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A Comprehensive Systematic Review of Management of Otolaryngology Conditions in Low-Income Communities

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ABSTRACT

Introduction: Otolaryngology (ENT) care in low-income and resource-limited communities faces profound challenges due to systemic inequities, financial constraints, and limited access to specialists. Chronic suppurative otitis media (CSOM) and other ENT conditions disproportionately affect disadvantaged populations, leading to significant morbidity and preventable complications.

Methods: This comprehensive systematic review synthesized evidence from 80 studies identified through rigorous screening. We included primary research and systematic reviews focusing on ENT condition management in low-income settings, low-resource environments, or among economically disadvantaged groups. Data extraction encompassed ENT conditions, population characteristics, management approaches, outcomes, barriers, facilitators, and resource requirements.

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Results: Chronic suppurative otitis media (CSOM) was the most frequently studied condition, with high prevalence linked to poverty, overcrowding, and poor hygiene (Minja et al., 2006; Clarke et al., 2015). Effective management strategies included community-based task-shifting, such as training community health workers (CHWs) in Malawi, which was both feasible and cost-effective at approximately $189 per CHW trained (Mulwafu et al., 2017). Telemedicine demonstrated high diagnostic concordance (>80%) and improved access (Ning et al., 2020; Dash et al., 2024). Low-cost pharmacological alternatives, like topical acetic acid and vinegar wash, showed comparable efficacy to more expensive antibiotics (Vishwakarma et al., 2015; Shenoy et al., 2017). Major barriers included financial limitations, geographic isolation, and systemic gaps in provider knowledge and resources (Beaudoin et al., 2020; Khoza-Shangase et al., 2020).

Discussion: The evidence underscores the context-dependent success of interventions. Success hinged on community integration, the use of affordable and effective treatments, and technology-enhanced delivery models. Culturally appropriate, community-codesigned programs were essential for sustainability, particularly for Indigenous and marginalized populations (Gotis-graham et al., 2020).

Conclusion: Prioritizing scalable, low-cost interventions—such as CHW training, telemedicine, and task-shifted care models—is crucial for improving ENT care equity in low-income communities. Future efforts must address long-term sustainability, contextual adaptation, and the integration of community-based and specialist services.

Keywords: Otolaryngology; Low-Income Communities; Global

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Health; Healthcare Disparities; Telemedicine; Task-Shifting; Chronic Suppurative Otitis Media; Resource-Limited Settings.

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INTRODUCTION

Background

Otolaryngological (Ear, Nose, and Throat - ENT) disorders represent a significant global health burden, with their prevalence and impact being disproportionately severe in low-income and resource-constrained communities (Mulwafu et al., 2017). Conditions such as chronic suppurative otitis media (CSOM), hearing loss, and head and neck cancers are often linked to poverty, inadequate sanitation, limited access to preventive care, and delayed treatment, leading to preventable complications including permanent disability and increased mortality (Minja et al., 2006; Beaudoin et al., 2020). The World Health Organization has identified CSOM, particularly among Indigenous children, as a public health emergency, highlighting the profound health inequities that exist across socioeconomic and geographic divides (Clarke et al., 2015).

The delivery of specialized ENT care in these settings is hampered by a complex interplay of barriers, including acute shortages of trained specialists, prohibitive costs, geographic inaccessibility, and infrastructural deficits (Turrell et al., 2003; Boss et al., 2011). Furthermore, systemic issues such as low health literacy, cultural mismatches in healthcare delivery, and inadequate referral systems exacerbate these challenges, leaving vulnerable populations without timely and effective management (Gotis-graham et al., 2020; Rao et al., 2021). The COVID-19 pandemic further strained these fragile systems, disrupting services and exposing critical vulnerabilities in emergency and oncology care pathways (Yanzon et al., 2021; Gascon et al., 2021).

Research Aim

This comprehensive systematic review aims to synthesize and critically evaluate the existing evidence on the management of otolaryngology conditions within low-income, low-resource, and

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economically disadvantaged communities globally. The primary objective is to identify effective, feasible, and sustainable intervention strategies, delineate the key barriers to care, and propose evidence-based solutions to bridge the equity gap in ENT health services.

Research Benefits

The findings of this review are intended to serve multiple stakeholders. For policymakers and health planners, it provides a consolidated evidence base to inform the design and funding of equitable ENT programs. For clinicians and healthcare providers working in resource-limited settings, it offers practical insights into effective management protocols and alternative care models. For the global health community and researchers, it highlights critical gaps in knowledge and priorities for future investigation, ultimately contributing to the reduction of global ENT morbidity through improved, context-sensitive care delivery.

Hypothesis

We hypothesize that effective management of ENT conditions in low-income communities is achievable through scalable, low-cost interventions that prioritize community engagement, task-shifting to non-specialist providers, and the strategic integration of appropriate technology, rather than relying solely on traditional, resource-intensive specialist-centric models.

Research Gap

Despite the recognized burden of ENT diseases in low-income settings, the existing literature remains fragmented, with studies varying widely in design, quality, and context. Significant gaps persist in understanding the long-term sustainability and cost-effectiveness of interventions, the comparative effectiveness of different management models across diverse cultural and geographic settings, and the optimal integration of surgical innovations, such as endoscopic

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techniques, in regions like Sub-Saharan Africa where they are underreported (Mulwafu et al., 2019; Chowdhury & Das, 2021). Furthermore, there is a paucity of research focusing on the unique needs of specific vulnerable subgroups, such as homeless populations or those in humanitarian crises (Mavedatnia et al., 2023).

Novelty

This review provides a novel and holistic synthesis of a large and diverse body of evidence (80 studies) spanning multiple continents and ENT sub-specialties. Its novelty lies in its simultaneous focus on both clinical management strategies and the systemic facilitators and barriers that determine their real-world success. By integrating findings on community-based care, telemedicine, low-cost therapeutics, and surgical innovations within the overarching framework of health equity, this work moves beyond a mere clinical summary to offer a roadmap for health systems strengthening in otolaryngology for underserved populations.

METHODS

Protocol

The study strictly adhered to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines to ensure methodological rigor and accuracy. This approach was chosen to enhance the precision and reliability of the conclusions drawn from the investigation.

Criteria for Eligibility

This systematic review aims to evaluate the management of otolaryngology conditions in low-income communities.

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Screening

We screened in sources based on their abstracts that met these criteria:

- **ENT Population**: Does this study include patients with otolaryngology/ENT conditions (ear, nose, throat, head and neck disorders)?
- **Low-Resource Setting**: Was this study conducted in or does it specifically address low-income communities, low-resource settings, or economically disadvantaged populations?
- **Management Focus**: Does this study describe management, treatment, or intervention strategies for otolaryngology conditions?
- **Study Design**: Is this a primary research study (randomized controlled trial, cohort study, case-control study, cross-sectional study, case series) or a systematic review/meta-analysis?
- **Relevant Outcomes**: Does this study report clinical, economic, or implementation outcomes?
- **Setting Relevance**: Is this study NOT focused solely on high-income or well-resourced healthcare settings without relevance to low-income communities?
- **Clinical Management Component**: Is this study NOT limited to basic science, laboratory research, or pathophysiology without clinical management components?
- **Publication Quality**: Is this study NOT a case report, conference abstract, editorial, commentary, or letter without original data?

We considered all screening questions together and made a holistic judgement about whether to screen in each paper.

