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Original Research Article

Otitis Media and Upper Respiratory Infection Health Loss in 11 Current ASEAN Member States, 1990–2023

Imanuel Simbolon[1,*], Muhammad Rusli[2], Moon Kaeun[3]

[1]*Department of Public Health, CMHC Research Center, Palembang, Indonesia*
[2]*Department of Radiology, Al Bayan Medical Center, Kendari, Indonesia*
[3]*Department of Family Medicine, Rarotonga Medical Center, Rarotonga, Cook Islands*

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***Corresponding author:**
Imanuel Simbolon
E-mail:
imanuel.simbolon@cattleyacenter.id
ORCID: *0009-0007-8812-0486*

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ABSTRACT

Background: Otitis media and upper respiratory infections (URIs) are distinct Global Burden of Disease (GBD) causes but form a clinically relevant comparative pair for otorhinolaryngology.

Objective: To quantify their health loss in 11 current ASEAN member states.

Methods: We analysed GBD 2023 estimates for both sexes from 1990 to 2023. Outcomes were all-age disability-adjusted life-year (DALY) numbers, age-standardized DALY rates, and DALY numbers and rates at ages 0–14 years. Country-specific estimated annual percentage changes (EAPCs) used log-linear regression with Newey–West 95% confidence intervals. Analyses were descriptive and non-causal.

Results: The sum of 11 national URI DALY point estimates increased from 372,296 in 1990 to 476,741 in 2023 (+28.1%), while the unweighted cross-country median age-standardized rate fell 10.9% to 66.2 per 100,000. Otitis media DALYs increased from 175,399 to 191,971 (+9.4%), while the corresponding median rate fell 19.7% to 29.0 per 100,000. All 22 country-cause EAPC point estimates were negative. Thailand had the highest 2023 URI rate and Cambodia the highest otitis media rate. Ages 0–14 years accounted for 35.8% and 39.1% of summed URI and otitis media DALYs, respectively.

Conclusion: Declining standardized rates coexisted with increasing absolute health loss. DALYs provide a planning signal rather than measured clinical workload; translation into otolaryngology services requires local diagnostic, hearing, referral, and capacity data.

All authors have reviewed and approved the final version of the manuscript.

1. Introduction

Upper respiratory infections are among the most frequent acute illnesses encountered by health systems, while otitis media is a major middle-ear disorder managed across primary care, paediatrics, audiology, and otorhinolaryngology. The Global Burden of Disease (GBD) 2023 study provides a common framework for comparing health loss across causes, years, and countries.[1] Before extraction, we defined URI and otitis media as a comparative pair, not as a causal chain and not as a combined outcome. The clinical question was whether long-term and geographic patterns in broad upper-airway infectious health loss parallel or diverge from those in middle-ear health loss within the same countries, years, sex, age frame, metric, and GBD release.

Recent GBD analyses describe the exceptionally high global incidence of URIs and their heterogeneous temporal pattern.[2–4] Parallel otitis media studies report declining age-standardized disability-adjusted life-year (DALY) rates in many settings despite persistent or increasing episode counts, with the greatest incidence concentrated in young children.[5–9] These analyses establish global context but do not answer the ASEAN-specific otorhinolaryngology question addressed here. Our paired design supplies an upper-airway comparator for an ear-specific cause while preserving separate results and interpretations; it does not assume that country-level URI burden caused country-level otitis media burden.

The comparison is anatomically and clinically relevant because the nasopharynx, Eustachian tube, mucosal immunity, microbial ecology, and age-dependent anatomy connect upper-airway infection with middle-ear disease at the patient level. Nevertheless, the two GBD causes differ greatly in clinical granularity. URI is a broad cause category, whereas otitis media incorporates several middle-ear sequelae. Recent evidence links early otitis media with altered auditory processing, shows substantial spontaneous resolution for some effusions, and identifies heterogeneous learning effects among children with hearing loss.[10–12]

We therefore report the exact ages 0–14 years band throughout and do not describe it as a younger-than-five or preschool analysis.

Southeast Asia combines densely populated urban centres, archipelagic and remote communities, and wide variation in surveillance and service organization. Recent multi-institutional data and studies from Indonesia describe real-world epidemiology, nutritional and household determinants, and chronic suppurative disease.[13–16] Investigations in Viet Nam evaluate pneumococcal-vaccine-era effusion and antimicrobial susceptibility, while cohort and clinical trial data from the Philippines and Thailand address longer-term ear outcomes and treatment in selected paediatric populations.[17–20] These studies are not nationally representative of all ASEAN settings, but they demonstrate that clinical phenotype, diagnostic pathway, microbiology, function, and access cannot be reconstructed from DALYs alone.

Contemporary vaccine and treatment evidence also requires phenotype-specific interpretation. High-valency pneumococcal conjugate vaccines reduce selected acute otitis media outcomes, but serotype replacement and variation in all-cause effectiveness remain relevant.[21,22] Reviews of pharmacotherapy and antibiotics for otitis media with effusion report limited or uncertain long-term benefit, while longitudinal and procedural studies emphasize natural history, recurrence, hearing, and the need for carefully selected intervention.[23–26] Cause-level DALYs cannot determine which patients meet those clinical criteria.

Respiratory epidemiology changed markedly during the COVID-19 period. Recent paediatric surveillance studies documented suppression, altered seasonality, and later resurgence of multiple respiratory pathogens.[27–29] These observations justify describing 2019–2023 separately, but they do not establish why the modelled GBD series changed. Our analyses therefore treat pandemic-era variation descriptively and retain a sensitivity analysis that reduces the leverage of 2020–2021.

The incremental contribution of this study is not the two-year update alone. It combines an 11-current-member ASEAN policy frame, a 2023 endpoint, paired interpretation of absolute numbers and age-standardized rates, an explicit ages 0–14 analysis, country-specific trend estimates with autocorrelation-robust uncertainty, pandemic-period description, membership and time-window sensitivities, and a reproducible extraction audit. This focus addresses how an otorhinolaryngology reader should interpret modelled health loss across heterogeneous regional systems without converting it into measured consultations, hearing-loss prevalence, or surgical demand.

We aimed to quantify (1) national all-age DALY numbers and age-standardized DALY rates for otitis media and URIs from 1990 to 2023; (2) long-term country-specific trends using estimated annual percentage changes (EAPCs); (3) DALY numbers and age-specific rates at ages 0–14 years, including their share of all-age DALYs; (4) geographic heterogeneity in 2023; and (5) robustness to alternative temporal and ASEAN-membership specifications. Outcomes and strata were defined before data extraction. The study was a DALY-focused, descriptive evidence base for comparative otorhinolaryngology priority setting, not an analysis of incidence, prevalence, clinical workload, individual-level causation, or treatment effectiveness.

