



Empowering Schools for Inclusive Hearing Care: A Public Health Approach to Early Detection and Prevention of Hearing Loss in Nepal

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Abstract

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Background: Hearing loss is a neglected public health concern in Nepal, affecting an estimated 16.6% of the population, with significant implications for children, occupational groups, and underserved communities. Despite its prevalence, ear and hearing care remain underprioritized in national health policy. This study aimed to assess the burden of hearing impairment in Nepal and evaluate interventions to inform inclusive and context-sensitive strategies.

Methods: A systematic literature review was conducted using databases such as PubMed, Google Scholar, and ResearchGate, following PRISMA guidelines. Sixteen studies meeting the inclusion criteria were synthesized, encompassing cross-sectional surveys and randomized trials. Quantitative analyses included Q-Q plots, P-P plots, and forest plots to assess prevalence distributions and intervention outcomes.

Results: It revealed hearing loss prevalence ranging from 5.4% to 49.6% across different populations, with conductive hearing loss due to chronic otitis media being most common. Children in monastic schools and rural areas, workers exposed to occupational noise, and patients at tertiary hospitals were disproportionately affected. Surgical interventions like tympanoplasty showed high success rates, while telemedicine emerged as a promising tool for remote care. School-based programs and community outreach initiatives demonstrated potential but faced barriers such as low awareness, cultural stigma, and economic constraints.

Conclusion: The study addressing hearing loss in Nepal requires a multifaceted approach that integrates early screening, community engagement, surgical capacity-building, and telemedicine. Inclusive and sustainable ear care interventions, especially in schools, are essential to reduce the burden of preventable hearing impairment in low-resource settings.

Keywords: Chronic otitis media, Hearing loss, School-based screening, Telemedicine

Declaration: There is no conflict of interest.



Background

Hearing loss and ear-related conditions represent a major public health issue in Nepal, yet remain under-prioritized within national health policies. An estimated 16.6% of the population, approximately 2.71 million people, live with hearing impairment, with 7.4% experiencing chronic tympanic membrane pathology (Sharma et al., 2004). A large-scale screening of 79,340 school-aged children revealed a 5.73% prevalence of hearing loss, of which 70.47% were due to conductive causes such as chronic otitis media. (Maharjan et al., 2023). In eastern districts (Sunsari and Morang), 36.1% of 3,729 children had ear-related issues, with 45.8% having impacted wax, 16.8% otitis media with effusion, and 7.7% chronic otitis media (data from local study) (Thakur et al., 2017). In Pokhara, 21.4% of children suffered hearing impairment; 9.8% had chronic otitis media, and 71.7% of impaired cases were conductive. Among adolescents and young adults (aged 15–23) in rural Sarlahi, 6.1% had clinically significant hearing loss, and 32.8% showed abnormal tympanic membranes suggestive of chronic or recurrent infections. (Thakur et al., 2017). In adults presenting to a tertiary ENT outpatient department in Kathmandu, 4.62% of 3,201 patients had hearing impairment, with conductive loss (2.12%) being most common. (Khanal et al., 2022). Occupational noise exposure is also substantial: 31% of carpenters and 44% of sawyers studied met criteria for noise-induced hearing loss, with 7-17% reaching WHO-defined thresholds for significant impairment. (Robinson et al., 2015). A student in Nepal showed poor academic performance due to hearing problems and even adopted cultural and religious rituals for treatment. During a school health program focused on ear and hearing care, the Public Health Research Society Nepal (PHRSN, 2025) Introduced the HearWHO app (De Sousa et al., 2022). “The hearWHO app is a simple hearing screening tool developed by WHO that gives a score of 100 to assess hearing ability. A score of 75 or above indicates normal hearing, 50-74 suggests possible hearing difficulty, and below 50 signals likely hearing loss, needing professional evaluation. The app helps detect hearing issues early, especially in noisy environments, allowing timely care and prevention of further damage.” To assess the burden of hearing impairment in Nepal and explore evidence-based, inclusive, and school-centered strategies for ear and hearing care, with a focus on prevention, early detection, and sustainable interventions in low-resource settings.