Search Strategy

The keywords used for this research based PICO :

Element	P (Population)	I (Intervention/Exposure)	C (Comparison/Context)	O (Outcome)
Keyword 1	Low-income	Otolaryngology	Standard care	Access to care

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	communities	management		
Keyword 2	Low-resource settings	ENT care	Conventional management	Clinical outcomes
Keyword 3	Economically disadvantaged populations	Ear nose throat treatment	Usual practice	Cost-effectiveness
Keyword 4	Resource-limited communities	Otologic intervention	In-person specialist care	Healthcare delivery improvement

The Boolean MeSH keywords inputted on databases for this research are: *("Low-income communities" OR "Low-resource settings" OR "Economically disadvantaged populations" OR "Resource-limited communities") AND ("Otolaryngology management" OR "ENT care" OR "Ear nose throat treatment" OR "Otologic intervention") AND ("Standard care" OR "Conventional management" OR "Usual practice" OR "In-person specialist care") AND ("Access to care" OR "Clinical outcomes" OR "Cost-effectiveness" OR "Healthcare delivery improvement").*

Data extraction

- **ENT Conditions**:

  Extract all otolaryngology/ENT conditions studied, including:

  - Specific diagnoses or condition categories
  - Anatomical regions affected (ear, nose, throat, head/neck)
  - Acute vs chronic conditions
  - Severity or staging if mentioned
  - Comorbidities or associated conditions

- **Population and Setting**:

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Extract details about the study population and setting to identify low-income/resource-limited contexts:

- Geographic location (country, region, urban/rural)
- Socioeconomic indicators (income level, insurance status, housing status)
- Healthcare setting (community clinics, safety net hospitals, mobile clinics, shelters)
- Population demographics (age, race/ethnicity, special populations like homeless)
- Community characteristics that indicate resource limitations

- **Management Approaches**:

  Extract all management strategies, interventions, or care approaches described:

  - Diagnostic methods or tools used
  - Treatment modalities (medical, surgical, conservative)
  - Care delivery models (community-based, mobile services, telemedicine)
  - Provider types involved (specialists, primary care, community health workers)
  - Prevention or screening strategies
  - Patient education or self-management approaches
  - Note if no specific management approach was studied

- **Outcomes and Effectiveness**:

  Extract findings related to management effectiveness and patient outcomes:

  - Clinical outcomes (symptom improvement, cure rates, complications)
  - Process outcomes (access rates, follow-up compliance, diagnostic accuracy)
  - Patient-reported outcomes (quality of life, satisfaction)
  - Cost-effectiveness or resource utilization data
  - Comparison of different management approaches
  - Long-term vs short-term results

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- **Barriers to Care**:

  Extract all identified barriers to ENT care in low-income communities:

  - Financial barriers (cost, insurance, transportation)
  - Geographic barriers (distance to providers, rural location)
  - System barriers (appointment availability, specialist access, equipment)
  - Social barriers (language, health literacy, cultural factors)
  - Provider-related barriers (knowledge gaps, training needs)
  - Patient-related barriers (competing priorities, health beliefs)

- **Facilitators and Solutions**:

  Extract factors that enabled or improved ENT care delivery:

  - Successful intervention components or care models
  - System improvements or innovations
  - Community partnerships or collaborations
  - Provider training or capacity building approaches
  - Patient education or engagement strategies
  - Policy changes or resource allocation
  - Technology solutions (telemedicine, mobile apps, portable equipment)

- **Resource Requirements**:

  Extract information about resources needed for ENT care management:

  - Staffing requirements (number, type, training level)
  - Equipment or technology needs
  - Infrastructure requirements
  - Funding or cost considerations

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- Time investments
- Community partnerships or support systems needed
- Sustainability factors for long-term implementation

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Table 1. Article Search Strategy

Database	Keywords	Hits
Pubmed	*("Low-income communities" OR "Low-resource settings" OR "Economically disadvantaged populations" OR "Resource-limited communities") AND ("Otolaryngology management" OR "ENT care" OR "Ear nose throat treatment" OR "Otologic intervention" AND "Standard care" OR "Conventional management" OR "Usual practice" OR "In-person specialist care" AND "Access to care" OR "Clinical outcomes" OR "Cost-effectiveness" OR "Healthcare delivery improvement")*	27
Semantic Scholar	*("Low-income communities" OR "Low-resource settings" OR "Economically disadvantaged populations" OR "Resource-limited communities") AND ("Otolaryngology management" OR "ENT care" OR "Ear nose throat treatment" OR "Otologic intervention") AND ("Standard care" OR "Conventional management" OR "Usual practice" OR "In-person specialist care") AND ("Access to care" OR "Clinical outcomes" OR "Cost-effectiveness" OR "Healthcare delivery improvement")*	250
Springer	*("Low-income communities" OR "Low-resource settings" OR "Economically disadvantaged populations" OR "Resource-limited communities") AND ("Otolaryngology management" OR "ENT care" OR "Ear nose throat treatment" OR "Otologic intervention") AND ("Standard care" OR "Conventional management" OR "Usual practice" OR "In-person specialist care") AND ("Access to care" OR "Clinical outcomes" OR "Cost-effectiveness" OR "Healthcare delivery improvement")*	1
Google Scholar	*("Low-income communities" OR "Low-resource settings" OR "Economically disadvantaged populations" OR "Resource-limited communities") AND ("Otolaryngology management" OR "ENT care" OR "Ear nose throat treatment" OR "Otologic intervention") AND ("Standard care" OR "Conventional management" OR "Usual practice" OR "In-person specialist care") AND ("Access to care" OR "Clinical outcomes" OR "Cost-effectiveness" OR "Healthcare delivery improvement")*	3
Wiley Online Library	*("Low-income communities" OR "Low-resource settings" OR "Economically disadvantaged populations" OR "Resource-limited communities" AND "Otolaryngology management" OR "ENT care" OR "Ear nose throat treatment" OR "Otologic intervention" AND "Standard care" OR "Conventional management" OR "Usual practice" OR "In-person specialist care") AND ("Access to care" OR "Clinical outcomes" OR "Cost-effectiveness" OR "Healthcare delivery improvement")*	4,095