2. Methods

Study design and reporting

We performed a longitudinal descriptive geographic and temporal analysis of annual country-level health estimates. The unit of observation was the country–year–cause–age–metric cell. The study was ecological only in the sense that it compared aggregate national estimates; it did not link individual exposures to individual outcomes, test associations between the two causes, or estimate causal or risk-attributable effects. Outcomes, strata, years, and summary procedures were defined before data extraction. We followed the Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER) and used relevant items from the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.[30,31] Because the data were publicly accessible, aggregated estimates containing no personal identifiers, institutional research ethics approval and informed consent were not required.

Setting and geographic frame

The primary frame comprised the 11 states that were ASEAN members on 24 July 2026: Brunei Darussalam, Cambodia, Indonesia, the Lao People's Democratic Republic, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Timor-Leste, and Viet Nam. Timor-Leste became ASEAN's 11th member on 26 October 2025, according to the ASEAN Secretariat. We applied this current-member frame consistently to 1990–2023 for contemporary policy comparability. It is not a reconstruction of historical institutional membership, and it does not imply that Timor-Leste was an ASEAN member during the earlier observation years. We therefore reported a complete ten-country sensitivity analysis excluding Timor-Leste. Countries were joined with ISO 3166-1 alpha-3 codes.

Data source and extraction

We downloaded estimates from the IHME GBD Results Tool for the GBD 2023 release on 23 July 2026 [1]. The official query selected the "Cause of death or injury" estimate type; DALYs as the measure; Number and Rate as metrics; Upper respiratory infections and Otitis media as causes; Both sexes; All ages, Age-standardized, and 0–14 years as ages; every year from 1990 through 2023; and the 11 countries. The tool returned point estimates with lower and upper bounds of GBD 95% uncertainty intervals (UIs). The successful IHME task identifier was e03184c898648d367860c2ebb507ce61. The archive was downloaded from the official IHME server and had SHA-256 checksum 9058327c101285ded538d948f43185ace13142ca7b24cfed942d7c79a85036b1. The complete extraction dictionary and expected dimensions are detailed in Table S1.

The raw export contained 3,740 rows: 11 countries × 34 years × two causes × five valid age–metric combinations. These combinations were all-age Number, all-age Rate, age-standardized Rate, 0–14-year Number, and 0–14-year Rate. We retained all combinations for auditability and identified three core outcomes before extraction. Data validation required exactly 11 countries, both causes, 34 unique years, both sexes only, the DALY measure only, no duplicate analytical cells, no missing core values, and lower ≤ point estimate ≤ upper for every row. All checks passed. We preserved original IHME labels and created a canonical long-format file with country, ISO3, cause, age, metric, year, value, lower, and upper. All computations used double-precision floating-point values; rounding occurred only for presentation.

Outcome definitions

A DALY is the sum of years of life lost because of premature mortality and years lived with disability. It is a comparative population-health metric, not a clinical severity score or a count of episodes, visits, antibiotic courses, hearing assessments, referrals, or operations.[1,2] DALYs were selected because the same measure was available consistently for both causes, countries, age frames, and years, allowing comparison of overall health loss. We did not extract incidence, prevalence, years lived with disability, or years of life lost separately; therefore, we do not quantify recurrence, clinical workload, or the relative disability and mortality contributions. All-age DALY numbers describe absolute health loss. Age-standardized DALY rates per 100,000 use the GBD standard population and reduce the influence of differing population age structures. The 0–14-year DALY rate is a crude age-specific rate within that band, expressed per 100,000 persons aged 0–14 years. We also calculated the share of all-age DALY numbers occurring in this age band.

The GBD cause "upper respiratory infections" is a broad modelled category rather than a synonym for one otorhinolaryngology diagnosis. Published GBD methods describe mild and moderate-to-severe URI health states. Published otitis media methods describe acute otitis media and chronic otitis-media sequelae that include infectious complications and combinations of hearing loss, tinnitus, and vertigo.[2] These modelled health states are not a clinical case-mix table for the present country estimates. The public Results Tool export did not expose release-specific ICD mappings, phenotype counts, laterality, episode duration, or the amount of hearing loss assigned within each country-year estimate. We therefore retained official cause labels and did not translate URI into rhinitis, rhinosinusitis, pharyngitis, or laryngitis, or otitis media into acute otitis media, otitis media with effusion, chronic suppurative disease, cholesteatoma, or another bedside phenotype. The supported clinical interpretation and explicit exclusions are detailed in Table S6.

Descriptive analysis

For each cause and year, we summed national all-age DALY point estimates to describe the sum across the 11-country frame. This derived sum is not an official GBD ASEAN estimate. We did not calculate a pooled regional 95% UI because posterior draws and dependence between country estimates were unavailable; adding reported lower or upper bounds would not produce a valid interval. We calculated the unweighted median and interquartile range of national age-standardized rates. This statistic gives Brunei Darussalam and Indonesia equal weight and is not a population-weighted regional rate. For 2023, we ordered countries by point estimate and retained each country's GBD 95% UI. The ordering was descriptive because UIs frequently overlapped.

Temporal trends

Country-specific temporal trends were summarized with the estimated annual percentage change. For each country and cause, we fitted ordinary least-squares regression to the natural logarithm of the age-standardized DALY rate as a linear function of calendar year. The exact model, EAPC transformation, and lag rule are displayed below.

$\ln(ASR_{c,t}) = \alpha_c + \beta_c \times Year_t + \varepsilon_{c,t}$; $EAPC_c = 100 \times [\exp(\beta_c) - 1]$.

$L = \max\{1, \mathrm{floor}[4(n/100)^{2/9}]\} = 3$ when $n = 34$.

Newey–West heteroskedasticity- and autocorrelation-consistent covariance was used to estimate the standard error of the fitted annual slope.[32] For n = 34, the lag rule yielded L = 3. The trend-model 95% confidence interval (CI) quantifies uncertainty conditional on the annual GBD point-estimate series. It does not propagate GBD posterior uncertainty, account for dependence created by the GBD modelling process, or convert modelled annual estimates into independent surveillance observations. Direction and magnitude of the EAPC point estimate were therefore primary; threshold-based significance language was avoided. The custom implementation was independently reproduced in R 4.5.3 with sandwich 3.1.1, NeweyWest lag = 3, no prewhitening, and finite-sample adjustment; the maximum absolute difference across the 22 principal EAPCs and interval limits was 1.37×10^{-12}.

Analysis at ages 0--14 years

For children aged 0–14 years, we summarized 2023 DALY rates, change from 1990, all-age share, and geographic variation for each cause. The 0–14 grouping was chosen before download because it was directly available as a composite age group in the Results Tool and is highly relevant to paediatric otorhinolaryngology. It should not be interpreted as showing the much higher risks reported for infants or children younger than five years. Those finer strata require a separate extraction. We avoided calling the 0–14 rate "age-standardized," because it is a crude age-specific rate within a broad paediatric band.

