

# **Supplemental Material for 2026 Clinical Practice Guideline Update by the Infectious Diseases Society of America and the Pediatric Infectious Diseases Society on the Management of Community-Acquired Pneumonia in Infants and Children Older than 3 Months of Age: The Use of Pleural Fluid Drainage versus Observation**

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## **CLINICAL PRACTICE GUIDELINE DEVELOPMENT PROCESS**

### **Guideline Panel Composition**

The chairs of the guideline panel were selected by the leadership of IDSA. Twelve additional panelists comprised the full panel. The panel included clinicians with expertise in infectious diseases, pediatric infectious diseases, and emergency medicine. Panelists were diverse in gender, geographic distribution, and years of clinical experience. Guideline methodologists oversaw all methodological aspects of the guideline development and identified and summarized scientific evidence for each clinical question. IDSA staff oversaw all administrative and logistic issues related to the guideline panel.

### **Conflicts of Interest**

All members of the expert panel complied with the IDSA policy on conflict of interest (COI), which requires disclosure of any financial, intellectual, or other interest that might be construed as constituting an actual, potential, or apparent conflict. Evaluation of such relationships as potential conflicts of interest was determined by a review process which included assessment by the Standards and Practice Guideline Subcommittee (SPGS) Chair, the SPGS liaison to the Guideline panel and the Board of Directors liaison to the SPGS, and if necessary, the Conflict of Interests Task Force of the Board. This assessment of disclosed relationships for possible COI was based on the relative weight of the financial relationship (i.e., monetary amount) and the relevance of the relationship (i.e., the degree to which an independent observer might reasonably interpret an association as related to the topic or recommendation of consideration). The reader of these guidelines should be mindful of this when the list of disclosures is reviewed. See the Notes section at the end of this guideline for the disclosures reported to IDSA.

### **Practice Recommendations**

Clinical Practice Guidelines are statements that include recommendations intended to optimize patient care by assisting practitioners and patients in making shared decisions about appropriate health care for specific clinical circumstances. These are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options [IOM 2011]. The “IDSA Handbook on Clinical Practice Guideline Development” provides more detailed information on the processes followed throughout the development of this guideline [IDSA CPG Handbook].

### **GRADE approach for Developing Clinical Practice Guidelines**

The GRADE (Grading of Recommendations Assessment, Development and Evaluation) approach for the assessment of the certainty of evidence and strength of recommendation was followed. For certainty of evidence of each critical and important outcome, risk of bias, indirectness, inconsistency, and imprecision were considered, along with publication bias and other special considerations according to GRADE (see Figure 1). (Guyatt 2008, Schunemann 2020) Risk of bias for non-randomized studies was assessed by the Newcastle Ottawa scale. This information is reported in evidence profiles developed using the GRADEpro Guideline Development Tool. Based on certainties of evidence for critical outcomes, a final judgment of confidence in the evidence was made for each recommendation.

The Evidence to Decision framework was used to translate evidence of summaries into practice recommendations. All recommendations are labeled as “strong” or “conditional” according to an evaluation of the certainty of evidence, the balance between benefits and harms, patients’ values and preferences, resources/cost, and other factors such as acceptability, feasibility, and equity. Nonsystematic literature searches were used to inform these evaluations as needed. “The panel recommends” indicates a strong recommendation, and “the panel suggests” indicates a conditional recommendation. Figure 1 provides the suggested interpretation of strong and conditional recommendations for patients, clinicians, and healthcare policymakers. Where there were knowledge gaps, the panel opted to provide limited clinical guidance for reasonable approaches, rather than no guidance at all, and these statements are specifically labeled as knowledge gaps.

### **Approval Process**

Feedback was obtained from two IDSA reviewers, three selected external peer reviewers, and the American Academy of Pediatrics (AAP). The IDSA Standards and Practice Guidelines Subcommittee (SPGS) and Board of Directors reviewed and approved the guideline prior to publication, along with any endorsing societies with the Pediatric Infectious Diseases Society (PIDS).