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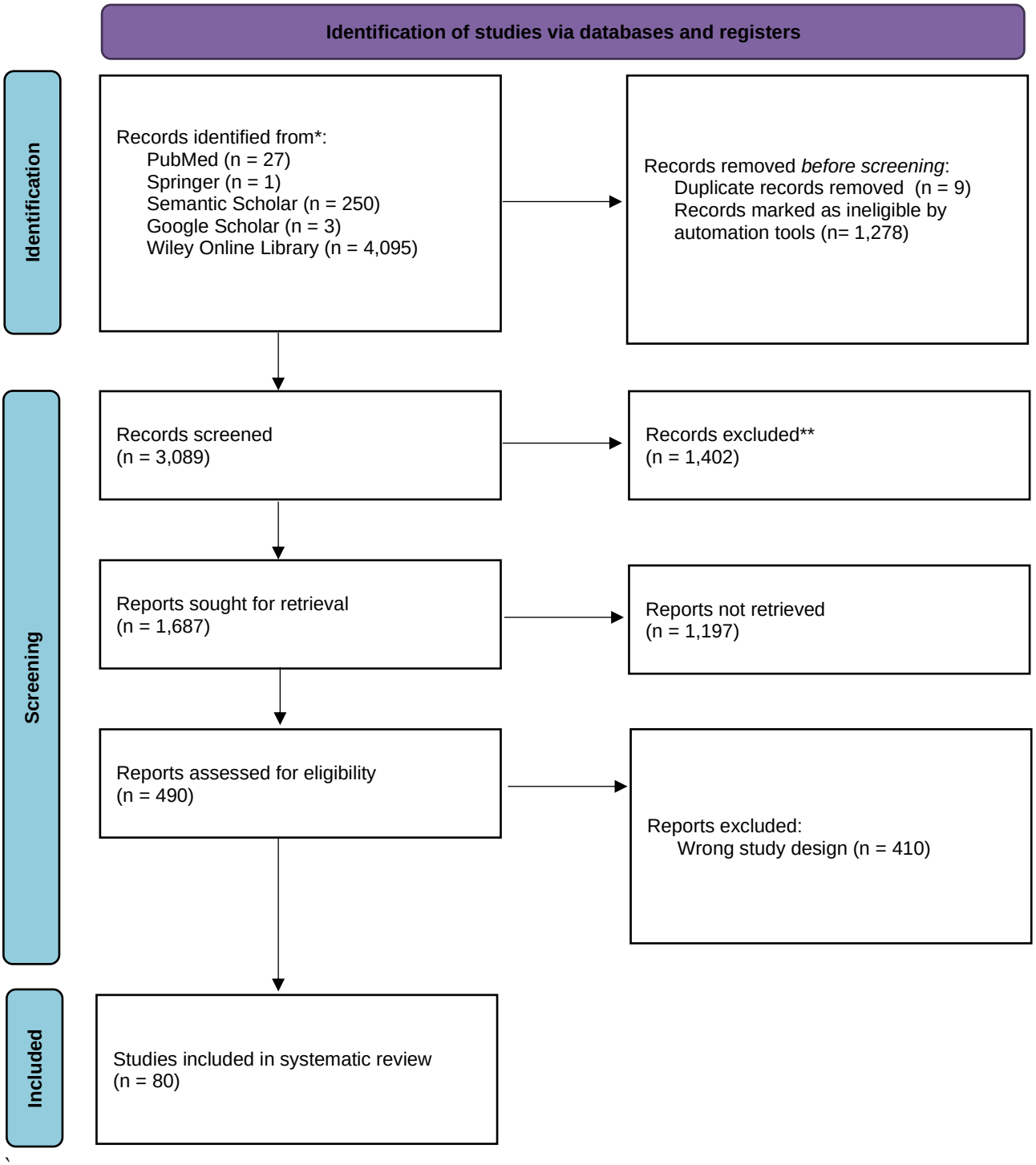


Figure 1. Article search flowchart

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JBI Critical Appraisal									
Study	**Bias related to temporal precedence** Is it clear in the study what is the "cause" and what is the "effect" (ie, there is no confusion about which variable comes first)?	**Bias related to selection and allocation** Was there a control group?	**Bias related to confounding factors** Were participants included in any comparisons similar?	**Bias related to administration of intervention/exposure** Were the participants included in any comparisons receiving similar treatment/ care, other than the exposure or intervention of interest?	**Were there multiple measurements of the outcome, both pre and post the intervention/exposure?**	**Were the outcomes of participants included in any comparisons measured in the same way?**	**Were outcomes measured in a reliable way?**	**Bias related to participant retention** Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed?	**Statistical conclusion validity** Was appropriate statistical analysis used?
Dorsa Mavedatnia et al., 2023	✓	✓	✓	✗	✓	✗	✓	✓	✓
E. Boss et al., 2011	✓	✓	✓	✗	✓	✗	✓	✓	✓
G. Turrell et al., 2003	✓	✓	✓	✗	✓	✗	✓	✓	✓

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C. B. Wood et al., 2020	✓	✓	✓	✗	✓	✗	✓	✓	✓
Susan O'Neill et al., 2024	✓	✓	✓	✗	✓	✗	✓	✓	✓
W. Mulwafu et al., 2017	✓	✓	✓	✗	✓	✗	✓	✓	✓
K. Katijah et al., 2009	✓	✓	✓	✗	✓	✗	✓	✓	✓
Anna Gotis-graham et al., 2020	✓	✓	✓	✗	✓	✗	✓	✓	✓
Shashin Khadkekar et al., 2021	✓	✓	✓	✗	✓	✗	✓	✓	✓
Susan Clarke et al., 2015	✓	✓	✓	✗	✓	✗	✓	✓	✓
Sahil Kapoor et al., 2021	✓	✓	✓	✗	✓	✗	✓	✓	✓
Karen Y Chung et al., 2022	✓	✓	✓	✗	✓	✗	✓	✓	✓
N. Justicz et al., 2019	✓	✓	✓	✗	✓	✗	✓	✓	✓
B. Minja et al., 2006	✓	✓	✓	✗	✓	✗	✓	✓	✓

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Kirti Vishwakarma et al., 2015	✓	✓	✓	✗	✓	✗	✓	✓	✓
K. Khoza-Shangase et al., 2020	✓	✓	✓	✗	✓	✗	✓	✓	✓
Sean O'Leary et al., 2024	✓	✓	✓	✗	✓	✗	✓	✓	✓
Jasmine M. Chaij et al., 2024	✓	✓	✓	✗	✓	✗	✓	✓	✓
Chhetri Ss et al., 2014	✓	✓	✓	✗	✓	✗	✓	✓	✓
Susan Clarke et al., 2019	✓	✓	✓	✗	✓	✗	✓	✓	✓
Gunay Arsoy et al., 2018	✓	✓	✓	✗	✓	✗	✓	✓	✓
S. Elzayat et al., 2021	✓	✓	✓	✗	✓	✗	✓	✓	✓
Mahmood F Bhutta et al., 2025	✓	✓	✓	✗	✓	✗	✓	✓	✓
T. Ibekwe et al., 2022	✓	✓	✓	✗	✓	✗	✓	✓	✓

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Hadi Sudrajad et al., 2024	✓	✓	✓	✗	✓	✗	✓	✓	✓
A. Chowdhury et al., 2021	✓	✓	✓	✗	✓	✗	✓	✓	✓
Sung Huhn Kim et al., 2012	✓	✓	✓	✗	✓	✗	✓	✓	✓
Christopher P. Kruglik et al., 2025	✓	✓	✓	✗	✓	✗	✓	✓	✓
Suman Khatri et al., 2024	✓	✓	✓	✗	✓	✗	✓	✓	✓
Wendy Hu et al., 2025	✓	✓	✓	✗	✓	✗	✓	✓	✓
S. Thejas et al., 2025	✓	✓	✓	✗	✓	✗	✓	✓	✓
Chinwe I. Ojimadu et al., 2025	✓	✓	✓	✗	✓	✗	✓	✓	✓
Debabrata Ray et al., 2025	✓	✓	✓	✗	✓	✗	✓	✓	✓
A. Krishna et al., 2022	✓	✓	✓	✗	✓	✗	✓	✓	✓