Methodology

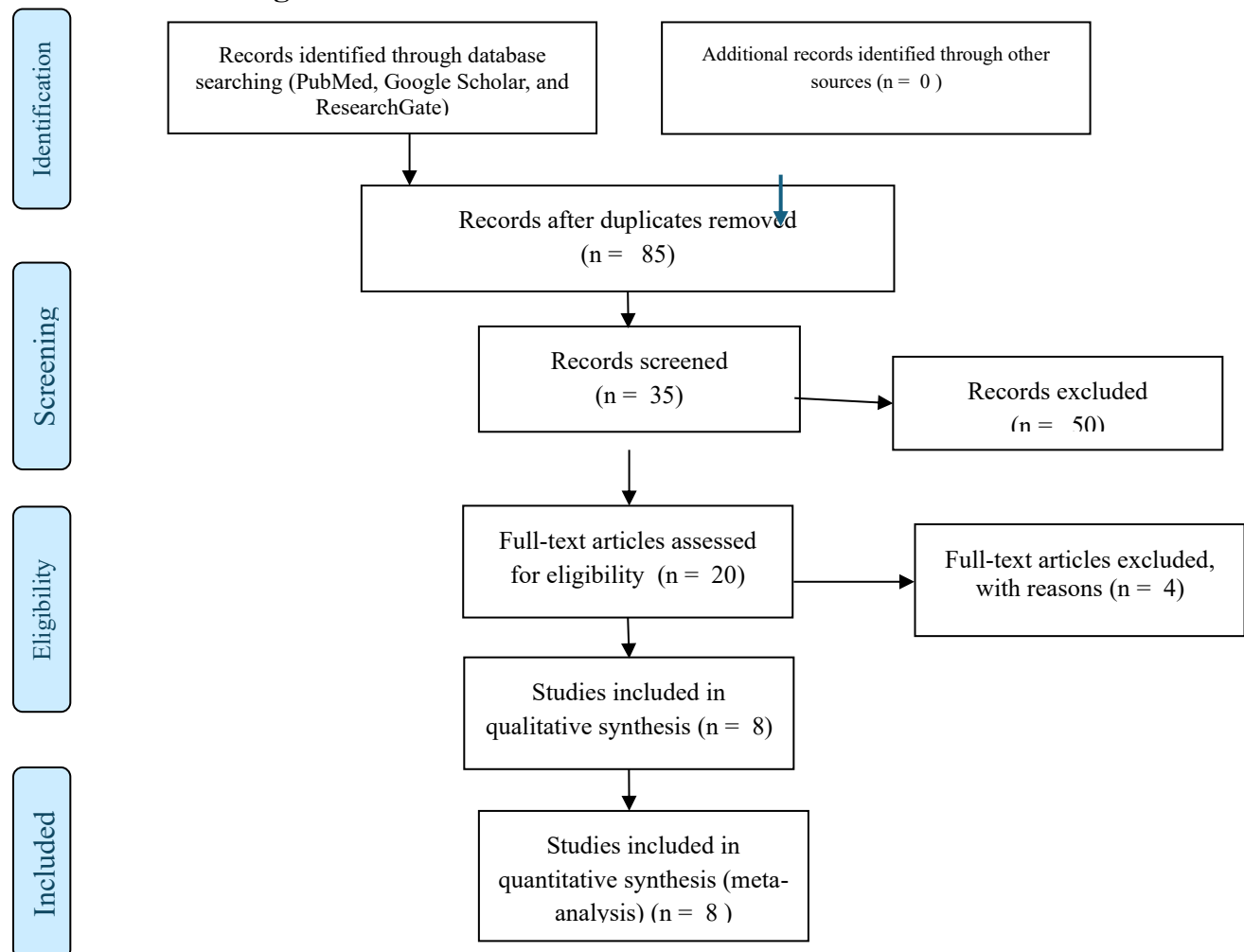
This article was conceptualized based on insights from the World Health Organization's Hearing Day campaign, which highlighted the growing burden of hearing impairment and the need for preventive and rehabilitative strategies, especially in low-resource settings like Nepal. A focused literature search was conducted to gather relevant evidence from Nepali contexts. The search strategy employed the keywords: (((Hearing) AND (Ear)) AND (Care)) AND (Nepal), across multiple platforms including PubMed, Google Scholar, and ResearchGate. Only studies conducted in Nepal or involving Nepali populations were included. A PRISMA flow diagram was used to guide the selection process and ensure systematic inclusion of articles. Preference was given to peer-reviewed journal articles, government or institutional reports, and relevant grey literature written in English or Nepali. In total, 17 studies were included in the final synthesis,