### **Process for Updating**

IDSA guidelines are regularly reviewed for currency. The need for updates to the guideline is determined by a scan of current literature and the likelihood that any new data would impact the recommendations. Any changes to the guideline will be submitted for review and approval to the appropriate Committees and Board of IDSA.

## **SYSTEMATIC REVIEW PROCESS**

### **Clinical Question**

The clinical question was formatted according to the PICO style: Patient/Population (P), Intervention (I), Comparator/Control (C), Outcome (O). For each PICO question, outcomes of interest were identified a priori and rated as critical, important, or not important, according to their relative importance for decision-making.

### **Eligibility Criteria**

Inclusion criteria:

- *Patient population*- Children with parapneumonic effusion
- *Intervention* - Pleural fluid drainage
- *Comparator*- No fluid drainage/observation (antibiotics alone)
- *Outcomes*- Length of stay, recurrence, cost, morbidity
- *Study design*- Randomized controlled trials (RCTs) with no date limit, observational studies

Exclusion criteria:

- *Patient population*- International populations in resource limited settings
- *Comparator*- No comparator
- *Study design*- case reports

### **Literature Search Methods**

A medical librarian (EG) designed the literature searches for Medline via PubMed, Embase, CINAHL and Cochrane Library, including appropriate MeSH terms, where applicable. Searches were limited to studies published in English. The initial formal literature searches were performed August 2019, and updated literature searches were conducted in October 2022 and August 2024. To supplement the electronic searches, reference lists of related articles and guidelines were reviewed for relevance.

### **Study Selection**

Titles and abstracts were screened in duplicate, and all potentially relevant citations were reviewed in full text by two panelists (SS and KA). Covidence was used to facilitate screening (Covidence Systematic Review Software). Predefined inclusion and exclusion criteria tailored to meet the specific population, intervention, and comparator of each question were applied during the screening process. Abstracts and conference proceedings, letters to the editor, editorials, and review articles were excluded. The steps of the literature selection process were supervised and reviewed by a guideline methodologist for the final selection of the relevant articles. Details of this selection process are reported via PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) diagrams.

### **Data Extraction**

A guideline methodologist in conjunction with panelists extracted the data for each pre-determined patient-important outcome.

## Assessment of Risk of Bias

We assessed risk of bias of individual studies using the Risk of Bias in Non-randomized Studies of Interventions (ROBINS-1) tool (Sterne 2016).