Sensitivity analyses

We examined whether conclusions depended on temporal specification by re-estimating EAPCs for 1990–2019, 2000–2023, and after omitting 2020–2021. The first avoids making the pandemic period the endpoint; the second emphasizes a more recent era; and the third checks whether the two most disrupted years dominate the long-run slope. The omission analysis preserves calendar year as the regression variable but creates an irregularly spaced series; its HAC interval was therefore not used for inference and only its slope direction is reported. We compared 2023 country orderings with orderings based on the mean of 2021–2023. We repeated principal descriptive summaries for the ten-country frame excluding Timor-Leste. These were interpretive robustness checks, not additional hypothesis tests, and no multiplicity adjustment was applied. Complete numerical results are in Tables S2–S5.

Visualization and software

We created three publication figures: paired temporal trajectories and country–year heat maps; national 2023 burden estimates with GBD 95% UIs alongside EAPCs with conditional trend-model 95% CIs; and paired choropleth maps of 2023 age-standardized DALY rates. Heat maps and choropleths used the perceptually uniform cividis palette. Cause-specific colour scales were labelled separately and were not compared numerically across panels. Map polygons came from the public-domain Natural Earth Admin-0 Countries dataset, 1:10m, version 5.1.1 (https://www.naturalearthdata.com). The local GeoJSON checksum was 239eec57ac17f100a11e2536cffc56752c318b50ae76 5b0918ff7aab4ce8f255.

Analyses used Python 3.12.13, pandas 2.2.3, NumPy 2.3.5, and Matplotlib 3.11.1; document generation used python-docx 1.2.0. The independent trend check used R 4.5.3 and sandwich 3.1.1. All transformation, validation, analysis, figure, and document steps were scripted. Values in narrative text are rounded only for presentation; machine-readable tables preserve full precision. The command order, hashes, expected dimensions, and software environment are summarized in the supplement.

Interpretive safeguards

The analysis was explicitly descriptive. We did not regress outcomes on $PM_{2.5}$, socioeconomic indicators, vaccine coverage, health expenditure, antibiotic use, climate, or any other country-level covariate. Consequently, the observed patterns cannot identify causes of between-country differences or changes over time. We did not infer that policies, vaccines, air quality, clinical practices, or pandemic restrictions produced specific changes. Such explanations are considered only as hypotheses requiring linked data and designs capable of addressing confounding, measurement differences, temporal ordering, and ecological bias. The study's reporting against the applicable GATHER items is detailed in Table S7.

3. Results

Dataset completeness and overall pattern

All 3,740 expected analytical cells were present and passed the checks defined before extraction. Each cause contributed a complete 11-country annual series for 1990–2023 at all requested age–metric combinations. The central pattern was a divergence between absolute and standardized burden: sums of 11 national DALY point estimates rose for both causes, while unweighted medians of national age-standardized rates fell. The complete 1990 and 2023 burden summary is detailed in Table 1, and the annual trajectories and country–year heterogeneity are shown in Figure 1.

Upper respiratory infections

The sum of 11 national all-age URI DALY point estimates increased from 372,296 in 1990 to 476,741 in 2023, an increase of 28.1%. In contrast, the unweighted cross-country median age-standardized DALY rate decreased from 74.2 (interquartile range 66.5–82.8) to 66.2 (59.3–79.7) per 100,000 (-10.9%). Thailand had the highest 2023 point estimate at 93.0 per 100,000, followed by Brunei Darussalam (82.1) and Singapore (81.8). Viet Nam had the lowest point estimate (52.4), narrowly below Myanmar (52.7). The highest-to-lowest point-estimate ratio was 1.77; overlapping GBD UIs mean that this ordering does not establish true between-country separation.

All 11 URI EAPC point estimates were negative. The steepest estimated decline occurred in Myanmar (EAPC -0.73% per year; conditional trend-model 95% CI -0.85 to -0.60), followed by Cambodia. The smallest decline occurred in Singapore. These CIs condition on the annual GBD point estimates and exclude GBD posterior uncertainty. Because the regression imposes one average log-linear slope across 34 years, the values summarize direction and pace but do not imply smooth year-to-year change. Country-specific 2023 UIs and EAPCs are detailed in Table 2 and visualized in Figure 2.

Otitis media

The sum of 11 national all-age otitis media DALY point estimates increased from 175,399 in 1990 to 191,971 in 2023, an increase of 9.4%. The unweighted median age-standardized rate declined from 36.1 (interquartile range 30.3–39.0) to 29.0 (24.3–30.1) per 100,000 (-19.7%). Cambodia had the highest 2023 point estimate (32.5), followed by the Philippines (31.0) and Timor-Leste (30.1). Singapore had the lowest point estimate (15.9), followed by Brunei Darussalam (16.6). The highest-to-lowest point-estimate ratio was 2.04. Wide GBD UI overlap precluded treating adjacent order positions as established differences.

Otitis media EAPC point estimates were negative in every country. Myanmar showed the steepest decline (EAPC -1.38% per year; conditional trend-model 95% CI -1.56 to -1.20). Brunei Darussalam showed the smallest change (EAPC -0.03%; conditional trend-model 95% CI -0.09 to 0.02). The Brunei interval crossed zero, but this is conditional model uncertainty and not a full GBD uncertainty statement.

Burden at ages 0--14 years

Persons aged 0–14 years accounted for 170,480 URI DALYs in 2023, equivalent to 35.8% of the summed all-age point estimate. The corresponding otitis media burden was 75,086 DALYs, or 39.1% of the all-age burden. The age-band share varied substantially by country. For URI, it ranged from 23.4% to 50.4%; for otitis media, from 26.5% to 49.6%. Timor-Leste had the largest age-band share for URI, while the Philippines, Timor-Leste, and several lower-middle-income settings had prominent ages 0–14 otitis media shares. These shares reflect both age-specific rates and population age structure; they are not direct measures of clinical severity or access to care. All country-specific ages 0–14 rates and shares are detailed in Table 3.

Geographic pattern

The spatial distribution was cause-specific rather than uniform. Thailand had the highest URI point estimate, whereas Cambodia had the highest otitis media point estimate; several countries occupied different relative positions for the two causes. The paired choropleths in Figure 3 display these national point estimates with separate cause-specific colour scales. The maps should be interpreted together with the UIs in Table 2 and should not be read as subnational risk surfaces.

Sensitivity analyses

The direction of the principal trends was stable under alternative periods (Table S2). Every URI alternative-period EAPC point estimate remained negative. Otitis media estimates were also negative except for Brunei Darussalam during 2000–2023 (+0.02% per year after rounding). Omitting 2020–2021 did not reverse the long-run direction, although this irregularly spaced check was interpreted only descriptively. The 2021–2023 mean produced no URI rank changes and a maximum absolute otitis media rank change of one (Table S3).

