Policy Brief

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Health Technology Assessment of Telemedicine-Enabled Otoscope (TEO) for Prevention of Ear Diseases

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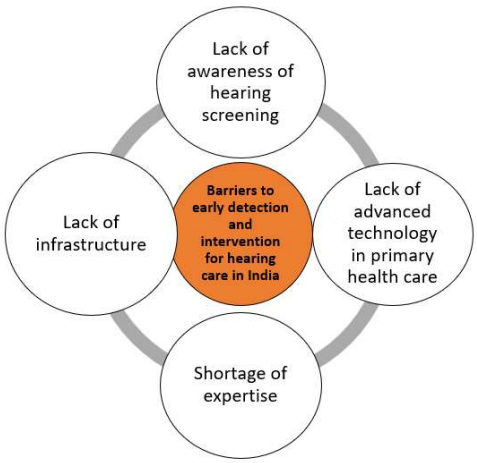
Background

The World Health Organization (WHO) estimates that untreated hearing loss costs the global economy $980 billion per year. This includes healthcare costs (excluding hearing aids), educational support costs, lost productivity, and societal costs. Low-and middle-income countries (LMICs) bear roughly 57% of these costs. Untreated ear infections can lead to hearing loss, social isolation, loneliness, psychosocial distress, anxiety, and depression. The primary barriers to treatment are a lack of awareness and limited care in primary health care (PHCs) for ear care.

Adult-onset hearing loss was estimated to have a prevalence of 7.6 percent in India. In India, barriers to early detection and intervention for ear care include lack of infrastructure, shortage of expertise, lack of awareness on screening, and absence of advanced technology in primary health care settings.



About 20% of the population said the cost was a barrier to obtaining treatment, and 41% of screened respondents said they didn't have time for an ear checkup. Regular hearing checks were neglected, requiring door-step digital health services.

Telemedicine services are critical in areas where the doctor-patient ratio is significantly lower than the WHO recommended ratio (1:1000). In India, there is one doctor for every 1445 population. Medical services, particularly doctors, are scarce in rural and remote areas, where health care services are challenging.

Rationale

Hearing loss prevention is essential throughout the life span, from prenatal and perinatal stages to middle age and beyond. It is critical to developing effective prevention strategies for hearing loss at various stages of life. Hence, community-based hearing screening using digital technology is critical for reducing the burden of hearing loss.

Telemedicine was conceptualized by the Ministry of Health and Family Welfare under Ayushman Bharat scheme during 2018. Teleconsultations in India were developed by the National Telemedicine Service of the Union Health Ministry. On April 13, 2020, the eSanjeevani out-patient-department was launched to enable patients to receive health care by a specialist at primary health care for Medicine, Obstetrics & Gynaecology and Pediatric patients. However, no such tele-facilities implemented for ENT care.