## Data Synthesis

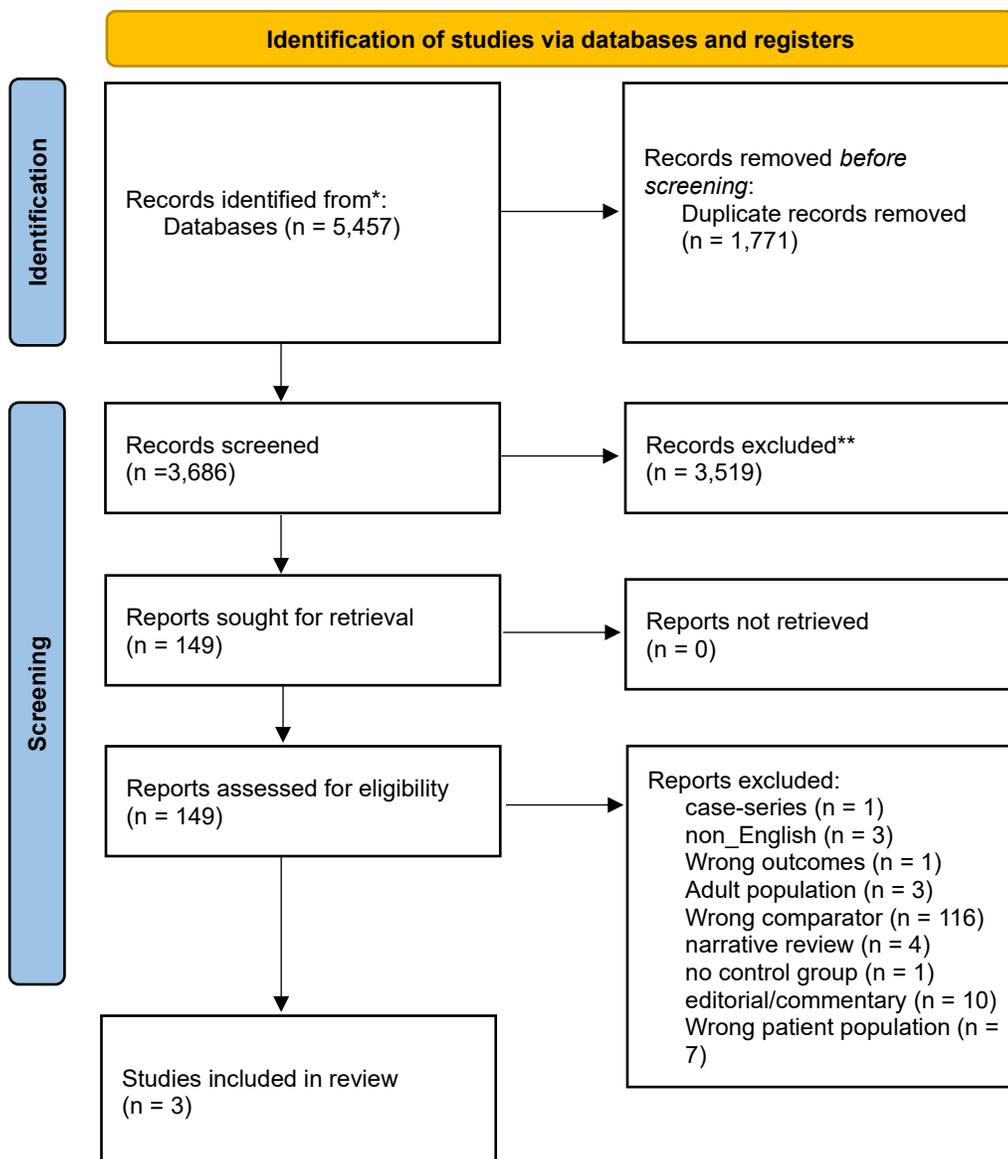
A guideline methodologist in conjunction with panelists extracted the data for each pre-determined patient-important outcome. Where applicable, data were pooled using a random-effects model (fixed effects model for pooling of rates) using RevMan [RevMan].

## Assessment of the Certainty of Evidence

We assessed the certainty of evidence at the outcome level using the GRADE approach (Schünemann 2013). We followed the guidance developed by the GRADE working group to communicate the findings of the systematic review (Santesso 2020).

## SYSTEMATIC REVIEW RESULTS

### Results of the Search



## Characteristics of Included Studies

Author	Location	Study Design	Study Population	Number of Patients, age,	Intervention Description	Comparator Description
<b>Segerer 2017</b>	Germany	Case-control	Pediatric patients with parapneumonic effusion or pleural empyema using nationwide surveillance system (ESPED)	N=645; median age 5 yrs (IQR 3-9)	Pleural drainage catheter (n=347)	Non-invasive therapy (antibiotics alone) (n=282)
<b>Goldin 2012</b>	USA	Retrospective cohort	Pediatric patients (<18y) with diagnosis of empyema or PPE (concurrent diagnosis of pneumonia and pleural effusion) from Pediatric Health Information System (PHIS) database	N=14,936	Drainage procedure (thoracentesis, fibrinolytic therapy, VATS, thoracotomy) (n=7,169)	Observation (Antibiotics alone) (n=7,766)
<b>Carter 2010</b>	USA	Retrospective cohort	Children (1-18yrs) hospitalized with pneumonia and pleural effusions	N=182	Drainage procedure (VATS, chest tube, thoracotomy, fibrinolytics) (n=87)	Observation (antibiotics alone) (n=95)

## Evidence Tables

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Observation	Fluid Drainage	Relative (95% CI)	Absolute (95% CI)		