ranging from cross-sectional studies, retrospective reviews, cluster randomized trials, to community health surveys and intervention protocols.

For data analysis, three statistical visualization techniques were employed: Q-Q (Quantile-Quantile) plots, P-P (Probability-Probability) plots, and Forest plots. The forest plot was used to summarize the prevalence rates or intervention success across the selected studies, allowing for visual comparison and identification of patterns across different population groups and methodologies. The Q-Q and P-P plots were used to assess the distribution of the prevalence data and test the assumption of normality. These plots help determine whether parametric methods (like linear regression or t-tests) are suitable for further analysis.

PRISMA Flow Diagram





Results

A range of studies conducted across Nepal reveal the substantial burden of hearing loss, especially among children, occupational groups, and rural populations. Methodologically, these studies employed diverse designs including cross-sectional surveys, retrospective chart reviews, randomized trials, and telemedicine pilots. Screening tools such as otoscopy, pure tone audiometry, HRCT imaging, and teleconsultation platforms were used across settings- schools, tertiary hospitals, remote clinics, and community programs. Several studies focused on specific subpopulations, such as children in Buddhist monastic schools and patients in police hospitals, while others explored the effectiveness of surgical interventions like tympanoplasty and cochlear implants, or assessed broader public health strategies including education, telemedicine, and behavior change interventions.

Summary of hearing loss studies in Nepal

Title	Methodology	Findings	Conclusion
A rural health survey and treatment initiative in Sunsari district, Nepal (Thakur et al., 2017)	Community survey; hearing screening; treatment provision; follow-up over 1 year; hearing aids and ear care programs	Hearing loss incidence 16.6%; mild hearing loss in 54%, moderate 41%, severe 5%; otorrhoea controlled in 67%; improvement in 65% mild cases; economic constraints limited advanced care	Community-based ear care programs improve hearing outcomes and control infections; economic barriers remain a challenge for surgery and hearing aid access.
Chronic Otitis Media and Subsequent Hearing Loss in Children from the Himalayan Region Residing in Buddhist Monastic Schools of Nepal (Maharjan et al., 2020)	Cross-sectional study in 53 Buddhist monastic schools; 3174 children aged 5-15 screened using otoscope and audiometer	10.83% had chronic otitis media; 5.42% had hearing loss; the conductive type was most common	High prevalence of preventable hearing loss among Himalayan children; early diagnosis and treatment needed
Cochlear implantation outcomes in children with Enlarged Vestibular Aqueduct Syndrome (LVAS) (Pradhananga et al., 2014)	Case series of 3 children; pre- and postoperative audiological assessment; surgical management including CSF gusher control; short-term follow-up	Cochlear implantation was effective with no complications; hearing and speech outcomes were comparable to normal implantees; CSF gushers were common but manageable; profound sensorineural hearing loss confirmed	Cochlear implantation is feasible and effective for children with LVAS, providing good auditory outcomes comparable to other candidates.



