



Methodology Adopted for the Development of Evidence-Based Guideline Recommendations on Childhood Empyema

Joseph L. Mathew^{1,2,3,4,5}

Received: 9 February 2026 / Accepted: 8 April 2026
© The Author(s), under exclusive licence to Indian Academy of Pediatrics 2026

Abstract

Objective To describe the methodology adopted for the development of evidence-based guideline recommendations for pediatricians managing childhood empyema.

Methods The methodology followed contemporary methods for evidence-based guideline development. It included ten steps viz. (i) establishing a steering group (SG) and an evidence-based guideline development group (EBGDG), (ii) formal declarations of interest by EBGDG members, and scrutiny for conflicts by the SG, (iii) identifying and prioritizing questions in the PICOTS (Patient/population, Intervention/exposure, Comparison, Outcome, Time-frame, and Setting) format, (iv) building working teams to answer the questions, (v) searching for existing guidelines with potential for adaptation, adoption, or adoption of recommendations, (vi) identifying existing systematic reviews addressing the prioritized questions, (vii) formal evidence synthesis (through systematic reviews) and critical appraisal of evidence for each question, (viii) drafting recommendation statements and formalizing them with strength and certainty of evidence, (ix) external peer review, and (x) preparation of the guideline document for dissemination.

Results The EBGDG collated 115 potential questions, narrowed them to 18 through the Delphi consensus-building process, and ultimately prioritized 11. The questions covered diverse aspects of empyema management including therapy options, microbiological and radiological investigations, and monitoring issues. There were no recent guidelines or systematic reviews addressing any of the 11 questions, thereby necessitating eleven de novo systematic reviews. The EBGDG examined the evidence from these reviews and certainty estimates, evaluated the criteria in the evidence-to-decision framework, and formulated evidence-based recommendation statements. The draft guideline underwent external peer review and finalization.

Conclusion The methodological rigor resulted in trustworthy recommendations for managing childhood empyema.

Keywords Empyema thoracis · Evidence-based guideline methods · Evidence-based recommendation methods · GRADE · Guideline methodology · Pediatric empyema

✉ Joseph L. Mathew
dr.joseph.l.mathew@gmail.com

¹ Department of Pediatrics, Advanced Pediatrics Centre, Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh, India

² Advanced Centre for Evidence Based Child Health, Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh, India

³ Pediatric Empyema Guideline Project, Advanced Pediatrics Centre, Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh, India

⁴ Department of Health Research (DHR) Technical Resource Hub (TRH), Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh, India

⁵ Chair, Indian Academy of Pediatrics (IAP) National Respiratory Chapter (NRC) Evidence-Based Guideline Development Group (EBGDG), Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh, India

Introduction

The Indian Academy of Pediatrics (IAP) National Respiratory Chapter (NRC) established an Evidence Based Guideline Development Group (EBGDG) in 2021 [1], to develop high-quality, locally relevant guideline recommendations for common pediatric respiratory conditions. The IAPNRC EBGDG resolved to follow evidence-based processes to develop guidelines for Indian pediatricians, rather than expert, consensus-based recommendations. The details of the process have been described previously [2]. An initial list of 59 topics identified for guideline development was formally prioritized to 12 topics through the Delphi consensus-building process [3]. Evidence-based management of childhood empyema was shortlisted as a high-priority topic.

Empyema thoracis is the presence of pus or infected fluid in the pleural cavity [4]. It is generally a complication of pneumonia and parapneumonic effusion. Empyema adds to the morbidity, need for (non-invasive and invasive) interventions, and hospital stay in children with pneumonia. While the management of childhood pneumonia (including diagnosis and treatment) is fairly standardized [5–9], there is considerable variation (often confusion) in the management of empyema. These variations exist despite the availability of a limited number of old as well as recent guidance documents published by international agencies [10–15]. However, the recommendations in these documents have multiple methodological limitations, health system specific issues, and limited generalizability, making their direct implementation in Indian settings, highly challenging.

This article presents the methodology used for the development of the evidence-based guideline for the management of pediatric empyema.

Processes

The methodology followed contemporary guideline development methods [16] as closely as possible. The IAP NRC established a steering group (SG) comprising its office bearers and the Chair of the EBGDG, in the last quarter of 2023. The SG outlined the scope and purpose of the proposed guideline, focusing on the issues relevant to pediatricians working in diverse healthcare settings in India. The detailed steps followed are presented below.