### Mortality

1 (Goldin 2012)	non-randomised studies	serious <sup>a</sup>	not serious	not serious	serious	none	239/7767 (3.1%)	240/7169 (3.3%)	RR 0.93 (0.78 to 1.11)	<b>2 fewer per 1,000</b> (from 7 fewer to 4 more)	⊕○○○ Very low <sup>a</sup>	CRITICAL
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### Repeat Procedures

1 (Segeer 2017)	non-randomised studies	serious <sup>a</sup>	not serious	not serious	not serious	none	127/282 (45.0%)	91/347 (26.2%)	RR 1.71 (1.38 to 2.13)	<b>186 more per 1,000</b> (from 100 more to 296 more)	⊕○○○ Very low	CRITICAL
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### Length of Stay

2 (Segeer 2017, Carter 2010)	non-randomised studies	serious <sup>a</sup>	not serious	not serious	not serious	none	237	590	-	<b>MD 4.65 days lower</b> (5.43 lower to 3.87 lower)	⊕○○○ Very low	CRITICAL
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## EXPLANATIONS

a. Per ROBINS-I assessment

## Risk of Bias Assessment in Included Studies

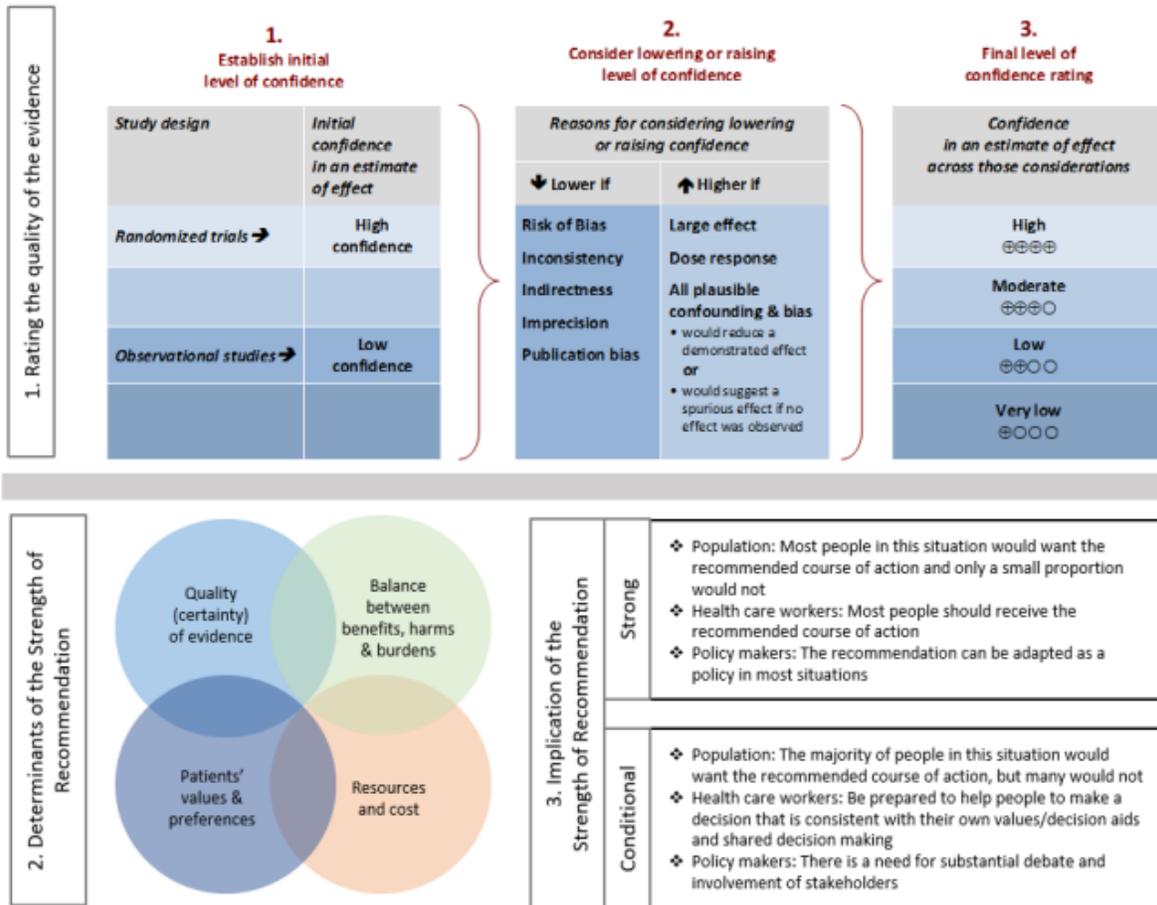
		Risk of bias domains							
		D1	D2	D3	D4	D5	D6	D7	Overall
Study	Segerer 2017								
	Goldin 2012								
	Carter 2010								