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Eslam Mossa Mossa Shabaka et al., 2022	✓	✓	✓	✗	✓	✗	✓	✓	✓
Y. Ramakrishnan et al., 2012	✓	✓	✓	✗	✓	✗	✓	✓	✓
A. Donaldson et al., 2009	✓	✓	✓	✗	✓	✗	✓	✓	✓
W. Mulwafu et al., 2019	✓	✓	✓	✗	✓	✗	✓	✓	✓
Supreetha B. Shenoy et al., 2017	✓	✓	✓	✗	✓	✗	✓	✓	✓
Pier-Luc Beaudoin et al., 2020	✓	✓	✓	✗	✓	✗	✓	✓	✓
Ajay Philip et al., 2013	✓	✓	✓	✗	✓	✗	✓	✓	✓
Jaskaran Singh et al., 2018	✓	✓	✓	✗	✓	✗	✓	✓	✓
Manza Maqsood et al., 2024	✓	✓	✓	✗	✓	✗	✓	✓	✓
Maryam Khan et al., 2021	✓	✓	✓	✗	✓	✗	✓	✓	✓

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Graeme B. Mulholland et al., 2015	✓	✓	✓	✗	✓	✗	✓	✓	✓
A. Ning et al., 2020	✓	✓	✓	✗	✓	✗	✓	✓	✓
Jared Goldfarb et al., 2016	✓	✓	✓	✗	✓	✗	✓	✓	✓
K. Coutts et al., 2022	✓	✓	✓	✗	✓	✗	✓	✓	✓
Alejandro Yanzon et al., 2021	✓	✓	✓	✗	✓	✗	✓	✓	✓
Michael R Moentmann et al., 2021	✓	✓	✓	✗	✓	✗	✓	✓	✓
Sunny R Shah et al., 2023	✓	✓	✓	✗	✓	✗	✓	✓	✓
F. Pond et al., 2002	✓	✓	✓	✗	✓	✗	✓	✓	✓
L. Gascon et al., 2021	✓	✓	✓	✗	✓	✗	✓	✓	✓
B. Takoutsing et al., 2024	✓	✓	✓	✗	✓	✗	✓	✓	✓

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Tiffany Chen et al., 2021	✓	✓	✓	✗	✓	✗	✓	✓	✓
K. Chorath et al., 2022	✓	✓	✓	✗	✓	✗	✓	✓	✓
Christian Deininger et al., 2024	✓	✓	✓	✗	✓	✗	✓	✓	✓
E. Frank et al., 2019	✓	✓	✓	✗	✓	✗	✓	✓	✓
C. Whiteford et al., 2016	✓	✓	✓	✗	✓	✗	✓	✓	✓
Sundip Patel et al., 2011	✓	✓	✓	✗	✓	✗	✓	✓	✓
S. Aremu et al., 2011	✓	✓	✓	✗	✓	✗	✓	✓	✓
Lana M. Saleh et al., 2024	✓	✓	✓	✗	✓	✗	✓	✓	✓
Khanh K. Nguyen et al., 2019	✓	✓	✓	✗	✓	✗	✓	✓	✓
B. Faizal et al., 2020	✓	✓	✓	✗	✓	✗	✓	✓	✓
Shambavi J. Rao et al., 2021	✓	✓	✓	✗	✓	✗	✓	✓	✓

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Carolyn A Macfadyen et al., 2005	✓	✓	✓	✗	✓	✗	✓	✓	✓
M. Bhutta et al., 2018	✓	✓	✓	✗	✓	✗	✓	✓	✓
Maria Athina Tsitsika et al., 2024	✓	✓	✓	✗	✓	✗	✓	✓	✓
M. Adham et al., 2022	✓	✓	✓	✗	✓	✗	✓	✓	✓
E. Fisher et al., 2021	✓	✓	✓	✗	✓	✗	✓	✓	✓
Yousseria Elsayed Yousef et al., 2015	✓	✓	✓	✗	✓	✗	✓	✓	✓
A. Masood et al., 2008	✓	✓	✓	✗	✓	✗	✓	✓	✓
Michael P. Avillion et al., 2023	✓	✓	✓	✗	✓	✗	✓	✓	✓
H. I. Farrukh et al., 2024	✓	✓	✓	✗	✓	✗	✓	✓	✓
H. Szőke et al., 2016	✓	✓	✓	✗	✓	✗	✓	✓	✓

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G. Dash et al., 2024	✓	✓	✓	✗	✓	✗	✓	✓	✓
Anisha Puri et al., 2022	✓	✓	✓	✗	✓	✗	✓	✓	✓
Madeleine St. Peter et al., 2021	✓	✓	✓	✗	✓	✗	✓	✓	✓
S. Bukhari et al., 2021	✓	✓	✓	✗	✓	✗	✓	✓	✓
Poornima Kabadar et al., 2022	✓	✓	✓	✗	✓	✗	✓	✓	✓

RESULTS

Characteristics of Included Studies

This systematic review encompasses 80 sources examining the management of otolaryngology conditions in low-income communities across diverse geographic and clinical settings. Studies varied considerably in design, population focus, and intervention type.

Study	ENT Condition	Setting/Population
Dorsa Mavedatnia et al., 2023	Nasal trauma, chronic rhinosinusitis, dysphonia, hearing loss, head/neck lesions	Homeless populations in shelters
E. Boss et al.,	Pediatric sleep-disordered breathing	United States,

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Study	ENT Condition	Setting/Population
2011		racial/ethnic minorities
G. Turrell et al., 2003	Otitis media	Rural and remote Australia
C. B. Wood et al., 2020	Head and neck conditions (ultrasound training)	Semirural Kenya, LMIC
Susan O'Neill et al., 2024	Respiratory tract infections, otitis media, ear disease	Rural and remote regions
W. Mulwafu et al., 2017	CSOM, impacted wax, hearing disorders	Thyolo district, Malawi, rural
K. Katijah et al., 2009	Ototoxicity, hearing loss	South Africa, Gauteng
Anna Gotis-graham et al., 2020	Otitis media, CSOM, hearing loss	Aboriginal and Torres Strait Islander communities, Australia
Shashin Khadkekar et al., 2021	CSOM attico-antral type	India, lower socioeconomic group
Susan Clarke et al., 2015	CSOM	Jumla, Nepal, rural
Sahil Kapoor et al., 2021	Foreign bodies, tracheostomy, head/neck cancer	India
Karen Y Chung et al., 2022	Cleft lip and/or palate	LMICs broadly
N. Justicz et al., 2019	Ear reconstruction	Haiti, LMIC

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Study	ENT Condition	Setting/Population
B. Minja et al., 2006	CSOM	Dar es Salaam, Tanzania
Kirti Vishwakarma et al., 2015	CSOM safe type	Not specified
K. Khoza-Shangase et al., 2020	Ototoxicity from TB treatment	Rural Eastern Cape, South Africa
Sean O'Leary et al., 2024	CSF leaks	LMICs broadly
Jasmine M. Chaij et al., 2024	Craniofacial conditions	India, Niger, Nigeria, Vietnam, Syria
Chhetri Ss et al., 2014	Acute otitis media	Resource-limited primary care
Susan Clarke et al., 2019	CSOM, acute otitis media	Jumla, Nepal, remote rural
Gunay Arsoy et al., 2018	Allergic rhinitis	Northern Cyprus
S. Elzayat et al., 2021	Chronic otitis media	Egypt, university hospital
Mahmood F Bhutta et al., 2025	CSOM	Solomon Islands, Indigenous population
T. Ibekwe et al., 2022	Otitis media with effusion	Abuja, Nigeria
Hadi Sudrajad et al., 2024	CSOM non-cholesteatoma	Indonesia