In the ten-country frame excluding Timor-Leste, the median country EAPC was −0.21% per year for URI and −0.71% per year for otitis media; median 1990–2023 rate changes were −6.3% and −21.0%, respectively (Table S4). Thus, the principal direction did not depend on back-casting current 11-member status.

From 2019 to 2023, the unweighted median URI age-standardized rate was nearly flat (66.0 to 66.2 per 100,000). Country changes ranged from −0.25% in Thailand to +1.78% in Myanmar. The unweighted median otitis media rate declined from 29.6 to 29.0; country changes ranged from −2.56% in Cambodia to +0.95% in Timor-Leste, with small increases also in Brunei Darussalam (Table S5). These descriptive changes do not identify whether transmission, care seeking, school exposure, surveillance, coding, source data, or GBD modelling produced the pattern.

Table 1. Descriptive summary across 11 current ASEAN member states, 1990 and 2023.

Cause	DALY sum 1990	DALY sum 2023	Change	Median ASR (IQR) 1990	Median ASR (IQR) 2023	Change
URI	372,296	476,741	+28.1%	74.2 (66.5–82.8)	66.2 (59.3–79.7)	-10.9%
Otitis media	175,399	191,971	+9.4%	36.1 (30.3–39.0)	29.0 (24.3–30.1)	-19.7%

Note: DALY sums are derived sums of 11 national point estimates, not official GBD ASEAN estimates; no pooled UI was calculated. ASR summaries are unweighted cross-country medians (IQRs) of national age-standardized DALY rates per 100,000, not population-weighted regional rates.

4. Discussion

Principal findings

This 34-year analysis provides an otorhinolaryngology-focused comparison of two separate GBD causes. Four findings are central. First, all country-specific EAPC point estimates indicated declining age-standardized DALY rates from 1990 to 2023. Second, the sums of 11 national DALY point estimates increased for both causes. Third, geographic heterogeneity persisted in 2023, and the countries with the highest URI point estimates were not identical to those with the highest otitis media point estimates. Fourth, ages 0–14 years accounted for more than one third of URI DALYs and nearly two fifths of otitis media DALYs in the derived national point-estimate sums.

The simultaneous decline in standardized rates and increase in counts is not contradictory. Rates describe health loss after accounting for age structure, whereas numbers also respond to population size and composition. Lower age-standardized health loss can therefore coexist with a larger absolute total. The counts are a potential planning signal, not evidence that consultations, hearing assessments, antibiotic decisions, referrals, or operations actually increased. Operational demand requires separate incidence, attendance, referral-conversion, procedure, workforce, geography, and access data. Presenting only rates could obscure absolute health loss; presenting only counts could obscure improvement after standardization.

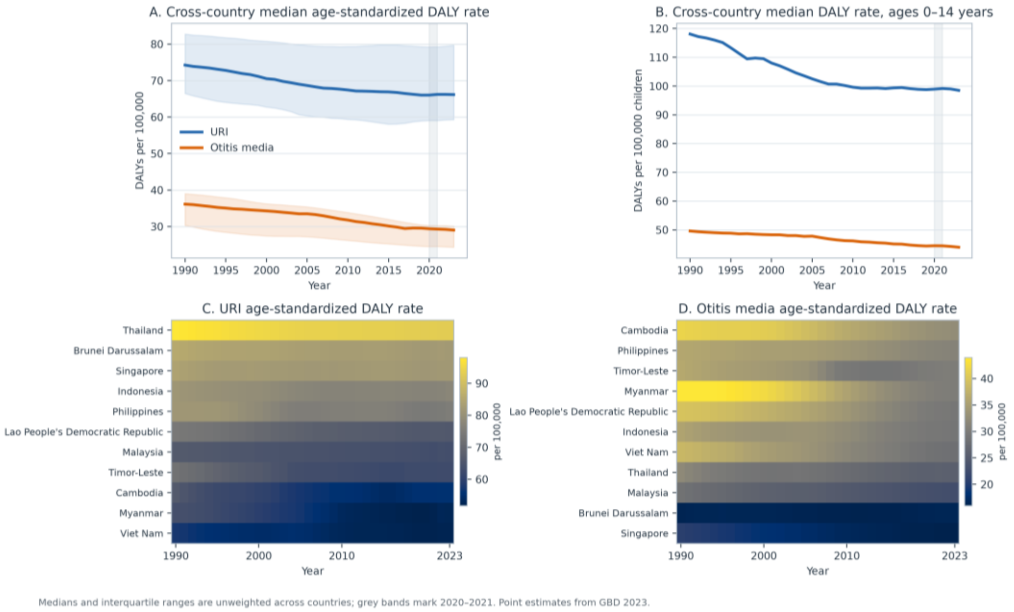

Figure 1. Temporal patterns of URI and otitis media health loss in 11 current ASEAN member states, 1990–2023. Panel A shows the unweighted cross-country median national age-standardized rate with interquartile range; panel B shows the unweighted median national age-specific rate at ages 0–14 years; panels C and D show country–year heat maps. Grey shading marks 2020–2021.

Table 2. National age-standardized DALY rates and trends.

Cause	Country	2023 rate (95% UI)	EAPC, %/year (95% CI)
URI	Thailand	93.0 (57.4–139.7)	-0.15 (-0.18 to -0.12)
URI	Brunei Darussalam	82.1 (51.2–123.5)	-0.12 (-0.14 to -0.10)
URI	Singapore	81.8 (50.6–126.2)	-0.05 (-0.08 to -0.02)
URI	Indonesia	77.6 (49.0–115.6)	-0.16 (-0.21 to -0.11)
URI	Philippines	75.3 (47.4–112.6)	-0.29 (-0.36 to -0.22)
URI	Lao People's Democratic Republic	66.2 (42.4–99.5)	-0.38 (-0.44 to -0.32)
URI	Malaysia	63.4 (39.8–94.6)	-0.14 (-0.16 to -0.13)
URI	Timor-Leste	62.7 (40.2–91.1)	-0.45 (-0.59 to -0.30)
URI	Cambodia	55.8 (36.2–80.7)	-0.56 (-0.72 to -0.39)
URI	Myanmar	52.7 (33.7–75.6)	-0.73 (-0.85 to -0.60)
URI	Viet Nam	52.4 (32.7–77.3)	-0.27 (-0.31 to -0.22)
Otitis media	Cambodia	32.5 (19.6–51.7)	-0.86 (-0.98 to -0.73)
Otitis media	Philippines	31.0 (19.2–50.2)	-0.46 (-0.53 to -0.39)
Otitis media	Timor-Leste	30.1 (17.7–49.6)	-0.74 (-0.93 to -0.55)
Otitis media	Myanmar	30.1 (17.8–48.7)	-1.38 (-1.56 to -1.20)
Otitis media	Lao People's Democratic Republic	29.3 (17.4–47.1)	-1.02 (-1.12 to -0.93)
Otitis media	Indonesia	29.0 (17.9–47.3)	-0.59 (-0.66 to -0.51)
Otitis media	Viet Nam	28.2 (16.3–45.5)	-0.97 (-1.00 to -0.95)
Otitis media	Thailand	25.7 (15.1–41.7)	-0.60 (-0.67 to -0.52)
Otitis media	Malaysia	22.9 (13.5–37.7)	-0.63 (-0.67 to -0.59)
Otitis media	Brunei Darussalam	16.6 (9.8–26.8)	-0.03 (-0.09 to +0.02)
Otitis media	Singapore	15.9 (9.4–26.0)	-0.79 (-0.89 to -0.69)

Note. Rates are per 100,000. GBD 95% UIs apply to 2023 burden estimates. Newey–West trend-model 95% CIs are conditional on annual GBD point estimates and exclude GBD posterior uncertainty. Countries are ordered descriptively by 2023 point estimate within cause; overlapping UIs preclude claims of rank separation.