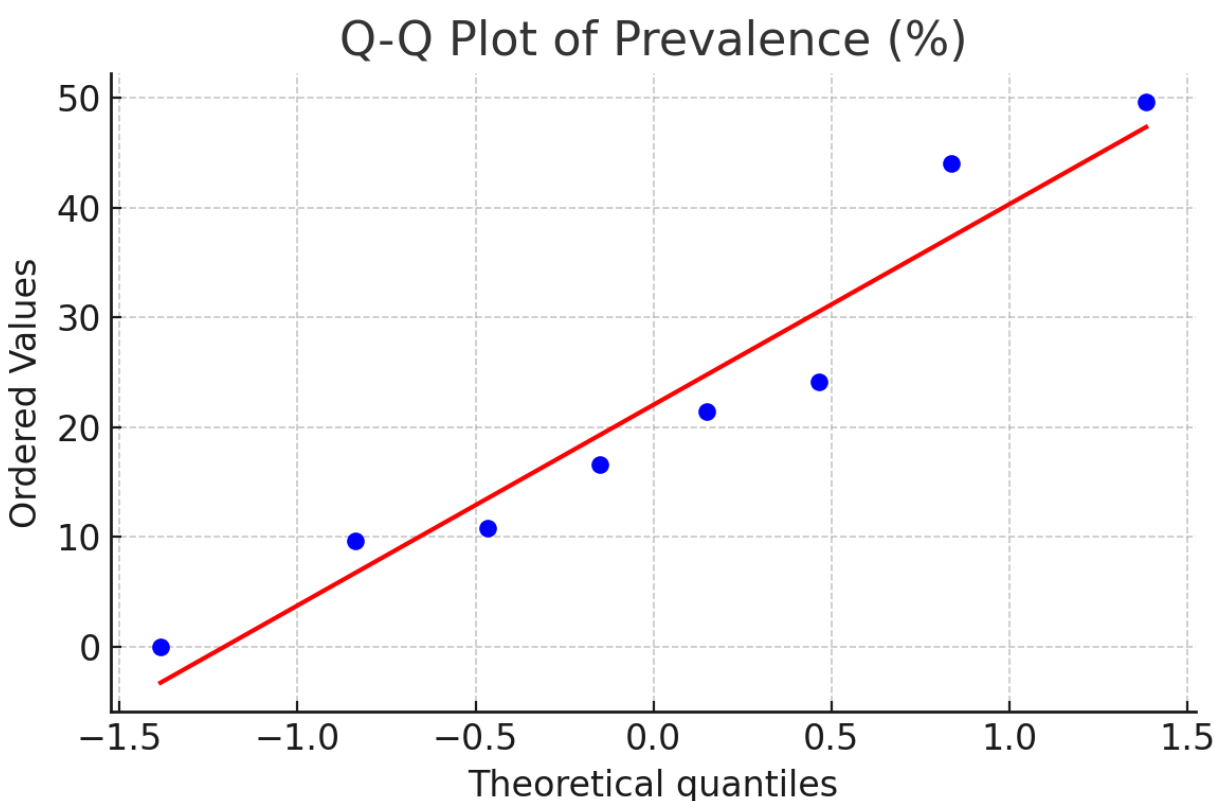
Title	Methodology	Findings	Conclusion
Developing interventions for healthcare access in LMICs: Ear services in Malawi and menstrual hygiene in Nepal (Pulok et al., 2016)	Case studies, systematic reviews, formative research, participatory workshops; Behaviour Centred Design; monitoring indicators	Ear services for people with intellectual impairments in Nepal; involvement of people with disabilities is crucial in intervention design; need for evidence on effectiveness.	Systematic, participatory approaches are essential for designing disability-inclusive health interventions in LMICs; further studies are needed on intervention effectiveness.
Ear Diseases in School-going Children of Sunsari (Thakur et al., 2017)	Prospective cross-sectional study of 3,729 children; otoscopy, clinical exams, consent from parents.	36.09% had ear problems: wax (45.76%), otitis media with effusion (16.79%), AOM (8.84%), and chronic otitis media (7.73%).	High burden of preventable ear diseases among children; improved health education and socioeconomic development are crucial.
External Auditory Canal Cholesteatoma: A Tertiary Care Experience (Dongol et al., 2022)	Retrospective study of 9 patients; HRCT scans and clinical review	Common symptoms: chronic otorrhoea, otalgia, hearing loss; HRCT showed canal wall erosion in all; 8/9 had mastoid involvement	Clinical and radiological correlation is essential; EACC is often misdiagnosed; early identification is needed
Factors affecting graft uptake and hearing improvement after myringoplasty in tubotympanic COM patients (Dangol & Shrivastav, 2017)	Prospective study; 219 patients; preoperative assessment; myringoplasty with temporalis fascia graft; 1-year follow-up; chi-square and paired t-test	Graft uptake rate 83.1% at 1 year; diseased contralateral ear negatively impacted graft success; hearing improvement significant with normal ossicular status; other factors not significant	Myringoplasty has a high success rate; contralateral ear status is an important prognostic factor; hearing improves significantly when the ossicles are normal.
Health promotion to reduce CSOM prevalence in Jumla, Nepal: A cluster randomized trial (Clarke et al., 2019)	Cluster randomized trial; 30 women's self-help groups; health promotion sessions using WHO resources; GEE analysis	Overall, KAP improved, and CSOM prevalence reduced due to community presence; control group care was better than expected.	Health promotion alone may not improve KAP or reduce CSOM prevalence in low-resource settings; more research is needed for effective interventions.
Hearing Impairment in School Children in	Cross-sectional study of 215 students (grades 5-6); tuning fork tests,	21.4% had hearing loss; chronic otitis media in 9.8%; 71.7% of losses	Public health education and large-scale national studies are needed;