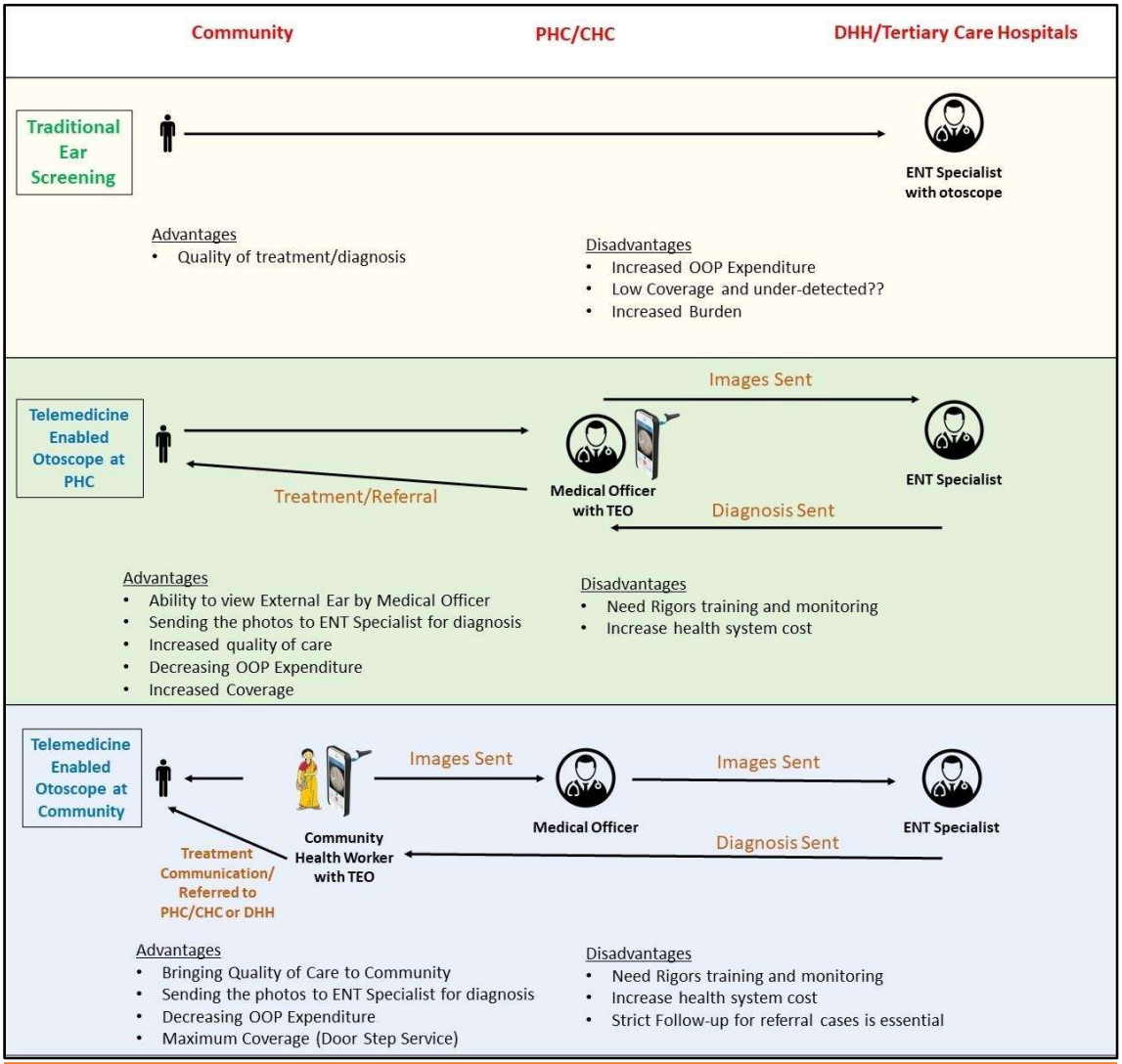
Objective

To assess the cost-effectiveness and operational feasibility of implementing a telemedicine-enabled otoscope (TEO) ear disease prevention.

Methods

This HTA study is classified into three broad areas: efficacy, economic evaluation and ethical and social implication of implementation.

Figure 1. Proposed model for hearing screening/check-up – traditional ear check-up, telemedicine enabled otoscope at primary health centre and community.



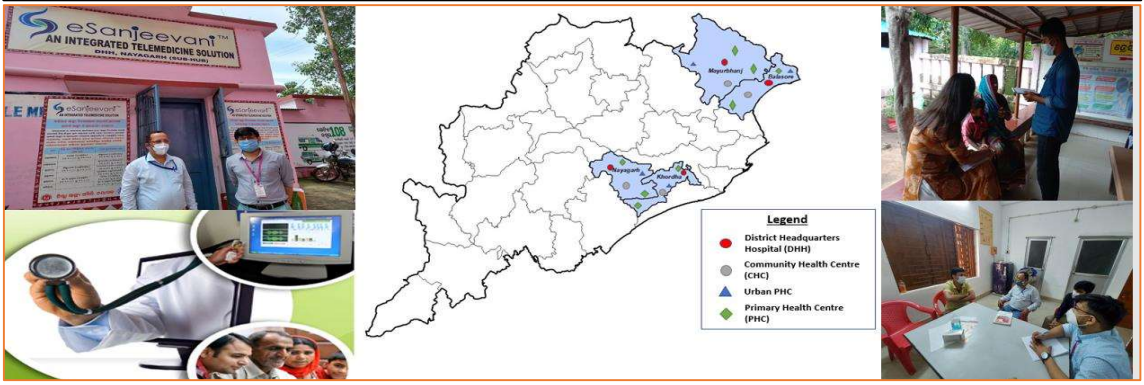


Figure 2. Population, Intervention, Comparator, and Outcome (PICO).

This project approved by the Technical Appraisal Committee (TAC), Health Technology Assessment, Department of Health Research, Ministry of Health and Family Welfare, Government of India. The ethical clearance was obtained from the Institutional Ethical Committee of RMRC Bhubaneswar. Permission was taken from the concerned local authorities, and consent was obtained from the participants.