Domains:  
D1: Bias due to confounding.  
D2: Bias due to selection of participants.  
D3: Bias in classification of interventions.  
D4: Bias due to deviations from intended interventions.  
D5: Bias due to missing data.  
D6: Bias in measurement of outcomes.  
D7: Bias in selection of the reported result.

Judgement  
 Serious  
 Moderate  
 Low  
 No information

## Other Tables and Figures

**Supplementary Figure 1.** Approach and implication to rating the certainty of evidence and strength of recommendations following the GRADE approach (*unrestricted use of figure granted by the US GRADE network*)



## Search Strategies

### PubMed (NLM)

Search #	Search Details	Results
2	((("Drainage"[MeSH Terms] OR "Thoracentesis"[MeSH Terms] OR "Drainage"[Title/Abstract] OR "drain"[Title/Abstract] OR "drained"[Title/Abstract] OR "draining"[Title/Abstract] OR "drains"[Title/Abstract] OR "Thoracentesis"[Title/Abstract] OR "Thoracenteses"[Title/Abstract] OR "Aspiration"[Title/Abstract] OR "Aspirations"[Title/Abstract] OR "Aspirate"[Title/Abstract] OR "Aspirated"[Title/Abstract] OR "Aspirating"[Title/Abstract] OR "Thoracocentesis"[Title/Abstract] OR "Thoracocenteses"[Title/Abstract] OR "Pleurocentesis"[Title/Abstract] OR "Pleurocenteses"[Title/Abstract] OR "pleuraentesis"[Title/Abstract] OR "Pleurocentesis"[Title/Abstract])) AND ("Adolescent"[MeSH Terms] OR "Child"[MeSH Terms] OR "child, preschool"[MeSH Terms] OR "Infant"[MeSH Terms] OR "adolescence"[Title/Abstract] OR "Adolescent"[Title/Abstract] OR "adolescents"[Title/Abstract] OR "baby"[Title/Abstract] OR "babies"[Title/Abstract] OR "Child"[Title/Abstract] OR "childhood"[Title/Abstract] OR "children"[Title/Abstract] OR "Infant"[Title/Abstract] OR "infants"[Title/Abstract] OR "infancy"[Title/Abstract] OR "juvenile"[Title/Abstract] OR "paediatric"[Title/Abstract] OR "paediatrics"[Title/Abstract] OR "pediatric"[Title/Abstract] OR "pediatrics"[Title/Abstract] OR "preschool child"[Title/Abstract] OR "preschool children"[Title/Abstract] OR "teen"[Title/Abstract] OR "teenager"[Title/Abstract] OR "teenagers"[Title/Abstract] OR "teens"[Title/Abstract] OR "toddler"[Title/Abstract] OR "toddlers"[Title/Abstract] OR "youth"[Title/Abstract] OR "youths"[Title/Abstract])) AND ("empyema, pleural"[MeSH Terms] OR "Pleural Effusion"[MeSH Terms] OR "Pleural Effusion"[Title/Abstract] OR "pleural effusions"[Title/Abstract] OR "pleura effusion"[Title/Abstract] OR "pleura effusions"[Title/Abstract] OR "parapneumonic effusion"[Title/Abstract] OR "parapneumonic effusions"[Title/Abstract] OR "pleural suppuration"[Title/Abstract] OR "lung effusion"[Title/Abstract] OR "empyema"[Title/Abstract])) AND (english[Filter])	1,888
1	("Drainage"[MeSH Terms] OR "Thoracentesis"[MeSH Terms] OR "Drainage"[Title/Abstract] OR "drain"[Title/Abstract] OR "drained"[Title/Abstract] OR "draining"[Title/Abstract] OR "drains"[Title/Abstract] OR "Thoracentesis"[Title/Abstract] OR "Thoracenteses"[Title/Abstract] OR "Aspiration"[Title/Abstract] OR "Aspirations"[Title/Abstract] OR "Aspirate"[Title/Abstract] OR "Aspirated"[Title/Abstract] OR "Aspirating"[Title/Abstract] OR "Thoracocentesis"[Title/Abstract] OR "Thoracocenteses"[Title/Abstract] OR "Pleurocentesis"[Title/Abstract] OR "Pleurocenteses"[Title/Abstract] OR	2,273