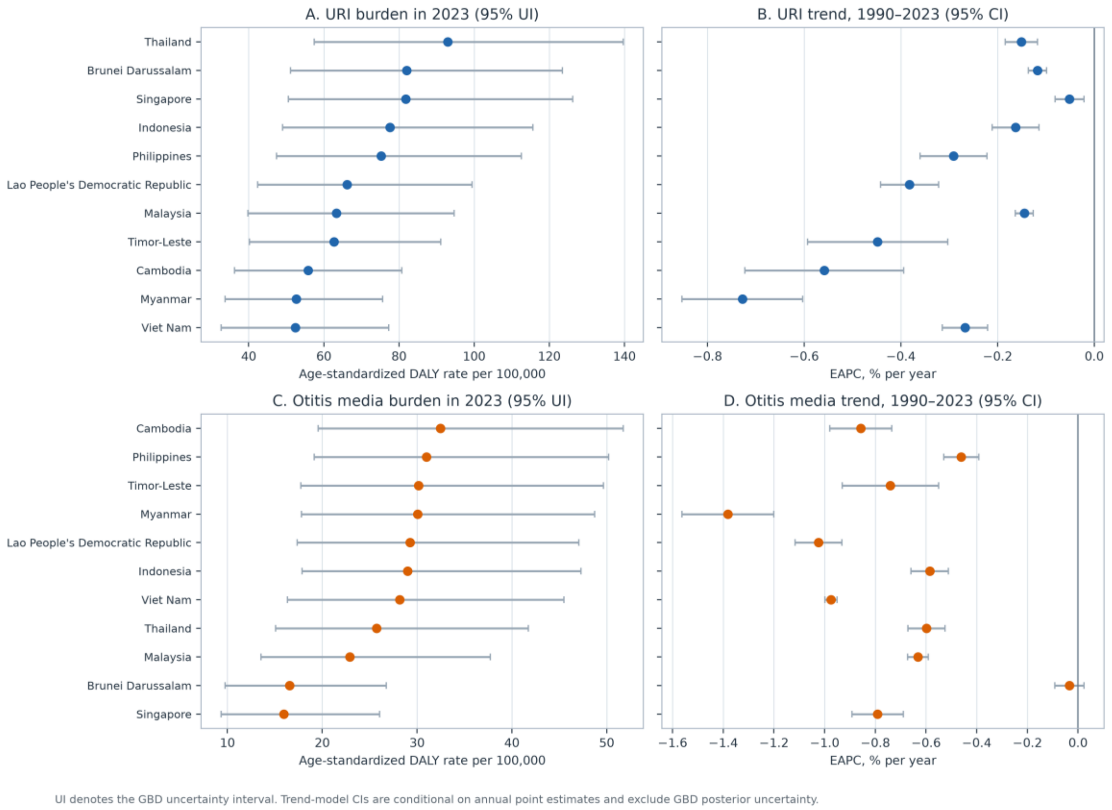

Figure 2. National health loss and long-term trends. Left panels show 2023 age-standardized DALY rates with GBD 95% UIs. Right panels show 1990–2023 EAPCs with Newey–West trend-model 95% CIs conditional on annual point estimates; these CIs exclude GBD posterior uncertainty.

Table 3. Burden at ages 0–14 years in 2023.

Cause	Country	Rate ages 0–14 (95% UI)	Share of all-age DALYs
URI	Thailand	131.6 (75.2–198.9)	23.4%
URI	Brunei Darussalam	117.2 (70.0–179.3)	30.6%
URI	Singapore	118.4 (70.1–183.9)	23.7%
URI	Indonesia	113.0 (68.2–171.5)	35.2%
URI	Philippines	108.3 (65.5–163.6)	41.5%
URI	Lao People's Democratic Republic	98.5 (59.1–149.8)	44.0%
URI	Malaysia	92.1 (54.6–142.4)	34.1%
URI	Timor-Leste	94.2 (57.3–139.3)	50.4%
URI	Cambodia	82.7 (50.7–124.7)	42.6%
URI	Myanmar	78.1 (48.6–114.5)	41.3%
URI	Viet Nam	76.9 (45.8–117.8)	37.1%
Otitis media	Cambodia	46.2 (25.5–73.4)	41.0%
Otitis media	Philippines	48.3 (27.1–77.8)	44.4%
Otitis media	Timor-Leste	44.5 (25.7–71.9)	49.6%
Otitis media	Myanmar	45.3 (25.0–72.1)	41.7%
Otitis media	Lao People's Democratic Republic	44.0 (24.2–70.8)	44.5%
Otitis media	Indonesia	45.6 (25.5–72.8)	38.2%
Otitis media	Viet Nam	43.3 (23.6–70.4)	38.8%
Otitis media	Thailand	40.7 (22.1–64.1)	26.5%
Otitis media	Malaysia	38.5 (20.7–61.8)	40.4%
Otitis media	Brunei Darussalam	27.0 (14.7–44.4)	35.8%
Otitis media	Singapore	26.9 (14.7–44.8)	28.6%

Note. Rates are age-specific DALY rates per 100,000 children aged 0–14 years and are not age-standardized. Shares use point-estimate DALY numbers.

