific age of retesting suggested after the newborn hearing screening. The evidence gathered identified some risk factors associated with delayed-onset hearing loss. Although the panelists agreed that periodic hearing monitoring is necessary for high-risk populations, no high-quality evidence is available to recommend the proper timing of re-screening.

More updated studies are needed to determine the reliability of different hearing tests in screening for hearing loss among children. This may be the reason why, even worldwide, screening protocols for children of school age differ in terms of timing, screening tests included, and thresholds used. There are currently no established or proposed standards for the standardization of hearing screening protocols for the school-age population. Global standardization may help facilitate more accurate studies on hearing loss prevalence and determine the diagnostic accuracy of screening tests. Furthermore, cost-effectiveness studies of hearing screening programs for primary school children are available abroad but not in the local setting.

Evidence on the effect of screening on critical outcomes for the adult high-risk population (i.e., work-related injuries and disabilities, safety, and quality of life) is also lacking. Similar to that of children, the cost-effectiveness of screening in adults has been demonstrated abroad but not locally.

The epidemiology of balance symptoms and disorders in the local setting is not yet known. In the US, dizziness and vertigo were among the most frequently referred neurological symptoms to subspecialty centers and services and constitute a significant proportion of emergency care visits. Having this information locally may assist in planning interventions, avoiding overdiagnosis and unnecessary referrals, and improving disease outcomes. All diagnostic accuracy studies of clinical balance testing included in the evidence summary had a high risk of bias due to their case-control design, unblinded assessors, lack of prespecified diagnostic thresholds, or non-assessment of control patients with the reference standard. Future studies may consider addressing these limitations.

Many research questions emerged from collating the evidence for this CPG and can be explored further. Filling in these gaps can provide a clearer picture of the impact of screening programs using the previously mentioned tests and may influence the recommendations for updating this guideline.

CONCLUSION

The consensus panel for the Philippine Periodic Health Examination Task Force on Screening for Hearing Disorders recommended the screening for hearing disorders in certain population groups, based on the available evidence, the burden of disease, the cost of the confirmatory testing, and its applicability to the population. These population groups include asymptomatic, apparently healthy children with known risk factors for congenital and late-onset hearing loss, apparently healthy newborns using OAE or AABR, asymptomatic, apparently healthy school-aged children using smartphone-based screening audiometry or tuning fork test, and asymptomatic, apparently healthy elderly adults (50 years old and above) using portable pure tone audiometer screener or mobile-based audiometric applications.

Disclaimer

This guideline is intended to be used by general practitioners, specialists, and allied health professionals who are primary care providers. Although adherence to this guideline is encouraged by the Department of Health (DOH), it should not restrict clinicians from using their clinical judgment and considering patients' values, needs, and preferences while handling individual cases. Payors and policymakers, including hospital administrators and employers, can also utilize this Clinical Practice Guideline (CPG), but nonconformance to this guideline should not be the sole basis for granting or denying financial assistance or insurance claims. Recommendations from this guideline should not be treated as strict rules on which to base legal action. Evidence summaries are based on the best available scientific evidence as of the time of their formulation. However, certain aspects of the screening may not have been addressed by the clinical trials and observational studies, and as such, evidence bases are therefore not all-inclusive. Considerations on these aspects were still deemed necessary in the current context of primary care.

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Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

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APPENDIX

Critical and Important Outcomes

The clinical questions cover different hearing screening tests (e.g., Otoacoustic Emissions [OAE], Automated Auditory Brainstem Response [AABR], Auditory Steady State Response [ASSR], Behavioral Observation Audiometry [BOA], tympanometry, tuning fork test, pneumatic otoscopy, screening audiometry, Pure Tone Audiometry [PTA]), genetic testing, clinical vestibular tests (Tandem Walking and Romberg's Test), and fetal heart rate monitoring. Critical outcomes for the pediatric population included speech delay, hearing loss, psychosocial development, quality of life, and school performance. Critical outcomes for the adult population included hearing loss, work-related injuries and disabilities, risk of falls, and quality of life.

A. Test specific efficacy outcomes:
   1. Tympanometry: Verbal expression, verbal comprehension, and adverse events.
   2. Behavioural Observation Audiometry: Hearing impairment and adverse events
   3. Auditory/Language Development and Hearing Aid Use
   4. Puretone audiometry: Quality of life, speech discrimination, delay in developmental outcome, presence of ear canal debris
   5. No direct evidence for efficacy outcomes for the tuning fork test, pneumatic otoscopy, and screening audiometry.
   6. Adult hearing screening: hearing loss, hearing aid use, quality of life, work-related injuries, and disabilities
   7. No direct evidence for balance testing: tandem walking with eyes open, tandem walking with eyes closed, and Romberg's test
   8. No direct evidence for fetal hearing screening: speech and language outcomes

B. Accuracy outcomes: sensitivity and specificity

C. Safety Outcomes

D. Cost:
   1. Universal hearing screening: total cost, intervention cost, total cost averted, daily adjusted life-years (DALY), potential return on investment
   2. Unit cost of pure tone and speech audiometry
   3. Unit cost of hearing aid
   4. Cost of MRI test

E. Patient's Values and Preferences, Equity, Acceptability, and Feasibility

F. Knowledge gaps

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