"pleuracentesis"[Title/Abstract] OR "Pleurocentesis"[Title/Abstract]) AND ("Adolescent"[MeSH Terms] OR "Child"[MeSH Terms] OR "child, preschool"[MeSH Terms] OR "Infant"[MeSH Terms] OR "adolescence"[Title/Abstract] OR "Adolescent"[Title/Abstract] OR "adolescents"[Title/Abstract] OR "baby"[Title/Abstract] OR "babies"[Title/Abstract] OR "Child"[Title/Abstract] OR "childhood"[Title/Abstract] OR "children"[Title/Abstract] OR "Infant"[Title/Abstract] OR "infants"[Title/Abstract] OR "infancy"[Title/Abstract] OR "juvenile"[Title/Abstract] OR "paediatric"[Title/Abstract] OR "paediatrics"[Title/Abstract] OR "pediatric"[Title/Abstract] OR "pediatrics"[Title/Abstract] OR "preschool child"[Title/Abstract] OR "preschool children"[Title/Abstract] OR "teen"[Title/Abstract] OR "teenager"[Title/Abstract] OR "teenagers"[Title/Abstract] OR "teens"[Title/Abstract] OR "toddler"[Title/Abstract] OR "toddlers"[Title/Abstract] OR "youth"[Title/Abstract] OR "youths"[Title/Abstract]) AND ("empyema, pleural"[MeSH Terms] OR "Pleural Effusion"[MeSH Terms] OR "Pleural Effusion"[Title/Abstract] OR "pleural effusions"[Title/Abstract] OR "pleura effusion"[Title/Abstract] OR "pleura effusions"[Title/Abstract] OR "parapneumonic effusion"[Title/Abstract] OR "parapneumonic effusions"[Title/Abstract] OR "pleural suppuration"[Title/Abstract] OR "lung effusion"[Title/Abstract] OR "empyema"[Title/Abstract])