Step 1: Constitution of the EBGDG

The IAP NRC extended an open call to its members in the last quarter of 2023, inviting applications for the EBGDG. These were carefully scrutinized by the SG, ensuring

diversity in terms of healthcare system (public as well as private sector), experience (younger as well as senior members), and institution (teaching as well as non-teaching).

The shortlisted applicants participated in a one-day in-person workshop on ‘Evidence-based Guideline Development’ conducted at the NRC Annual Conference in November 2023. The workshop had teaching sessions and practical exercises covering framing questions, evidence synthesis, critical appraisal of evidence, GRADE-ing of evidence, evidence-to-decision framework, and guideline writing. The workshop was conducted by the EBGDG Chair and volunteers of the Allergic Bronchopulmonary Aspergillosis (ABPA) guideline group. Pre- and post-workshop test scores were evaluated by the SG, to assess suitability as EBGDG members. The final EBGDG included 30 members. Further training and mentoring were provided during online meetings and training sessions conducted by the EBGDG Chair.

The Chair also invited external experts to join the EBGDG, including a senior pediatric surgeon with expertise in empyema management, a senior pediatric radiologist, a medical microbiologist, and a qualified pediatric infectious diseases specialist. The SG attempted to identify parents of children with ‘lived experience’ of empyema for inclusion in the EBGDG, but did not succeed.

Step 2: Declarations of Interest (DoI) and management of Conflicts of Interest (CoI)

Each EBGDG member completed a detailed DoI form adapted from the WHO DoI form. The SG examined these for actual or potential conflicts of interest. EBGDG members did not have the right to decide if their declarations constituted conflicts (or not). The SG categorized and managed CoI of individual members as follows: very serious (managed by exclusion of the member from discussions and voting on issues with CoI), serious (managed by restricting voting rights on issues with CoI), non-serious (managed by disclosure in the final recommendation(s), or none. The DoI forms of the EBGDG members are available for scrutiny, upon reasonable request.

Step 3: Prioritization of clinical questions for the guideline

The EBGDG members were invited to independently submit four questions each, which they considered as priorities to be addressed in the guideline. The questions were framed in the PICOTS (Patient/population, Intervention/exposure, Comparison, Outcome, Time-frame, and Setting) format, along with a justification. This time-bound exercise generated 115 questions, which were related to etiology ($n = 7$), investigations ($n = 5$), imaging modalities ($n = 10$), antibiotic therapy ($n = 12$), intercostal drainage



($n = 5$), fibrinolytic therapy ($n = 8$), specific fibrinolytic agents ($n = 20$), surgical management ($n = 11$), therapy options ($n = 8$), prognosis and follow-up ($n = 8$), and other unclassified management issues ($n = 21$). All members assigned priority scores to each question, on a scale of 1 to 9, wherein 9 signified ‘top priority’, and 1 signified ‘no priority’, along with justification for their scores. The median with interquartile range (IQR) of scores was calculated for each question.

The median scores were circulated to the EBGDG, inviting revisions (if desired) along with justification for revision(s). The median (IQR) of the revised scores was similarly calculated. Questions with median score ≥ 7 were shortlisted, reducing the questions to 71. Among these, same/similar/duplicate questions were eliminated, reducing the number to 18. These were presented by the EBGDG Chair in an online meeting. The EBGDG shortlisted 11 as top priority questions, to be addressed in the guideline (Table 1); and the other seven as important questions to be taken up later. The EBGDG identified patient-centric outcomes relevant to each question and categorized them as critical or important. The members also listed relevant subgroups, settings where the guideline was intended for implementation, and the stakeholder perspective (for each question). The questions in the PICOTS format are presented in Supplementary Annexure 1.

The process of identifying and prioritizing questions took place over a period of 3 months from December 2023 to February 2024.

Step 4: Formation of working teams

The EBGDG was divided into seven working teams, ensuring that each team had previous and current EBGDG members, and representation from a teaching institution with medical library access. The EBGDG Chair was a member of all the seven teams. Each team was assigned an evidence synthesis specialist drawn from personnel of the (then existing) Advanced Centre for Evidence-Based Child Health (ACEBCH) and later Pediatric Empyema Guideline (PEG) Project.