Findings

Table 1. Pooled sensitivity and specificity of an otoscope and Telemedicine Enabled Otoscope (TEO).

Device	Sensitivity % (95% CI)	Specificity % (95% CI)
Traditional Otoscope (Overall)	89% (81– 96%)	87% (74-98%)
Telemedicine Enabled Otoscope (Overall)	82% (73-90%)	95% (91-98%)
Telemedicine Enabled Otoscope (Physician)	84% (75-92%)	91% (85-96%)
Telemedicine Enabled Otoscope (CHWs)	80% (64-94%)	97% (94-100%)

Many patients claimed that they could not travel to district hospitals due to a lack of time, distance, travel money, and the support of a companion during our initial interactions with various stakeholders. Furthermore, ENT specialists and advanced diagnostic equipment are lacking in PHCs and CHCs. Primary care physicians were optimistic about introducing TEO at Health & Wellness Centers (HWCs). The ENT doctor proposed using a cell phone or tablet to remotely observe and review the image, allowing for a faster diagnosis.

Table 2. Implementation cost.

Variables	Telemedicine-enabled Otoscope by Medical Officer at each Primary health centres	Telemedicine-enabled Otoscope by Community Health Workers at Community level	Screening with Traditional Otoscope by ENT specialist at tertiary health care facilities
Annual Heath System cost per facility	₹1.46 Lakhs	₹6.49 Lakhs	₹14.5 Lakhs
Expected no of cases per year	7280	31200	13780
Unit cost per patient (Health System)	₹ 20.07	₹ 20.82	₹ 105.45
Societal Cost	₹ 202.74	₹ 103.24	₹ 344.15
Total Cost	₹ 222.81	₹ 124.06	₹ 449.60

Table 3. Budget Implication.

Average number of facilities and annual implementation cost	Telemedicine-enabled Otoscope by Medical Officer at each Primary health centres	Telemedicine-enabled Otoscope by Community Health Workers at Community level	Screening with Traditional Otoscope by ENT specialist at tertiary health care facilities
At district level (facilities)	71	71	2
At district level (Cost)	6.9 Crore	12.5 Crore	29 Lakhs
At state level (facilities)	1360	1360	62
At state level – Odisha (Cost)	132.5 Crore	239.7 Crore	9.0 Crore
At national level (facilities)	29899	29899	2258
At national level – India (Cost)	2913.5 Crore	5271.2 Crore	328.1 Crore

- The annual health system cost per facility for ear screening with otoscope by an ENT specialist at tertiary health care facilities will be 14.5 lakhs INR with per-patient cost of 105.45 INR.
- The annual health system cost per facility for ear screening with TEO by a Medical Officer at each Primary Health Centre will be 1.46 lakhs INR with a patient cost of 20.07 INR.
- The yearly health system cost per facility for ear screening with TEO by CHWs at the community level will be 6.46 lakhs INR with 20.82 INR per patient.

- The annual cost of implementing ear screening with a typical otoscope by ENT specialists at tertiary health care facilities will be 328.1 Crore INR at the national level, coverage will be extremely low.
- At the national level, the yearly cost of implementing ear screening with TEO by Medical Officers in Primary Health Centers will be 436.87 crore INR, while the CHW model with TEO will cost 1942.42 crore INR, but will provide universal coverage.

	Variables	TEO at PHC	TEO by CHWs at Community level	Traditional Otoscope by ENT specialist at DHH
QALY	QALYs (per district)	44,08,661	8,55,84,094	9,63,898
	Average annual implementation cost at district level*	₹ 6.9 Crore	₹ 12.5 Crore	₹ 29 Lakhs
ICER		TEO at PHC	TEO by CHWs at Community level	
		Rs 19.19/QALY gained	Rs 1.44/QALY gained	

Conclusions and Implication

Telemedicine has been recommended to bridge the gap in human resources for health to alleviate the shortage of ear care specialists in India and other settings with limited resources. It can significantly enhance access to ear and hearing services, such as screening, community education, and primary treatment. Traditional otoscopes provide less coverage than PHC and CHW models. With TEO, both primary health care and CHW models have a high level of coverage. The community model has a lower QALY than the PHC model. However, the PHC model has a substantially lower implementation cost. The community model would be excellent for universal coverage, but it would overburden CHWs and be expensive to implement. Thus, the PHC model might be prioritised under the eSanjeevani platform for sustainability.