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Study	ENT Condition	Setting/Population
A. Chowdhury et al., 2021	Chronic otitis media	Developing countries
Sung Huhn Kim et al., 2012	Sleep-disordered breathing	Facility without PICU
Christopher P. Kruglik et al., 2025	Ear and hearing conditions	Tanzania, low-resource
Suman Khatri et al., 2024	COM mucosal active	Nepal
Wendy Hu et al., 2025	Otitis media with effusion	Aboriginal/Torres Strait Islander children
S. Thejas et al., 2025	Acute otitis externa	South India, rural
Chinwe I. Ojimadu et al., 2025	OME with adenotonsillar hypertrophy	Nigeria
Debabrata Ray et al., 2025	CSOM	Western Uttar Pradesh, India
A. Krishna et al., 2022	Thyroid nodules	LMIC tertiary center
Eslam Mossa Mossa Shabaka et al., 2022	Acute bacterial rhinosinusitis	Egypt
Y. Ramakrishnan et al., 2012	Airway emergencies	Tertiary center
A. Donaldson et al.,	CSOM	Remote Indigenous

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Study	ENT Condition	Setting/Population
2009		Queensland
W. Mulwafu et al., 2019	CSOM	Sub-Saharan Africa
Supreetha B. Shenoy et al., 2017	CSOM with chronic otorrhea	Not specified, cost-constrained
Pier-Luc Beaudoin et al., 2020	Head and neck cancer	LMICs, mostly India
Ajay Philip et al., 2013	Otomycosis	Vellore, India, developing country
Jaskaran Singh et al., 2018	Malignant otitis externa	North India, tertiary care
Manza Maqsood et al., 2024	CSOM	Pakistan, low SES
Maryam Khan et al., 2021	Acute otitis externa	Peshawar, Pakistan
Graeme B. Mulholland et al., 2015	IgG4-related disease	Asia, predominantly Japan
A. Ning et al., 2020	Various ENT conditions	Telemedicine settings
Jared Goldfarb et al., 2016	Eosinophilic granulomatosis with polyangiitis	Not specified
K. Coutts et al., 2022	Head and neck cancer	Africa (Tanzania, South Africa, Uganda,

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Study	ENT Condition	Setting/Population
		Nigeria)
Alejandro Yanzon et al., 2021	Head and neck emergencies	COVID-19 pandemic context
Michael R Moentmann et al., 2021	Peritonsillar abscess, nasal fractures	Telemedicine settings
Sunny R Shah et al., 2023	Various ENT conditions	Telehealth settings
F. Pond et al., 2002	Acute otitis externa	Royal Victoria Eye and Ear Hospital
L. Gascon et al., 2021	Head and neck cancer	COVID-19 pandemic context
B. Takoutsing et al., 2024	Sellar/parasellar masses	LMICs
Tiffany Chen et al., 2021	Eosinophilic otitis media	Not specified
K. Chorath et al., 2022	Head and neck cancer, tonsillectomy, sinus surgery	ERAS protocols
Christian Deininger et al., 2024	Cranio-maxillofacial fractures	LMICs, 137 countries
E. Frank et al., 2019	In-office ENT procedures	Not specified
C. Whiteford et al., 2016	Chronic ENT complaints	General/acute care settings

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Study	ENT Condition	Setting/Population
Sundip Patel et al., 2011	Otitis media	Urban tertiary care, US
S. Aremu et al., 2011	Various surgical conditions	Nigeria, teaching hospital
Lana M. Saleh et al., 2024	OME post-radiotherapy	Eastern Asia
Khanh K. Nguyen et al., 2019	Outpatient ENT surgery	Tertiary academic hospital
B. Faizal et al., 2020	Ménière's disease	Outpatient setting
Shambavi J. Rao et al., 2021	Pediatric ENT conditions	Spanish-speaking populations
Carolyn A Macfadyen et al., 2005	CSOM	Children
M. Bhutta et al., 2018	CSOM	Community settings
Maria Athina Tsitsika et al., 2024	Head and neck tumors, OSA	Greece, urban centers
M. Adham et al., 2022	Head and neck cancer	COVID-19 pandemic context
E. Fisher et al., 2021	Rhinosinusitis, COVID-19 manifestations	Various settings
Yousseria Elsayed	CSOM	Assiut, Egypt

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Study	ENT Condition	Setting/Population
Yousef et al., 2015		
A. Masood et al., 2008	Acute otitis externa	Not specified
Michael P. Avillion et al., 2023	Otologic procedures	Training setting
H. I. Farrukh et al., 2024	ENT procedures during COVID-19	Pandemic context
H. Szőke et al., 2016	COME, adenoid hypertrophy	Pediatric practice
G. Dash et al., 2024	Ear diseases	Community and hospital
Anisha Puri et al., 2022	Postoperative sore throat	Middle ear surgery patients
Madeleine St. Peter et al., 2021	Post-laryngectomy anosmia	Not specified
S. Bukhari et al., 2021	Acute otitis externa	Pakistan Naval Ship Shifa Karachi
Poornima Kabadar et al., 2022	Acute otitis externa	India, tertiary care

The included studies represent a broad geographic distribution with significant representation from Sub-Saharan Africa (Malawi, Tanzania, Nigeria, South Africa, Kenya), South Asia (India, Nepal, Pakistan), the Pacific region (Solomon Islands, Australia), and other LMICs. Chronic suppurative otitis media emerged as the most frequently studied

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condition, appearing in over 25 studies. Study designs ranged from randomized controlled trials to systematic reviews, observational studies, and quality improvement projects.

Conditions Studied and Prevalence

Chronic Suppurative Otitis Media

CSOM represented the most commonly studied condition, with the World Health Organization classifying rates in Indigenous Australian children as constituting a public health emergency . In Jumla, Nepal, baseline CSOM prevalence was 11.2% , while studies from India found the majority of patients belonged to lower socioeconomic groups . The condition disproportionately affects children living in poverty, with social determinants including low parental education, overcrowding, poor hygiene, and malnutrition playing significant roles .

Other Otologic Conditions

Acute otitis media was common in children under 15 years (64.7%) and frequently associated with recent upper respiratory tract infections (88.23%) . Otitis media with effusion was studied in Aboriginal and Torres Strait Islander children and in patients following nasopharyngeal carcinoma treatment . Hearing loss from ototoxic tuberculosis medications affected 63% of participants in one South African study , while otomycosis was identified as a recurrent tropical disease contributing to significant morbidity .

Head and Neck Conditions

Head and neck cancers presented unique challenges in LMICs, with surgical resection remaining the primary intervention while chemotherapy and radiation services remained limited . Barriers to care for these patients included low education levels, low socioeconomic status, and lack of knowledge about the disease . Cleft lip and/or palate care in LMICs was found to be cost-effective at thresholds of 51% of GDP per capita .

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Management Approaches

Community-Based Interventions and Task-Shifting

Intervention Type	Setting	Provider	Key Components	Outcomes
CHW training in ear care	Malawi, rural	Community health workers	3-day training, otoscopy, referral	Knowledge improved 55% to 68% , 1739 patients identified
Women's group education	Nepal, rural	Trained research assistants	WHO ear care training, interactive sessions	CSOM prevalence reduced 11.3% to 7.1%
ENT outreach programs	Australia, Indigenous	Specialists with community workers	Telemedicine, surgical outreach	Improved middle ear health, reduced wait times
Smartphone-based training	Tanzania	Primary healthcare workers	Self-led modules, in-person workshops	Significant improvement in EHC skills
Pharmacist-led education	Northern Cyprus	Community pharmacists	AR management, nasal spray technique	Significant improvement in QoL

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Intervention Type	Setting	Provider	Key Components	Outcomes
Maternal education program	Egypt	Researchers	Antibiotic use, ear cleaning, environment	Complete cure rates 32-84% over 6 months

Community-based programs demonstrated particular promise in resource-limited settings. Training community health workers in primary ear and hearing care proved feasible and acceptable in Malawi, with CHWs successfully identifying 1,739 patients with potential ear and hearing disorders . The average cost of training one CHW was $189 , making this approach economically viable for scale-up. A key success factor was integration with existing community structures and involvement of village heads in identification and referral processes .