Each team was responsible for one or two questions. The teams worked independently with their evidence synthesis specialist, under the supervision of the Chair. The teams reported to the full EBGDG at weekly online meetings using a free platform. The external experts participated in these meetings, and were also available as-required for advice.

Step 5: Identification of existing empyema guidelines

The EBGDG first searched for existing empyema guidelines, by accessing the websites of 24 reputed international and national bodies (Table 2). The goal was to enhance efficiency of the guideline development process by identifying existing evidence-based guidance (on any of the 11 prioritized questions) suitable for adoption, adaptation, or adolopment [17]. The search was conducted using broad search words/terms viz. “empyema” and “guideline” and their various synonyms. The EBGDG used three criteria to consider the suitability of any existing guideline document for its purposes viz. (i) containing questions matching any of the 11

Table 1 Prioritized questions listed in the order of final scores (highest to lowest)

Question 1	What is the efficacy, safety, and cost of intrapleural fibrinolytic therapy as the initial modality vs. no intrapleural fibrinolytic therapy, in children with empyema?
Question 2	What is the efficacy, safety, and cost of intrapleural fibrinolytic therapy versus video-assisted thoracoscopic surgery, as the initial treatment modality, in children with empyema?
Question 3	What is the comparative efficacy, safety, and cost of different intrapleural fibrinolytic agents used for the management of empyema in children?
Question 4	In children with empyema, is early initiation of fibrinolytic therapy (i.e. as the initial management, or at presentation), superior to late(r) instillation?
Question 5	In children with empyema, how does “initial intrapleural fibrinolytic therapy” (i.e. at or close to confirmation of empyema) compare to “intrapleural fibrinolytic therapy after failure of intercostal drainage alone”?
Question 6	What is the microbial etiology of empyema in children?
Question 7	Which antibiotics should be administered empirically pending culture reports?
Question 8	What is the efficacy, safety, and long-term outcome of empyema treated with short(er) i.e. ≤ 4 weeks of antibiotic therapy, compared to long(er) i.e. > 4 weeks?
Question 9	What is the comparison of molecular methods vs. culture, for identifying the microbial etiology in children with empyema?
Question 10	Should thoracic CT scan or ultrasonography be used routinely for the management of children with empyema?
Question 11	What are the predictors (clinical features, or radiological features, or biomarkers, or microbiological features, or pleural pus characteristics, or combinations thereof) associated with failure of medical management, or need for surgical management, in children with empyema?



Table 2 Agencies whose websites were accessed for existing guidelines on empyema management

S No	Agency
1	American Academy of Pediatrics (AAP)
2	American Association of Thoracic Surgery (AATS)
3	American College of Chest Physicians (ACCP)
4	American Pediatric Surgery Association (APSA)
5	American Thoracic Society (ATS)
6	Asia Pacific Society of Respiriology
7	Australian Pediatric Society
8	British Thoracic society (BTS)
9	Canadian Association of Thoracic Surgeons (CATS)
10	Canadian Pediatric Society
12	European Association of Cardiothoracic Surgery (EACTS)
13	European Respiratory Society (ERS)
14	European Society of Pediatric Infectious Diseases (ESPID)
15	Indian Academy of Pediatrics (IAP)
16	Indian Association of Pediatric Surgeons (IAPS)
17	Japanese Respiratory Society
18	Ministry of Health and Family Welfare, Government of India
19	National Institutes of Health (NIH)
20	National Institute for Health and Care Excellence (NICE)
21	Pediatric Infectious Diseases Society (PIDS) and Infectious Diseases Society of America (IDSA)
22	Scottish Intercollegiate Guidelines Network (SIGN)
23	Thoracic Society of Australia and New Zealand
24	World Health Organization (WHO)

EBGDG questions, (ii) being current (defined as published within the recent three years), and (iii) methodologically appropriate (defined as being an evidence-based guideline with contemporary methodology). Documents meeting these criteria were examined in detail to identify recommendations having scope of adoption, adaptation or adolopment appropriate for India.

For each question, if the search did not identify guideline recommendations addressing the question, the teams moved to the next step.