Title	Methodology	Findings	Conclusion
Pokhara (Byanju & Saha, 2017)	otoscopy, SPSS analysis.	were conductive; government school students were more affected.	focus on school screening programs.
Occupational Noise-Induced Hearing Loss in Woodworkers (Robinson et al., 2015)	Cross-sectional study of 124 workers (carpenters & sawyers); audiometry and workplace noise measurement; regression analysis.	31% of carpenters, 44% of sawyers had NIHL; workplace noise ranged from 71.2–93.9 dBA.	NIHL is a growing occupational hazard; regulatory policies and protective interventions are urgently needed in informal industries.
Outcomes of Type I Tympanoplasty in Children with Chronic Otitis Media (Maharjan et al., 2023)	Retrospective study of 629 children (8–16 yrs) undergoing surgery between 2015–2019	Anatomical success: 93.32%; functional success: 76%; no significant predictors found	Type I tympanoplasty is highly successful in children; outcomes are not strongly influenced by age or perforation size
Pattern of Hearing Loss in Nepal Police Hospital (Khanal et al., 2022)	Retrospective study of 1,360 patients (2016–2020); pure tone audiometry; SPSS analysis.	Sensorineural loss is most common (49.6%); 66% male; 68.24% bilateral loss; most prevalent in the 31–40 age group; mild hearing loss in 39.67%.	Sensorineural hearing loss is dominant; early screening and prevention measures are critical, especially in working-age populations.
Prevalence of Chronic Otitis Media in Outreach Clinics of Nepal (Mathema et al., 2023)	Descriptive cross-sectional study; systematic random sampling of 385 patients from 2017–2019	9.61% prevalence of COM; the majority were mucosal type (91.89%); more common in adults 18–60 years	COM remains a significant issue with lower prevalence than previous studies; it needs public health attention
Prevalence of Hearing Impairment in Nepal (Robinson et al., 2015)	Literature synthesis from various national and international reports; descriptive summary.	~16.6% of the population has hearing impairment; ~1.58 million unaware of their condition; 1/3 of disabilities in Nepal due to hearing loss; >50% of affected under 25; 17.34% of school children have some hearing loss.	Hearing loss is a major but neglected public health issue in Nepal, especially among youth and school-aged children. Integration into primary care and awareness is essential.
Prevalence of Tympanic Membrane Perforation Among Patients in a Tertiary Hospital (Ghimire et al., 2022)	Descriptive cross-sectional study over 6 months; 414 patients aged 11–70	24.15% had tympanic membrane perforation; all had hearing loss; posterior perforation led to greater loss	Tympanic membrane perforation is a major cause of hearing loss; posterior sites are linked to more severe outcomes
Reliability of a Tailored Telemedicine Model for ORL-HNS in Nepal (Gyawali et al., 2024)	Cross-sectional study at TUTH; 94 patients assessed with telemedicine tools, including the Mimi app	Substantial diagnostic agreement; chronic otitis media is most common; users are satisfied with teleconsultation	Telemedicine is a promising tool for remote ORL care; effective despite diagnostic limitations.