In Nepal, participatory interventions through women's self-help groups showed that while the intervention itself did not significantly improve outcomes compared to controls, the overall presence of researchers offering treatment and providing ciprofloxacin drops to local health posts was associated with significant reductions in CSOM prevalence . This suggests that simply increasing access to basic treatment can produce measurable population-level benefits.

Telemedicine and Technology Solutions

Technology	Application	Diagnostic Accuracy	Key Findings
Telemedicine-enabled otoscopes	Ear disease screening	Sensitivity 82%, specificity 95%	CHWs achieved 80% sensitivity, 97% specificity
Remote otoscopy	Various otologic conditions	Most well-supported telemedical	91% of studies found effective

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Technology	Application	Diagnostic Accuracy	Key Findings
		intervention	
WhatsApp Messenger	Surgical training, patient screening	Test scores improved 24.6% to 86.9%	Rated highly important by participants
Telehealth for ENT	Diagnosis and management	86.2% diagnostic, 91.5% management accuracy	Kappa 0.8 for interrater reliability
Videoconference technology	ENT outreach	Not specified	Reduced waiting times and costs

Telemedicine demonstrated substantial potential for expanding ENT care access. Telemedicine-enabled otoscopes showed 82% sensitivity and 95% specificity for ear disease diagnosis , with community health workers achieving comparable accuracy (80% sensitivity, 97% specificity) . Video-otoscopy emerged as the most well-supported telemedical intervention for reducing physical contact while maintaining care quality . Telehealth facilitators played a key role in achieving high-quality services .

The COVID-19 pandemic accelerated telemedicine adoption, with systematic reviews finding diagnostic concordance above 80% when comparing telehealth to in-person visits . Mobile platforms like WhatsApp proved valuable for surgical training in LMICs, enabling premodule patient screening, real-time discussion, and postmodule review .

Pharmacological Treatments for CSOM

Treatment	Comparator	Outcome Measure	Results	Cost Considerations
Boric acid +	Dry mopping	Dry ears at 3-	54-56% vs	Low cost

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Treatment	Comparator	Outcome Measure	Results	Cost Considerations
dry mopping	alone	4 months	31%	
Topical acetic acid 1.5%	Topical gentamicin 0.3%	Treatment success	92% vs 88%	Rs.102.94 vs Rs.160.25
Vinegar wash	Culture-based oral antibiotics	Ear dryness at 3 weeks	68.33% vs 81.67%	Lower cost alternative
Topical ciprofloxacin	Topical + oral ciprofloxacin	Initial cure	Equivalent effectiveness	Higher recurrence with topical alone
Topical chloramphenicol	Oral amoxicillin or combination	Discharge resolution	77% vs 69% vs 80%	No significant difference
Zinc supplementation	Placebo	MPO levels, otorrhea	Significant reduction in MPO	Not specified

Treatment studies consistently demonstrated that simple, low-cost interventions could achieve comparable outcomes to more expensive alternatives. Dry mopping combined with boric acid in alcohol ear drops was significantly more effective than dry mopping alone for CSOM (54-56% vs 31% dry ears) , with no increased risk of sensorineural hearing loss . Topical acetic acid showed equivalent efficacy to gentamicin (92% vs 88% treatment success) at approximately two-thirds the cost .

Vinegar wash, while slightly less effective than culture-based oral antibiotic therapy (68.33% vs 81.67% ear dryness), offered a substantially cheaper alternative for long-term CSOM management . The study specifically noted that vinegar could address Pseudomonas

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infections (96.2% resolution) and provided a sustainable option given emerging antibiotic resistance .

Surgical Interventions

Endoscopic trans-canal myringoplasty achieved high graft closure rates (88.3%) with mean air-bone gap gain of 9.8 , though the technique had not been reported in Sub-Saharan Africa despite its potential for surgical management of CSOM in the region . Comparison of endoscopic versus microscopic tympanoplasty showed equivalent hearing improvement and graft uptake, but endoscopic surgery significantly reduced operative duration and post-operative hospital stay, thereby reducing economic burden .

For otitis media with effusion, adenotonsillectomy alone resolved OME in 53% of ears at 6 weeks in children with concurrent adenotonsillar hypertrophy , suggesting potential for reducing surgical morbidity and healthcare costs by eliminating additional procedures . The EarPopper device for physiologic management of OME demonstrated 81.3% improvement rates in an African clinical trial .

Barriers to Care

Financial and Geographic Barriers

Barrier Category	Specific Barriers Identified	Sources
Financial	Lack of transportation , treatment costs , insurance status , out-of-pocket expenses	Multiple LMICs
Geographic	Rural/remote location , distance to providers , limited specialist access	Australia, Nepal, Africa

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Barrier Category	Specific Barriers Identified	Sources
System	Appointment availability , equipment shortages , waiting times , specialist shortages	Multiple settings
Social	Low health literacy , cultural factors , language barriers	Indigenous communities, LMICs
Provider	Knowledge gaps , training needs , lack of guidelines awareness	Multiple settings

Financial barriers manifested across multiple dimensions. In India, the cost difference between acetic acid (Rs.102.94) and gentamicin (Rs.160.25) treatment represented a meaningful burden for patients . Transportation costs to health facilities were identified as barriers in Malawi and for homeless populations . Insurance disparities in the United States resulted in differential access to adenotonsillectomy, with privately insured children more likely to receive surgical intervention .

Geographic barriers particularly affected Indigenous communities in Australia, where long wait times for audiology testing and ENT services combined with limited availability of services in rural and remote areas . In Jumla, Nepal, geographical isolation contributed to care access challenges despite the theoretical availability of services .

Provider and System Barriers

Only 33.3% of ENT specialists and 15.7% of community pharmacists were aware of the ARIA guidelines for allergic rhinitis management in Northern Cyprus , illustrating significant knowledge gaps among providers. In Africa, head and neck cancer management

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was hampered by limited availability of radiotherapy services, long waiting times for radiation, and limited access to chemotherapy . The lack of skilled medical and rehabilitative staff further compounded these challenges .

For ototoxicity monitoring in tuberculosis patients, no participants had been referred to an audiologist or ENT specialist despite 63% reporting auditory symptoms since commencing treatment . None were enrolled in any ototoxicity monitoring program , reflecting systematic failures in care coordination.

Cultural and Social Barriers

Aboriginal and Torres Strait Islander communities faced culturally inappropriate services and unfamiliar health system processes . Community involvement in program planning and delivery was often limited . In Nepal, social determinants including low parental education, lack of knowledge, overcrowding, poor hygiene, and malnutrition created complex barriers to care . Competing priorities and disempowerment further limited healthcare seeking .

Spanish-language patient-reported outcome measures in pediatric otolaryngology were found to be above recommended reading levels, potentially limiting their utility for families with lower literacy .