Step 6: Identification of existing systematic reviews addressing the prioritized questions

Each working team searched for existing systematic reviews (addressing their question) through three databases (PubMed, Cochrane Library, Epistemonikos). Here also, broad search terms were used, viz. “empyema” and “review” and their various synonyms. The search output was collated and de-duplicated. The final output was scrutinized by at least two members working independently. They examined the titles, abstracts, and full texts of potentially relevant reviews. Reviews meeting the following criteria were considered

relevant (i) directly addressing the EBGDG question, (ii) being current (i.e., published within the recent three years), and (iii) methodologically rigorous. The goal was to foster efficiency by updating such reviews, rather than undertaking de novo evidence synthesis.

For each question, if the search did not identify guideline recommendations addressing the question, the teams moved to the next step.

Step 7: Evidence synthesis

Where there was no existing guideline or systematic review meeting the required criteria, the EBGDG undertook de novo systematic reviews, including only randomized controlled trials (RCT) for questions on interventions, and relevant observational studies (diagnostic accuracy studies, other comparative designs or prevalence studies) for other questions. Formal systematic review protocols were developed and registered in the PROSPERO database.

For each review, literature search was conducted through seven databases, including five databases of published research (PubMed, EMBASE, the Cochrane Library, Web of Science, and Scopus) and two grey-literature databases (ProQuest and OpenGrey). The search strategy was developed and pilot-tested with the assistance of a skilled information retrieval specialist, under the supervision of the EBGDG Chair.

Standard systematic review methodology was followed including collation of search output; electronic and manual de-duplication; independent screening by two members studying titles, abstracts, and full texts; and final decision on inclusion/exclusion by the entire working team [18]. Data extraction from the included studies and quality assessment for each critical outcome was done by two team members working independently. The Cochrane RoB2 tool [19] was used for RCTs, the NIH tool for observational studies [20], and the QUADAS2 tool [21] for diagnostic test accuracy studies. Quantitative synthesis through meta-analysis was undertaken wherever feasible.

The Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach [22, 23] was used to estimate certainty of evidence for each critical outcome, and the body of evidence across all included studies. The evidence synthesis for each question was presented to the entire EBGDG through multiple online meetings.

Step 8: Formulation of recommendations

The EBGDG members individually examined the criteria in the evidence-to-decision (EtD) framework [24] for each question, considering their judgements from the perspectives of the stakeholders listed a priori. Judgments were based on the evidence (and certainty) presented, with room



for considering additional issues based on clinical expertise, value-based judgements, and potential stakeholder perspectives. Each team member independently voted for each criterion of the EtD, using a Google form (to enable an audit trail, and also preventing opinions of individual members from influencing others). The EBGDG Chair abstained from voting, in order not to influence the members' voting.

For each EtD criterion, the proportion of EBGDG members choosing each option was calculated. The results were presented to the EBGDG for discussion, clarification, and resolution of errors. Thereafter, the EBGDG members were provided another opportunity to re-vote for each EtD criteria. The revised votes (for each criterion) were tallied and presented to the EBGDG. The final option for each criterion was decided on the basis of simple majority.

Thereafter, the EBGDG Chair developed multiple draft recommendation statements (with the recommendation strength and evidence certainty) for each question, along with detailed justification. This was shared with the EBGDG members, who studied and independently voted for their preferred wording (using another Google form). The goal was to choose the recommendation wording achieving two-thirds majority. Following the first round of voting, the results were discussed in an online meeting, and draft wording with less than one-third votes were eliminated. A second round of voting was held to narrow down the preferred wording from among the remaining draft statements. The process was repeated until a statement achieving at least two-thirds majority was achieved for each question.

For each finalized recommendation statement, the EBGDG presented detailed justification, subgroup considerations, implementation considerations, monitoring and evaluation, and research priorities.

Step 9: External peer review

The finalized recommendation document was shared confidentially with a group of independent, external peer reviewers who were not involved with the guideline development process. These experts included a pediatric pulmonologist, pediatrician with special interest in respiratory care, qualified pediatric infectious disease specialist, two pediatric surgeons, a medical microbiologist with special interest in respiratory microbiology, and a qualified pediatric radiologist. The goal was to assess methodological rigor, clarity of the recommendations, suitability of the justification for each recommendation, and issues requiring clarification/correction. Several useful suggestions were received, based on which the recommendation document was revised and finalized.

Step 10: Guideline writing, dissemination, and updation

The EBGDG Chair drafted the guideline document. The SG Chair submitted the draft recommendations for the approval of the IAP Executive Board in May 2025. The IAP constituted a committee to examine the process and product developed. After a series of deliberations, on December 18, 2025, the IAP granted approval for the publication of the guideline.