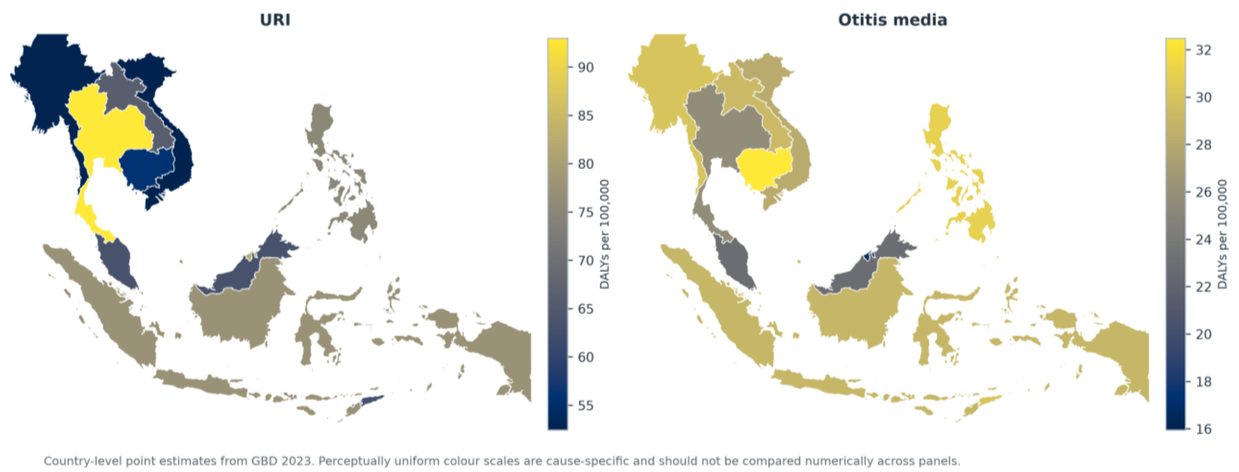

Figure 3. Geographic distribution of age-standardized DALY rate point estimates in 11 current ASEAN member states, 2023. Cause-specific perceptually uniform colour scales are labelled separately and should not be compared numerically across panels. Boundaries: Natural Earth Admin-0 Countries, 1:10m, version 5.1.1.

Comparison with existing evidence

Our findings extend the GBD 2021 systematic analysis of URI and otitis media burden by two years and focus on within-ASEAN comparisons.[2] Recent URI analyses similarly report very high incidence with long-term declines in standardized burden.[3,4] Our outcome was DALYs rather than incidence episodes because DALYs integrate fatal and non-fatal health loss and were available consistently for both causes and all selected strata. The agreement in direction supports the plausibility of our regional results, but direct numerical comparison is inappropriate because the GBD release, years, geographic aggregation, and chosen metrics differ.

Other GBD-based studies of childhood otitis media have reported declining DALY rates despite high or increasing incident counts in many settings.[5–9] The present analysis likewise shows that standardized health loss can improve while absolute DALYs remain substantial. Our ages 0–14 shares are not substitutes for age-specific incidence. A child may experience repeated URI or otitis episodes with limited DALYs per episode, while a smaller number of chronic or complicated cases may contribute disproportionately to disability. The composite also masks infancy and preschool periods highlighted in global analyses.

Clinical meaning for otorhinolaryngology

The URI cause is relevant to otorhinolaryngology because it encompasses disease of the nose, paranasal regions, pharynx, and laryngeal upper airway, but the GBD label is broader and less clinically granular than the diagnostic categories used in an ENT clinic. The burden estimate cannot distinguish viral rhinitis, bacterial rhinosinusitis, pharyngotonsillitis, or laryngitis, nor can it identify structural predisposition, recurrent disease, sleep-disordered breathing, or deep-neck complications. Accordingly, the high URI rate in a country should not be translated into a recommendation for a specific operation, antimicrobial policy, or referral threshold without supporting clinical data.

Otitis media is more directly ear-specific, but it remains a spectrum. Acute otitis media is characterized by middle-ear inflammation with acute symptoms; otitis media with effusion involves fluid without the same acute inflammatory picture; chronic suppurative disease includes persistent otorrhoea through a perforation; and mastoid or intracranial complications represent a different severity level. The GBD cause estimate aggregates across modelling inputs and sequelae and cannot separate these phenotypes. This limitation is critical because the appropriate clinical response differs markedly: analgesia and observation may be appropriate for selected uncomplicated acute disease; hearing surveillance and developmental context matter for persistent effusion; and chronic suppuration or complications require timely specialist evaluation and sometimes surgery.

The paediatric burden strengthens the case for integrated ear and hearing care. Recent syntheses associate early OME with altered auditory-processing performance, while the natural history of uncomplicated effusion and the magnitude of later learning effects remain heterogeneous.[10–12] The defensible implication is therefore not that every episode causes developmental impairment. Rather, children with persistent bilateral effusion, recurrent disease, suspected hearing loss, speech or learning concerns, craniofacial conditions, developmental vulnerability, or poor access to follow-up warrant reliable pathways for otoscopy, tympanometry or audiometry when available, reassessment, and referral.

Geographic heterogeneity and health-system interpretation

The national point-estimate pattern was cause-specific. Thailand, Brunei Darussalam, and Singapore had high URI point estimates, while Cambodia, the

Philippines, and Timor-Leste had high otitis media point estimates. This divergence argues against a single regional explanation and supports the paired-comparator rationale. Differences could arise from epidemiology, age-specific transmission, vaccination, primary and specialist care, nutrition, household exposures, antimicrobial practices, health-seeking behaviour, diagnostic capacity, source-data availability, and modelling choices. Without linked covariates and a causal design, the present study cannot apportion these explanations.

Rankings should be interpreted cautiously. Country point estimates provide an accessible policy summary, but GBD UIs were wide and often overlapped. A rank of first versus second does not establish a statistically credible difference. The more robust message is that countries occupy broad burden bands and may require different operational responses. Countries with high rates and large populations face both intensity and volume; small countries with high rates may require targeted prevention and referral capacity despite smaller numbers; countries with lower rates still need systems able to identify chronic, recurrent, and complicated disease.

The estimates also reflect national averages. Within-country inequality may be much larger than between-country differences. Remote islands, border areas, displaced populations, informal urban settlements, Indigenous communities, and areas affected by conflict or environmental disruption may have poorer access to ear and hearing care than national estimates suggest. Subnational data, where ethically and statistically robust, are a priority for service planning. National rate maps should never be read as uniform risk surfaces.

Potential pathways behind improvement

Several developments could plausibly contribute to declining standardized otitis media burden, including childhood immunization, nutrition, severe-infection survival, appropriate antimicrobial access, household exposures, primary care, and surgical or audiological management. Pneumococcal conjugate vaccines reduce selected acute otitis media outcomes, although effects on all-cause disease vary and serotype replacement remains relevant.[19,21,22] A population-based Vietnamese study found lower effusion prevalence in infants after PCV10 introduction but not in older children, illustrating age and phenotype specificity.[17] Our dataset did not include vaccine coverage or timing and cannot estimate vaccine effects.

For URIs, long-term changes could reflect demographic, behavioural, health-system, and modelling factors. Pandemic-era non-pharmaceutical interventions, altered mobility, masking, school closure, changes in care seeking, and surveillance disruption affected observed paediatric respiratory-virus patterns in multiple surveillance systems.[27–29] We intentionally retained 2020–2023 because they are part of the historical record and because GBD 2023 extends through the post-acute pandemic period. Sensitivity analyses reducing their leverage yielded similar long-run directions, but they do not resolve the mechanisms.