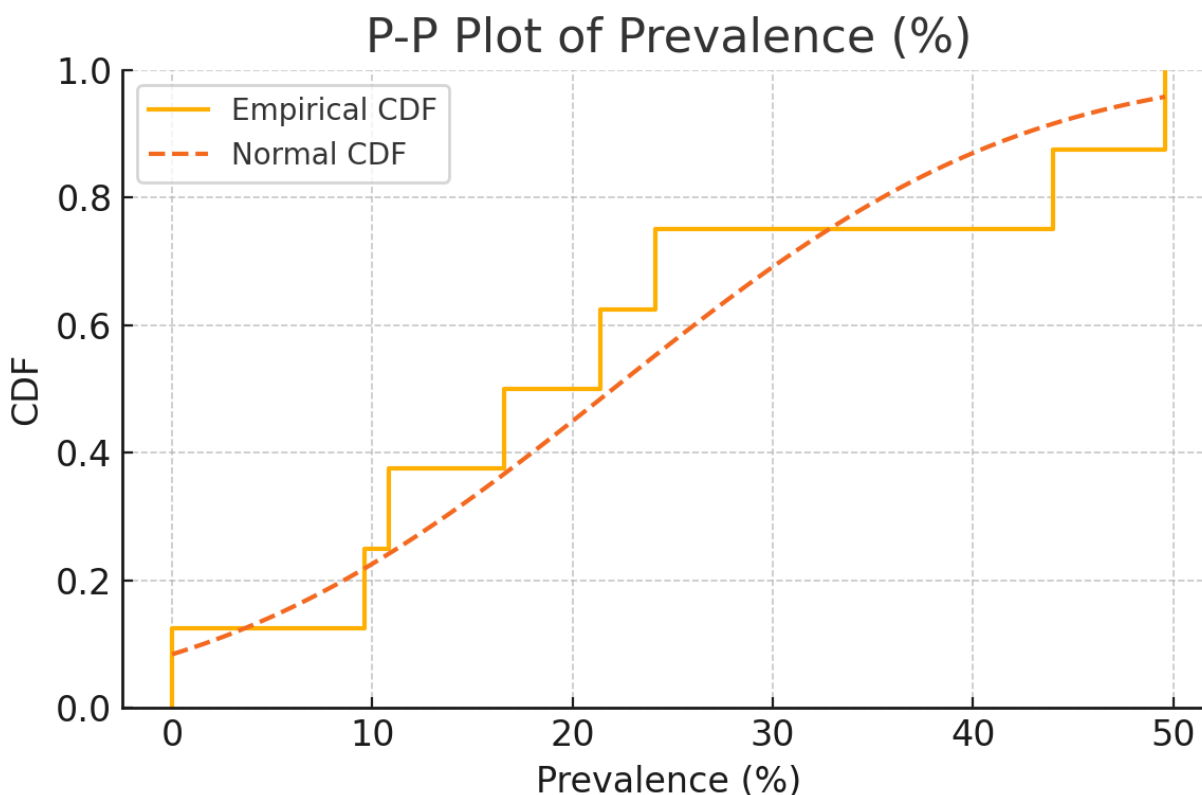
The findings consistently highlight a high and often preventable prevalence of hearing impairment: ranging from 10–24% in general or school-aged children to nearly 50% in specific populations such as police hospital patients or sawyers exposed to occupational noise. Common causes include chronic otitis media, tympanic membrane perforations, and noise-induced hearing loss (NIHL), with conductive hearing loss being the most common type. Preventive efforts, like WHO-guided health promotion, showed modest improvements, while surgical treatments, such as tympanoplasty and cochlear implants, achieved high rates of anatomical and functional success. Throughout the studies, barriers like lack of awareness, economic challenges, delayed care-seeking, and limited access to specialists were frequently reported.