The guideline is intended to be updated either 2 years from the date of publication, or the availability of new evidence having potential for changing the direction or strength of the recommendations, or hitherto unforeseen challenges faced by end-users in the implementation of the recommendations [2].

Discussion

A salient feature of the process was its methodological rigor, thereby raising confidence in the output (recommendations). Another notable feature was the absence of a budget for the EBGDG work, necessitating totally voluntary work. This makes the process replicable in diverse resource-constrained healthcare settings, including professional scientific societies, while ensuring freedom from financial conflicts of interest. The availability of evidence synthesis specialists speeded up and standardized the process considerably.

However, some limitations are acknowledged. Although the EBGDG included experts from diverse clinical disciplines, it could not include 'people with lived experience' viz. children or parents affected by empyema. Therefore, their perceptions could not be gauged first-hand. Although this is often overlooked in many guidelines developed for pediatricians in India, it is an important aspect as the perceptions of this group are vital. The EBGDG attempted to overcome this limitation by including multiple patient-centric outcomes in each question, and considering the evidence (and its applicability for framing recommendations) from that perspective. Similarly, the EBGDG did not include hospital administrators or policy-makers, whose viewpoints are also important. These lacunae were addressed by considering their perspective when the EtD framework was used.

Although the guideline development methodology was aligned to the methodology recommended by the WHO [16], some deviations are acknowledged. The EBGDG should be ideally an independent decision-making panel critically appraising the evidence, leaving the task of evidence synthesis to a different team. This separation of roles is envisaged to reduce potential bias(es). However, in this guideline, methodological rigor was maintained as none of the EBGDG members had contributed to the generation of primary research evidence, and there were no declared interests requiring management. Further, the WHO generally invites



systematic review teams through an open call, in contrast to the closed-loop process in this guideline.

The IAP NRC realized a priori that besides the development and dissemination of an evidence-based guideline, its implementation, and monitoring change(s) in practice are equally important. Toward this end, a nationwide pre-guideline survey of current practices in empyema management (in diverse healthcare settings) was undertaken [25]. The survey will be repeated twice after the publication of the guideline, in order to assess early change(s) in clinical practice, identify challenges in the implementation of the recommendations, and assess sustainability of the practice changes.

The evidence-based pediatric empyema management guideline was developed using contemporary, scientific methodology, thereby raising confidence in its recommendations for implementation across diverse healthcare settings.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s13312-026-00347-y>.

Acknowledgements Dr. Ketan Kumar (Department of Pediatrics, AIIMS Bhubaneswar) for assisting with a partial draft of the manuscript.

Author contributions JLM conceptualized the guideline, prepared the methodology as described, trained the Evidence Based Guideline Development Group, supervised all steps of the guideline process, drafted, revised, and finalized the manuscript.

Funding Partial funding support was received from the Indian Council for Medical Education and Research (ICMR), New Delhi, through financial grants for (i) Advanced Centre for Evidence Based Child Health (2019–24), and the Pediatric Empyema Guideline (PEG) Project (2025–27).

Data availability Data will be available on reasonable request.

Conflict of interest None.

Ethical approval Institutional Ethics Committee (Extramural) of PGIMER Chandigarh; Ref. No. PGI/IEC/2025/EIC000012 dated January 01, 2025.