Facilitators and Solutions

Successful Implementation Strategies

Strategy	Evidence of Effectiveness	Resource Requirements
CHW training programs	Feasible and acceptable; improved identification	$189 per CHW trained
Telemedicine integration	Reduced wait times and	Technology infrastructure

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Strategy	Evidence of Effectiveness	Resource Requirements
	costs	
One-stop clinics	Reduced visits, costs, improved satisfaction	Reorganization of services
Low-cost treatment alternatives	Comparable efficacy at lower cost	Minimal additional resources
Simulation-based training	Improved confidence and skills	Low-cost materials
Community codesign	Improved program sustainability	Community partnerships

Community health worker programs demonstrated particular success when they included structured training curricula based on WHO resources, involvement of ENT specialists in training, provision of appropriate diagnostic tools (such as Arclight otoscopes), and integration with village leadership structures . The intervention was perceived as feasible and acceptable in Malawi .

One-stop thyroid clinics in LMICs significantly reduced outpatient visits (1 vs 3 days), waiting times for ultrasonography (1 vs 3 days) and fine needle aspiration cytology (1 vs 2 days), and out-of-pocket expenditure (INR 3,965 vs 6,624) . Patient satisfaction was significantly higher in the one-stop model .

Technology-Enabled Solutions

Smartphone-based learning combined with in-person training effectively enhanced practical ear and hearing care skills among primary healthcare workers in Tanzania, supporting task-shifting in low-resource settings . The model demonstrated scalability potential given rising smartphone access in Africa . However, participants identified ongoing gaps in interpreting audiological tests, highlighting the need for continued hands-on training .

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Digital platforms for surgical education, including video-based teaching and 3D modeling for device printing, were proposed as solutions for craniofacial care in LMICs . Low-cost simulation training using readily available clinic supplies proved effective for improving provider comfort and clinical performance in otologic procedures .

Nurse-Led and Task-Shifted Care Models

Nurse-led ENT clinics demonstrated higher patient satisfaction, shorter waiting times, lower pain/discomfort levels, and cost-effectiveness compared to physician-led clinics. Nurses with specialized training provided longer consultation times and educated patients on ear care to prevent chronic conditions from becoming acute. This model allowed medical staff to focus on complex cases while expanding overall service capacity.

Outcomes and Effectiveness

Clinical Outcomes Summary

Intervention Category	Representative Outcome	Effect Size
CHW ear care training	Knowledge improvement	55% to 68% correct answers
Women's group education	CSOM prevalence	Reduced 11.3% to 7.1% overall
Topical antiseptics for CSOM	Dry ears at 3-4 months	54-56% with boric acid
Telemedicine diagnosis	Diagnostic accuracy	86.2% concordance
Maternal education	Complete cure rates	32-84% over 6 months
Intratympanic steroids for EOM	Success rate	45%

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Across studies, interventions generally demonstrated positive effects on clinical outcomes, though methodological quality varied. Community health worker training in Malawi resulted in identification of 1,739 patients with potential ear and hearing disorders, with 400 confirmed to have hearing loss . The maternal education program in Egypt showed progressive improvement in cure rates from 32% at one month to 84% at six months .

For pharmacological interventions, treatment with dry mopping and boric acid in alcohol ear drops was significantly better than dry mopping alone, and adding amoxicillin did not improve outcomes . Hearing thresholds remained the same or improved after treatment, and the potential risk of sensorineural hearing loss from boric acid was not confirmed .

Cost-Effectiveness Findings

Primary cleft lip/palate repair was cost-effective at the threshold of 51% of GDP per capita across all LMICs studied . One-stop thyroid clinics reduced out-of-pocket expenditure by approximately 40% compared to standard care . Medicated ribbon gauze for acute otitis externa required fewer outpatient visits (two vs three) with considerably less material and labor costs than ear wicks, while achieving similar resolution rates (70% vs 64%) .

Endoscopic tympanoplasty reduced the economic burden on patients through shorter surgical duration and post-operative hospital stay compared to microscopic approaches . Intratympanic gentamicin for Ménière's disease was described as a "simple, cheap treatment that can be carried out in an out-patient setting" .

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Synthesis

Reconciling Heterogeneous Findings

The evidence base for ENT management in low-income communities shows consistent themes despite methodological heterogeneity across studies. Three key patterns emerge that explain variations in reported outcomes:

Context-Specific Effectiveness : Interventions show differential effectiveness based on implementation context. Community health worker training was highly successful in Malawi where training was structured, integrated with community leadership, and supported by specialist oversight . In contrast, the women's group intervention in Nepal showed no significant difference from controls, though the overall presence of research teams and treatment availability produced population-level improvements . The critical difference appears to be the extent of active case-finding and treatment provision rather than education alone.

Treatment Equivalence for Low-Cost Alternatives : Multiple RCTs demonstrate that inexpensive treatments achieve comparable outcomes to more expensive alternatives. Acetic acid matched gentamicin for CSOM treatment success (92% vs 88%) . Vinegar wash achieved acceptable ear dryness rates compared to culture-directed antibiotics (68% vs 82%) . Glycerine-ichthammol dressing matched antibiotic dressing for severe acute otitis externa . This convergence suggests that cost should not be a barrier to effective treatment when simple alternatives are available.

Technology-Enhanced Care Delivery : Telemedicine and digital health solutions consistently show positive results, with diagnostic accuracy above 80% in multiple studies . However, the evidence base is strongest for video-otoscopy and remote consultation , while more complex procedures still require in-person evaluation. The scalability of these solutions is supported by rising smartphone access, particularly in Africa .

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Population-Specific Considerations

Indigenous populations in Australia and the Pacific require culturally appropriate service design with community codesign and local capacity building as essential components . Programs that failed to involve Aboriginal and Torres Strait Islander people in planning and delivery showed limited sustainability . Similarly, interventions in Nepal were more effective when integrated with existing community structures like women's self-help groups .

Pediatric populations face particular challenges, with children from socioeconomically disadvantaged backgrounds showing higher CSOM prevalence and greater risk for complications . Maternal education programs demonstrated effectiveness for this population, with compliance rates improving over time and correlating with improved cure rates .

Resource Allocation Implications

The evidence supports prioritizing investment in:

1. Community health worker training programs at approximately $189 per worker , which enable identification and basic management of common ear conditions
2. Telemedicine infrastructure for specialist consultation, which reduces wait times and costs while maintaining diagnostic accuracy
3. Low-cost treatment protocols (boric acid, acetic acid, vinegar) that achieve comparable outcomes to expensive alternatives
4. Task-shifting to nurse-led and pharmacist-led models for chronic condition management

The primary gaps in evidence relate to long-term sustainability of interventions, comparative effectiveness across different LMIC contexts, and optimal integration of community-based and specialist services. Studies from Sub-Saharan Africa notably did not report on endoscopic myringoplasty despite its potential for the region , suggesting geographic disparities in available surgical techniques that warrant further investigation.

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DISCUSSION

This systematic review reveals a compelling yet complex landscape of ENT care in low-income communities, characterized by significant challenges but also demonstrable successes through innovative, adaptive approaches. The discussion synthesizes these findings, interpreting their implications for practice, policy, and future research.