Antimicrobial stewardship

High URI and otitis media health loss does not by itself justify antibiotics. Many URIs are viral, and selected uncomplicated acute otitis media cases can be managed with observation under appropriate guidance. Conversely, delayed treatment of severe bacterial disease, mastoiditis, or chronic suppurative otitis media may be harmful. Recent hospital data from Viet Nam found substantial resistance to several commonly used oral agents among acute suppurative otitis media isolates, supporting local microbiology and stewardship surveillance rather than burden-based prescribing.[18] Contemporary reviews likewise find uncertain or limited evidence for routine pharmacotherapy in OME.[23,24] The appropriate inference is to strengthen diagnosis, follow-up, safety-netting, and local resistance monitoring, not to increase or indiscriminately decrease antimicrobial volume.

Prevention and service priorities

Potential responses should follow three steps. First, identify the observed burden pattern: absolute health loss, age-standardized rate, uncertainty, and the ages 0–14 share. Second, validate it locally using incidence or prevalence studies, otoscopic and audiological findings, attendance and referral data, antimicrobial use and resistance, vaccination coverage, workforce, geography, and equity. Third, select and evaluate a candidate response. Depending on the validated bottleneck, options may include immunization according to national schedules, smoke-exposure reduction, diagnostic training, reliable otoscopy, pain management, criteria for observation or antibiotics, reassessment of persistent effusion, hearing evaluation for at-risk patients, or referral pathways for chronic discharge and complications. Longitudinal and comparative treatment evidence supports selective, phenotype-specific decisions rather than burden-based intervention.[25,26] The present analysis does not establish the effectiveness or cost-effectiveness of any one option.

At referral level, integration of paediatric otolaryngology, audiology, speech-language services, and community hearing programmes is a candidate implementation hypothesis, not an effect demonstrated here. Task sharing and tele-otoscopy may be useful in some remote settings but require local evaluation of training, supervision, equipment, image quality, diagnostic accuracy, privacy, continuity, and referral capacity. Any service model should be tested with implementation outcomes such as waiting time, loss to follow-up, hearing recovery, recurrence, antimicrobial appropriateness, cost, and equity.

Country priority profiles

The data support a profile-based approach rather than a single ASEAN-wide intervention package. A country with a high standardized URI rate but a relatively lower otitis media rate may need to examine first-contact upper-airway care, diagnostic coding, access during acute illness, and referral thresholds without assuming an equivalent middle-ear problem. A country with a high otitis media rate and large paediatric share may place greater emphasis on early-childhood ear examination, follow-up of effusion, school or community hearing pathways, chronic ear disease, and surgical referral capacity. A populous country with moderate rates can still generate the largest absolute number of DALYs and therefore require the greatest total volume of trained personnel and equipment. A small country with a high rate may need less total volume but stronger geographic coverage and continuity.

These profiles should be constructed from multiple sources. The GBD indicators can define the broad burden axis; routine data can show attendance and referral; immunization and antimicrobial databases can identify prevention and treatment patterns; audiology and surgical registries can show functional and procedural demand; and qualitative work can identify barriers experienced by families. Disagreement between sources is itself informative. For example, high modelled burden with low reported attendance may indicate unmet need, limited surveillance, or modelling uncertainty. High attendance with low DALY rates may reflect strong access, low thresholds for consultation, or differences in coding. Triangulation is therefore more defensible than treating any single database as ground truth.

The high URI rates in Thailand, Brunei Darussalam, and Singapore should not be interpreted as evidence of poor otorhinolaryngology services. Better access and reporting can coexist with higher recorded or modelled disease, and standardized DALYs reflect more than treatment availability. Similarly, the high otitis media rates in Cambodia, the Philippines, and Timor-Leste do not identify a specific failed programme. They flag settings where local investigation and service review may have high value. The proper sequence is burden signal, validation with local evidence, identification of modifiable bottlenecks, intervention, and outcome monitoring.

From burden estimates to measurable action

For implementation, national plans need indicators that sit closer to care processes than DALYs. Candidate primary-care indicators include the proportion of clinicians trained in pneumatic otoscopy, availability and functioning of otoscopes, documentation of tympanic-membrane findings, appropriate analgesia, antibiotic prescribing concordance, explicit safety-netting, and scheduled reassessment when effusion or recurrent disease is suspected. Referral indicators include travel time, waiting time, completion of audiology, loss to follow-up, and the proportion of urgent warning signs receiving timely specialist review. Ear-surgery indicators could include access to microscopy, mastoid and tympanoplasty services, postoperative follow-up, dry-ear outcomes, and complication surveillance.

Paediatric programmes should add functional outcomes. These include hearing thresholds, speech perception where feasible, caregiver-reported listening difficulty, school participation, and timely developmental referral. Screening alone is not sufficient: a programme that identifies hearing difficulty but cannot confirm diagnosis, treat disease, fit amplification when needed, or retain children in follow-up may increase recorded activity without improving health. Each screening strategy requires a linked pathway, quality assurance, and an equity audit. The substantial 0–14-year share in our results justifies measurement of this pathway but does not establish that universal population screening is cost-effective in every setting.

Targets should be realistic and stratified by baseline capacity. In remote settings, the first goal may be reliable examination, pain management, danger-sign recognition, and referral transport. In better-resourced settings, priorities may include reducing unnecessary antibiotics, standardizing persistent-effusion surveillance, shortening audiology waits, and measuring patient-reported outcomes. Regional benchmarking can accelerate learning if definitions are harmonized, but public ranking without uncertainty or contextual information can create perverse incentives. Improvement collaboratives should emphasize within-country progress and equity rather than competition for a nominal rank.

Implications for education and workforce

The results also have implications for training. Medical and nursing curricula should treat common URI and otitis presentations as core diagnostic competencies while preserving clear thresholds for specialist escalation. Primary-care education should distinguish acute otitis media from otitis media with effusion and otitis externa, document laterality and severity, and integrate hearing and developmental history. Otorhinolaryngology training should include population health, antimicrobial stewardship, paediatric audiology, chronic ear disease in resource-limited settings, and interpretation of modelled burden estimates. Audiologists, speech-language professionals, community health workers, teachers, and paediatricians are essential partners.

Workforce planning cannot be derived from DALYs through a fixed conversion. The same burden can generate different specialist demand depending on primary-care competence, disease mix, referral criteria, geography, and available technology. Nevertheless, trends and counts can define scenarios. Ministries could combine projected childhood population, consultation rates, referral conversion, expected audiology time, and operative case mix to estimate staffing needs, then test assumptions against observed queues. This approach makes explicit where local data are missing and allows planners to update estimates rather than relying on static specialist-to-population ratios.