The Q-Q The findings consistently highlight a high and often preventable prevalence of hearing impairment, ranging from 10–24% in general or school-aged children to nearly 50% in specific populations such as police, hospital patients, or sawyers exposed to occupational noise. Common causes include chronic otitis media, tympanic membrane perforations, and noise-induced hearing loss (NIHL), with conductive hearing loss being the most common type. Preventive efforts, like WHO-guided health promotion, showed



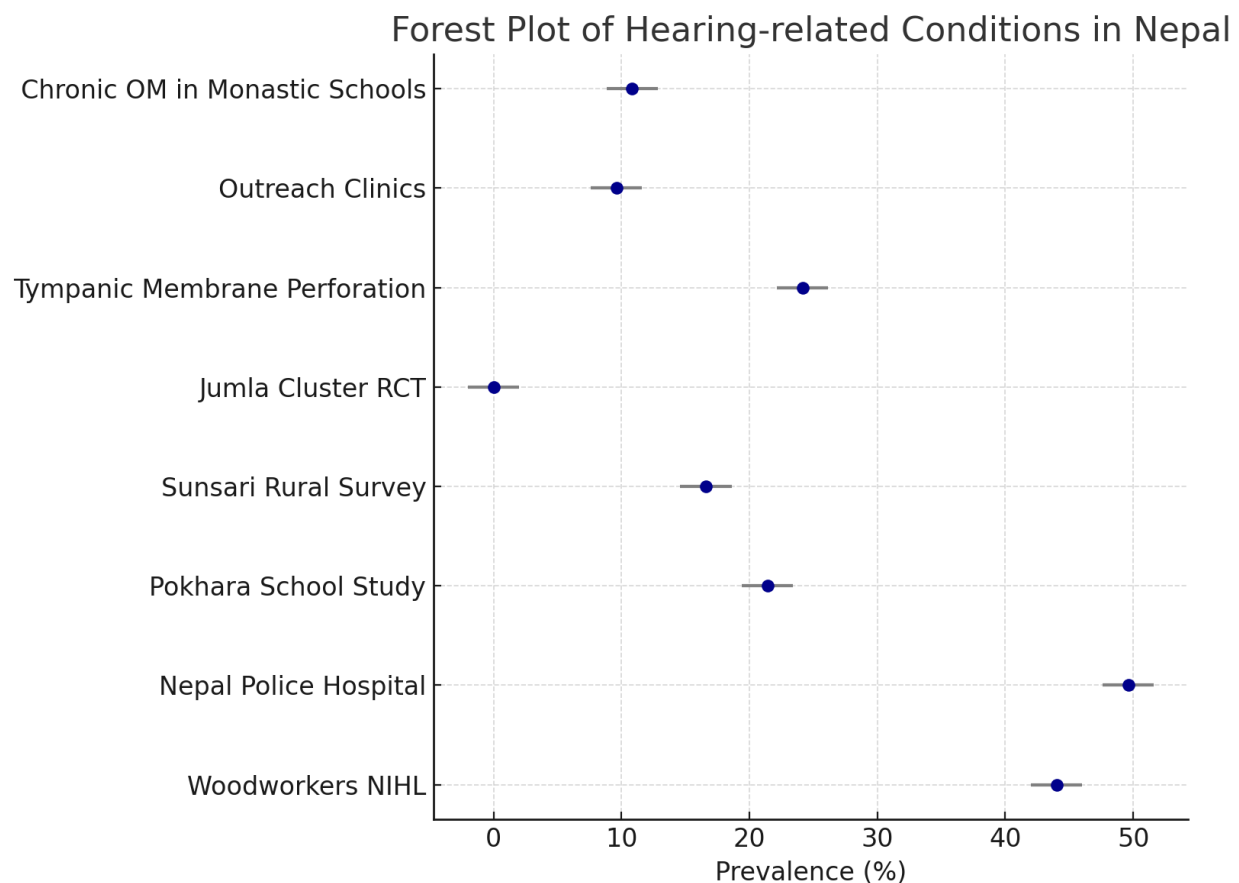
modest improvements, while surgical treatments, such as tympanoplasty and cochlear implants, achieved high rates of anatomical and functional success. Throughout the studies, barriers like lack of awareness, economic challenges, delayed care-seeking, and limited access to specialists were frequently reported. (Quantile-Quantile Plot) Visually compares the distribution of observed prevalence values from various studies to a theoretical normal distribution. In this analysis, most data points lie close to the reference line, indicating that the distribution of prevalence rates is approximately normal. This suggests that the majority of studies report prevalence figures clustering around a central tendency. However, a few outliers-particularly those with notably high values such as 44% and 49.6%, deviate from the line, reflecting mild departures from normality and hinting at heterogeneity among study populations or methodological differences.