References

- Subramanya NK, Rawat SS, Mathew JL. The story of the Indian Academy of Pediatrics National Respiratory Chapter evidence-based guidelines: what, why, how, who, and when! *J Pediatr Pulmonol*. 2023;2:S3–6.
- Mathew JL. Efficiency, economy and excellence: experimental exploration of evidence-based guideline development in resource-constrained settings. *Indian J Pediatr*. 2023;90:700–7.
- Delphi method. Accessed on December 11, 2025. Available from: https://en.wikipedia.org/wiki/Delphi_method
- Light RW. Parapneumonic effusions and empyema. *Proc Am Thorac Soc*. 2006;3:75–80.
- World Health Organization. Revised WHO classification and treatment of childhood pneumonia at health facilities. Accessed on December 20, 2025. Available from <https://iris.who.int/server/api/core/bitstreams/38cf9b2a-5d7d-49de-a27b-46d5ac4fc387/content>
- World Health Organization. Guideline on management of pneumonia and diarrhoea in children up to 10 years of age. Accessed on January 12, 2025. Available from: <https://www.who.int/publications/i/item/9789240103412>
- Government of India Ministry of Health & Family Welfare. Management of Common Respiratory Infections in Children in India. Accessed on December 12, 2025. Available from: <https://clinicalestablishments.mohfw.gov.in/sites/default/files/standard-treatment-guidelines/4671.pdf>
- National Health Mission. Guidance Note for Childhood Pneumonia Management. Accessed on December 20, 2025. Available from: https://nhm.gov.in/New-Update-2024-26/SAANS%202024-25%20Guidance%20Note_08112024.pdf
- Indian Academy of Pediatrics Standard Treatment Guidelines 2022. Community-Acquired Pneumonia. Accessed on December 20, 2025. Available from: <https://iapindia.org/pdf/Ch-011-Community-Acquired-Pneumonia.pdf>
- Balfour-Lynn IM, Abrahamson E, Cohen G. BTS guidelines for the management of pleural infection in children. *Thorax*. 2005;60(Suppl 1):i1–21.
- Shen KR, Bribiesco A, Crabtree T, et al. The American Association for Thoracic Surgery consensus guidelines for the management of empyema. *J Thorac Cardiovasc Surg*. 2017;153:e129–46.
- Strachan RE, Jaffé A. Thoracic Society of Australia and New Zealand Recommendations for managing paediatric empyema thoracis. *Med J Aust*. 2011;195:95.
- Bradley JS, Byington CL, Shah SS, et al. The management of community-acquired pneumonia in infants and children older than 3 months of age: clinical practice guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America. *Clin Infect Dis*. 2011;53:e25–76.
- Islam S, Calkins CM, Goldin AB, et al. The diagnosis and management of empyema in children: a comprehensive review from the APSA Outcomes and Clinical Trials Committee. *J Pediatr Surg*. 2012;47:2101–10.
- Canadian Pediatric Society. Chibuk T, Cohen E, Robinson J, Mahant S, Hartfield D. Paediatric complicated pneumonia: diagnosis and management of empyema. Accessed on March 12, 2024. Available from: <https://cps.ca/documents/position/complicated-pneumonia-empyema>
- World Health Organization. WHO handbook for guideline development 2nd edition. Accessed on December 20, 2025. Available from: <https://iris.who.int/server/api/core/bitstreams/809b813f-fcfe-451e-b242-d914d580c111/content>
- Darzi A, Harfouche M, Arayssi T, et al. Adaptation of the 2015 American College of Rheumatology treatment guideline for rheumatoid arthritis for the Eastern Mediterranean Region: an exemplar of the GRADE Adolopment. *Health Qual Life Outcomes*. 2017;15:183.
- Mathew JL. Systematic reviews and meta-analysis: a guide for beginners. *Indian Pediatr*. 2022;59:320–30.
- Cochrane Methods Bias. RoB 2: A revised Cochrane risk-of-bias tool for randomized trials. Accessed on March 11, 2024. Available from: <https://methods.cochrane.org/bias/resources/rob-2-revised-cochrane-risk-bias-tool-randomized-trials>
- National Institutes of Health (NIH) National Heart, Lung and Blood Institute. Study Quality Assessment Tools. Accessed on December 12, 2025. Available from: <https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools>
- Whiting PF, Rutjes AW, Westwood ME, et al. QUADAS-2: a revised tool for the quality assessment of diagnostic accuracy studies. *Ann Intern Med*. 2011;155:529–36.



22. Guyatt GH, Oxman AD, Vist GE, et al. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ*. 2008;336:924–6.
23. Brożek JL, Akl EA, Alonso-Coello P, et al. Grading quality of evidence and strength of recommendations in clinical practice guidelines: part 1 of 3. An overview of the GRADE approach and grading quality of evidence about interventions. *Allergy*. 2009;64:669–77.
24. Moberg J, Oxman AD, Rosenbaum S, et al. The GRADE evidence to decision (EtD) framework for health system and public health decisions. *Health Res Policy Syst*. 2018;16:1–5.
25. Mathew JL, Chandrasekaran V, Kumar K, Kaur S, Girish M. Clinical practices for management of empyema thoracis in children: a

survey of pediatricians in India. *Indian Pediatr*. 2026. <https://doi.org/10.1007/s13312-026-00340-5>.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.