The Pervasive Burden of CSOM and Social Determinants of Health

The overwhelming focus on Chronic Suppurative Otitis Media (CSOM) across the included studies is a stark indicator of its status as a disease of poverty. High prevalence rates, such as 11.2% in rural Nepal, are not merely clinical statistics but reflections of deeper social inequities (Clarke et al., 2015). The strong association with low parental education, overcrowding, poor hygiene, and malnutrition underscores that effective management cannot be confined to the clinic; it must be integrated with public health initiatives addressing these fundamental determinants (Minja et al., 2006). The success of interventions like women's group education in Nepal, which led to a reduction in CSOM prevalence, points to the potential of empowering communities with knowledge and simple resources, even if the specific educational component showed a more modest effect size (Clarke et al., 2019). This reinforces the principle that engaging with the social context is not ancillary but central to sustainable ENT care.

Reconciling Intervention Effectiveness: Context is Key

A critical finding of this review is the **context-specific effectiveness** of interventions. For instance, community health worker (CHW) training in Malawi was highly successful, leading to the identification of over 1,700 patients with ear and hearing issues, due to its structured curriculum, integration with village leadership, and specialist support (Mulwafu et al., 2017). In contrast, a participatory women's group intervention in Nepal showed no significant difference from the control group in its primary analysis, though the overall research presence and provision of treatment yielded population-level benefits (Clarke et al., 2019). This divergence highlights that the

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mere presence of a community-oriented program is insufficient; its design, integration with local power structures, and active provision of tangible services (like medication or referral pathways) are decisive factors for impact.

The Promise of Task-Shifting and Low-Cost Alternatives

The evidence strongly supports **task-shifting** as a viable and effective strategy. Training CHWs and nurses in basic ENT care can dramatically expand access, alleviate specialist shortages, and improve patient satisfaction and efficiency (Whiteford et al., 2016; Mulwafu et al., 2017). Equally important is the robust evidence for **treatment equivalence of low-cost alternatives**. Multiple RCTs demonstrate that inexpensive options like topical acetic acid for CSOM, vinegar wash, and glycerine-ichthammol for acute otitis externa achieve clinical outcomes comparable to more expensive antibiotic treatments (Vishwakarma et al., 2015; Shenoy et al., 2017; Masood et al., 2008). This has profound implications for formulary development and procurement in low-resource settings, suggesting that cost should not be a barrier to effective first-line therapy. The cost-effectiveness of primary cleft repair and one-stop thyroid clinics further demonstrates that streamlining care delivery can reduce both patient expenditure and system burden (Chung et al., 2022; Krishna et al., 2022).

Telemedicine and Digital Health: A Scalable Bridge, Not a Panacea

The acceleration of **telemedicine** adoption, particularly during the COVID-19 pandemic, presents a major opportunity. High diagnostic concordance rates (exceeding 80% in meta-analyses) for conditions amenable to visual inspection, such as otitis externa, validate its use for triage, follow-up, and specialist consultation in remote areas (Ning et al., 2020; Shah et al., 2023). Tools like telemedicine-enabled otoscopes can empower frontline workers (Dash et al., 2024). However, the evidence also indicates limits; telemedicine is best suited for diagnosis and management of select conditions, while complex assessments and surgical procedures remain reliant on in-person

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care. The digital divide—unequal access to smartphones and reliable internet—also remains a critical barrier to equitable implementation (Kruglik et al., 2025).

Surgical Innovations and Persistent Geographic Disparities

Surgical management in LMICs faces unique hurdles, yet innovations show promise. Endoscopic tympanoplasty, for example, offers advantages such as reduced operative time and hospital stay compared to microscopic approaches, thereby lowering the economic burden on patients and systems (Chowdhury & Das, 2021). However, a striking finding is the noted absence of reports on endoscopic trans-canal myringoplasty from Sub-Saharan Africa, despite its potential relevance (Mulwafu et al., 2019). This highlights a **geographic disparity in surgical technology diffusion** and underscores the need for targeted training, equipment donation, and context-appropriate innovation to ensure advanced techniques benefit those in regions with the greatest need.

Overcoming Multifaceted Barriers: A Systems Approach

The barriers identified are deeply entrenched and interconnected. **Financial and geographic barriers** (cost, transportation, distance) prevent initial access (Boss et al., 2011). **System and provider barriers**—including equipment shortages, long wait times, limited radiotherapy/chemotherapy for cancer, and critical knowledge gaps among both specialists and primary care providers about guidelines—hinder effective treatment once access is gained (Beaudoin et al., 2020; Arsoy et al., 2018; Khoza-Shangase et al., 2020). **Social and cultural barriers**, such as low health literacy, culturally inappropriate services, and language barriers, further disenfranchise populations like Indigenous Australians and non-native speakers (Gotis-graham et al., 2020; Rao et al., 2021). Addressing these requires a multifaceted, systems-strengthening approach that combines financial protection schemes, infrastructure investment, continuous professional development, and community codesign of services.

The Imperative of Community Engagement and Cultural Safety

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For interventions to be sustainable, they must be culturally safe and community-owned. Studies involving Aboriginal and Torres Strait Islander communities clearly show that programs failing to involve Indigenous people in planning and delivery have limited impact and sustainability (Gotis-graham et al., 2020). Similarly, the importance of working through existing community structures, like women's self-help groups in Nepal, cannot be overstated. This principle of **community codesign** ensures that interventions are respectful, relevant, and trusted, thereby improving uptake and long-term success.

Implications for Resource Allocation and Future Research

The synthesized evidence provides clear guidance for prioritization. Investment should be directed towards: 1) Scaling up **CHW and nurse training programs**, 2) Developing **telemedicine infrastructure** for consultation and mentoring, 3) Promoting **low-cost treatment protocols** in national guidelines, and 4) Establishing **streamlined, one-stop care models** for chronic conditions.

Future research must address persistent gaps: conducting **longitudinal studies** on the sustainability of community-based interventions, executing **comparative effectiveness research** across different LMIC contexts, exploring **implementation science** strategies to overcome local barriers, and actively investigating the transfer and adaptation of **surgical innovations** to underserved regions like Sub-Saharan Africa.

CONCLUSION

This comprehensive systematic review consolidates evidence from 80 studies to illuminate the state of otolaryngology care in low-income communities. The findings conclusively demonstrate that the high burden of ENT diseases, led by chronic suppurative otitis media, is intrinsically linked to poverty and social disadvantage. Despite formidable barriers—financial, geographic, systemic, and cultural—effective management is achievable through context-adapted, innovative strategies.

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Key effective approaches include the delegation of basic ENT tasks to trained community health workers and nurses; the adoption of simple, low-cost topical treatments that are as effective as more expensive antibiotics; and the strategic use of telemedicine to extend specialist reach. The success of any intervention is profoundly influenced by the degree of community engagement and cultural safety integrated into its design and delivery.

Recommendations:

1. **For Policymakers and Funders:** Prioritize and fund the scale-up of community health worker programs in ENT, invest in telemedicine infrastructure, and revise essential medicine lists to include proven low-cost alternatives like acetic acid.
2. **For Health Systems and Planners:** Implement integrated, one-stop care models for chronic conditions and develop referral networks that link community-based screening with specialist centers.
3. **For Clinicians and Educators:** Incorporate training on low-resource ENT management and telemedicine into curricula for both specialists and primary care providers working in or serving LMIC contexts.
4. **For Researchers:** Focus future studies on the long-term sustainability of interventions, head-to-head comparisons of care delivery models in different settings, and strategies for translating surgical innovations into sustainably implemented practices in the most resource-constrained regions.

Ultimately, advancing equity in global otolaryngology requires a committed shift from a solely specialist-dependent paradigm to a decentralized, community-empowered, and technology-enhanced model of care that is both effective and resilient within the realities of low-resource settings.

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