The P–P (Probability–Probability) plot compares the cumulative distribution of the observed prevalence and success proportions from 16 studies with a theoretical normal distribution. The data included a range of values-from lower prevalence figures such as 5.42% and 7.73% (hearing loss and chronic otitis media in



school children) to higher values like 44% and 49.6% (among woodworkers and police hospital patients), as well as success outcomes from interventions like tympanoplasty and myringoplasty ranging up to 93.32%. The plot shows that most of the data points align closely with the diagonal reference line, indicating that the distribution of these proportions approximates normality. However, the curve deviates slightly at both tails, suggesting some skew due to extreme values. These deviations are attributed to the particularly high prevalence in certain occupational or high-risk groups and the high success rates of surgical interventions. Overall, the P-P plot indicates that while the bulk of prevalence and outcome data is normally distributed, a few outliers at both ends reflect real-world variations across different populations and intervention contexts.



The forest plot illustrates the point prevalence of hearing-related conditions and intervention outcomes across selected studies conducted in Nepal. It reveals notable variation in prevalence estimates, with the highest observed in the Nepal Police Hospital (49.6%) and among sawyers exposed to occupational noise (44.0%), highlighting substantial clinical and occupational health burdens. On the other end of the



spectrum, a 0% prevalence reported in the Jumla randomized controlled trial (RCT) may reflect either successful intervention strategies or possible limitations in detection within the study population. The majority of studies, however, reported prevalence rates in the moderate range (10%-25%), suggesting a widespread burden of ear and hearing conditions across various demographics and regions. This variation emphasizes the importance of context-specific approaches in ear health interventions and the need for targeted public health strategies addressing both high-risk groups and general populations.

Conclusion

Chronic otitis media and tympanic membrane perforation are prevalent ear conditions among children and adults in Nepal, particularly in the Himalayan region and underserved populations such as those in Buddhist monastic schools and outreach clinics. These conditions are major causes of avoidable hearing loss, predominantly conductive, and significantly impact the quality of life. Telemedicine in otorhinolaryngology holds promise for improving access to diagnostic and management services in remote areas. However, challenges remain in early diagnosis, proper treatment, and public health awareness, especially considering risk factors such as smoking, ear picking, and poor hygiene. Overall, timely diagnosis, effective treatment, and continuous follow-up are crucial to reducing the burden of hearing loss related to chronic ear diseases. The studies highlight that improving ear and hearing health in low-resource settings like Nepal requires inclusive, community-based, and culturally sensitive interventions. While health promotion alone may not significantly reduce conditions like chronic suppurative otitis media, engaging existing social structures such as women's groups and involving people with disabilities in designing interventions enhances relevance and acceptance. Surgical interventions like myringoplasty and cochlear implantation show promising outcomes when clinical factors are optimized. However, economic barriers and limited long-term evidence on intervention effectiveness remain challenges.

Program and Policy Recommendations

- Implement routine ear and hearing screening programs, especially in high-risk populations such as children in Himalayan monastic schools and outreach clinics, to identify and treat chronic otitis media early.
- Conduct targeted education campaigns to raise awareness among parents, caregivers, and communities about ear hygiene, risk factors, and the importance of timely medical consultation for ear infections.
- Develop and scale telemedicine models for otorhinolaryngology to extend specialist care to remote and underserved areas, reducing the need for patient travel and facilitating early intervention.
- Implement interventions to reduce behaviors such as ear picking and smoking that contribute to external auditory canal cholesteatoma and chronic otitis media.
- Establish systematic follow-up protocols post-treatment and explore rehabilitative options like hearing aids for patients with persistent hearing loss to improve long-term outcomes.



- Support longitudinal and larger-scale studies to better understand predictors of surgical success and long-term outcomes in chronic ear diseases in Nepal's diverse populations.

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