Strengths

The study used one internally consistent GBD release, complete annual series, identical definitions across countries, and official uncertainty bounds. The extraction was limited to the 11-current-member frame rather than a broad "Southeast Asia" region that may not match the policy membership used for interpretation. We paired numbers with standardized rates, reported the exact ages 0–14 stratum, distinguished GBD UIs from conditional trend-model CIs, used autocorrelation-robust standard errors, independently validated the trend implementation, reported alternative specifications, and preserved an extraction audit with the task identifier and checksum. The title, methods, results, and conclusions consistently describe a cause-specific, non-attributable, descriptive analysis.

Limitations

First, GBD estimates are modelled rather than complete counts of clinically confirmed cases. Their accuracy depends on source data, case definitions, covariates, model structure, and borrowing of information across time and place. Countries with sparse data may have greater model dependence. UIs quantify selected sources of uncertainty but do not encompass every potential bias. Second, the public export supplied summary estimates rather than posterior draws. We could not propagate GBD uncertainty through summed national numbers, cross-country medians, EAPCs, or rank comparisons.

Third, DALYs compress heterogeneous outcomes into a common metric. They are useful for priority setting but do not report episodes, prevalence, clinic visits, antibiotic courses, operations, hearing thresholds, quality of life, school absence, caregiver costs, or catastrophic expenditure. Separate analyses of incidence, prevalence, YLDs, complications, and hearing loss would provide complementary clinical information. Fourth, the broad GBD cause labels do not separate the clinically important URI and otitis subtypes described above.

Fifth, the 0–14-year composite obscures variation across infancy, preschool, school age, and early adolescence. This broad grouping was chosen for a concise regional analysis, but future paediatric work should use finer strata and examine children younger than five years separately. Sixth, both-sex estimates cannot evaluate sex differences. Seventh, national averages conceal subnational inequity and do not represent local outbreak or service patterns. Eighth, present-day ASEAN membership was back-cast to 1990; this is appropriate for current planning but not for a historical institutional analysis.

Ninth, the log-linear EAPC is a summary of average change and can mask non-linearity or structural breaks. Joinpoint or spline models could describe changing slopes but would introduce additional model choices and multiple comparisons. Tenth, our 2023 rankings are based on point estimates with overlapping UIs and should not be treated as league tables. Finally, the study is descriptive. It cannot determine why countries differ, evaluate policy effectiveness, estimate individual risk, or guide patient-level treatment. These constraints are not minor caveats; they define the scope of valid inference.

Research agenda

The next phase should link burden surveillance with clinical and health-system data. National or multicountry sentinel networks could use standardized diagnostic definitions for acute otitis media, otitis media with effusion, chronic suppurative disease, recurrent URI phenotypes, hearing outcomes, complications, microbiology, antibiotic exposure, and referral. Prospective cohorts could clarify recurrence and functional outcomes, while pragmatic implementation studies could test integrated ear-and-hearing pathways. Data collection should oversample remote and underserved populations to avoid reproducing the blindness of national averages.

Analytically, future studies could examine finer ages, sex, socioeconomic position, vaccine coverage, smoke exposure, conflict, climate, and access to care. Causal questions require designs that address time-varying confounding, measurement error, policy timing, and ecological bias. Where posterior draws are available, uncertainty should be propagated through derived summaries and trend estimates. Open, documented code and estimands defined before extraction remain essential, particularly when secondary analyses use complex modelled databases.

Implications for clinical practice and policy

For otorhinolaryngology, the most actionable finding is the coexistence of declining standardized health loss with increasing sums of national DALY point estimates. Both dimensions should inform the first stage of priority setting. They cannot determine workforce or facility requirements by themselves. Countries with large counts should first compare the burden signal with observed episodes, attendance, referral conversion, audiology, procedures, workforce, travel, and unmet need. Countries with high rate point estimates should examine local uncertainty, source-data quality, phenotype distribution, and underserved populations before choosing a response. Ages 0–14 indicators should remain visible, but finer age extraction is needed for early-childhood decisions.

Clinical pathways should distinguish uncomplicated, recurrent, persistent, chronic, and complicated disease. A high-burden setting needs dependable first-contact assessment and safety-netting, not automatic specialist referral for every URI. Conversely, chronic otorrhoea, suspected cholesteatoma, persistent or bilateral effusion with hearing or developmental concerns, mastoid signs, cranial neuropathy, severe systemic illness, or suspected intracranial complications require escalation. Standardized pathways can reduce both undertreatment of serious disease and overtreatment of self-limited illness.

Policy makers should not interpret DALYs as clinic visits or surgical candidates. Translation to resources requires local data on incidence, attendance, referral conversion, procedure rates, travel time, workforce productivity, equipment uptime, care seeking, and unmet need. GBD estimates are best used to identify domains for validation and compare broad trajectories. Detailed planning should triangulate them with routine health information systems, otoscopic and audiological surveys, antibiotic and resistance surveillance, vaccination data, and community evidence.

The policy frame also creates testable opportunities for collaboration. ASEAN countries could consider harmonized minimum definitions for otitis media, hearing outcomes, referral, and antimicrobial indicators; any common training, procurement, or telehealth approach should then be piloted and evaluated in the participating settings. Regional collaboration should complement country-specific needs assessment because the cause patterns and uncertainty distributions differ.

5. Conclusion

From 1990 to 2023, country-specific EAPC point estimates indicated declining age-standardized DALY rates for otitis media and upper respiratory infections, while the sums of 11 national DALY point estimates increased. Geographic point-estimate differences persisted, and ages 0–14 years accounted for a substantial share of health loss, particularly for otitis media. These findings define priorities for local validation rather than prescribing interventions. DALYs do not measure clinical workload, and the broad GBD causes and age band cannot resolve phenotype, hearing-loss prevalence, or treatment need. Comparative burden should be triangulated with clinical, audiological, service, antimicrobial, vaccination, and equity data before prevention or referral strategies are selected.

Declarations

Ethics approval and consent to participate

Not applicable. This study analysed publicly accessible, aggregated country-level estimates and included no individual-level or identifiable data.

Consent for publication

Not applicable.

Availability of data and materials

GBD 2023 estimates are available through the IHME GBD Results Tool subject to IHME terms of use. The source archive was accessed on 23 July 2026 under task e03184c898648d367860c2ebb507ce61; its SHA-256 is 9058327c101285ded538d948f43185ace13142ca7b24cfed942d7c79a85036b1. The accompanying reproducibility package contains the query dictionary, checksum instructions, canonical schema, validation outputs, analytical scripts, derived tables, figure code, software versions, and expected dimensions. Raw IHME redistribution remains governed by IHME terms. A permanent repository identifier should be added to the unblinded title-page submission when assigned.

Conflict of interest

The authors declare that they have no conflict of interest.

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Author contributions

I.S. conceived and designed the study, extracted and analysed the data, and drafted the manuscript. M.R. and M.K. contributed to the interpretation of the results and critically revised the manuscript for important intellectual content. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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Use of artificial intelligence

No generative artificial intelligence was used in the preparation of this manuscript.

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