### **EMBASE**

('pleura effusion'/de OR 'parapneumonic effusion'/exp OR 'parapneumonic pleural effusion'/exp OR 'pleura empyema'/exp OR 'pleural effusion':ti,ab OR 'pleural effusions':ti,ab OR 'pleura effusion':ti,ab OR 'pleura effusions':ti,ab OR 'parapneumonic effusion':ti,ab OR 'parapneumonic effusions':ti,ab OR 'pleural suppuration':ti,ab OR 'lung effusion':ti,ab OR 'lung effusions':ti,ab OR 'empyema':ti,ab) AND ('drainage catheter'/exp OR "drainage":ti,ab OR "drain":ti,ab OR "drained":ti,ab OR "draining":ti,ab OR "drains":ti,ab OR "thoracentesis":ti,ab OR "Thoracenteses":ti,ab OR "Aspiration":ti,ab OR "Aspirations":ti,ab OR "Aspirate":ti,ab OR "Aspirated":ti,ab OR "Aspirating":ti,ab OR "Thoracocentesis":ti,ab OR "Thoracocenteses":ti,ab OR "Pleurocentesis":ti,ab OR "Pleurocenteses":ti,ab OR "pleuracentesis":ti,ab OR "pleurocantensis":ti,ab OR "pleurocentesis":ti,ab) AND ('juvenile'/exp OR 'adolescent'/exp OR 'child'/exp OR 'infant'/exp OR 'adolescence':ti,ab OR 'adolescent':ti,ab OR 'adolescents':ti,ab OR 'baby':ti,ab OR 'babies':ti,ab OR 'boy':ti,ab OR 'boys':ti,ab OR 'child':ti,ab OR 'childhood':ti,ab OR 'children':ti,ab OR 'girl':ti,ab OR 'girls':ti,ab OR 'infancy':ti,ab OR 'infant':ti,ab OR 'infants':ti,ab OR 'juvenile':ti,ab OR 'paediatric':ti,ab OR 'paediatrics':ti,ab OR 'pediatric':ti,ab OR 'pediatrics':ti,ab OR 'pre teen':ti,ab OR 'pre teens':ti,ab OR 'preteen':ti,ab OR 'preteens':ti,ab OR 'teen':ti,ab OR 'teenager':ti,ab OR 'teenagers':ti,ab OR 'teens':ti,ab OR 'toddler':ti,ab OR 'toddlers':ti,ab OR 'youth':ti,ab OR 'youths':ti,ab)

### **CINAHL**

#	Query	Results
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S4	((MH "Adolescence+" OR MH "Child+" OR MH "Infant+" OR TI ("adolescence" OR "adolescent" OR "adolescents" OR "baby" OR "Babies" OR "Boy" OR "Boys" OR "Child" OR "Childhood" OR "Children" OR "Girl" OR "Girls" OR "Infancy" OR "Infant" OR "Infants" OR "Juvenile" OR "paediatric" or "paediatrics" OR "pediatric" OR "pediatrics" OR "pre teen" OR "pre teens" OR "preteen" OR "preteens" OR "teen" OR "teenager" OR "teenagers" OR "teens" OR "toddler" OR "toddlers" OR "youth" OR "youths")) OR AB ("adolescence" OR "adolescent" OR "adolescents" OR "baby" OR "Babies" OR "Boy" OR "Boys" OR "Child" OR "Childhood" OR "Children" OR "Girl" OR "Girls" OR "Infancy" OR "Infant" OR "Infants" OR "Juvenile" OR "paediatric" or "paediatrics" OR "pediatric" OR "pediatrics" OR "pre teen" OR "pre teens" OR "preteen" OR "preteens" OR "teen" OR "teenager" OR "teenagers" OR "teens" OR "toddler" OR "toddlers" OR "youth" OR "youths"))	1,363,493
	S1 andS2	344
S2	(MH "Drainage" OR TI("drainage" OR "drain" OR "drained" OR "draining" OR "drains" OR "thoracentesis" OR "Thoracenteses" OR "Aspiration" OR "Aspirations" OR "Aspirate" OR "Aspirated" OR "Aspirating" OR "Thoracocentesis" OR "Thoracocenteses" OR "Pleurocentesis" OR "Pleurocenteses" OR "pleuracentesis" OR "pleurocantensis" OR "pleurocentesis") OR AB("drainage" OR "drain" OR "drained" OR "draining" OR "drains" OR "thoracentesis" OR "Thoracenteses" OR "Aspiration" OR "Aspirations" OR "Aspirate" OR "Aspirated" OR "Aspirating" OR "Thoracocentesis" OR "Thoracocenteses" OR "Pleurocentesis" OR "Pleurocenteses" OR "pleuracentesis" OR "pleurocantensis" OR "pleurocentesis"))	9,897
S1	(MH "Pleural Effusion" OR TI("pleural effusion" OR "pleural effusions" OR "pleura effusion" OR "pleura effusions" OR "parapneumonic effusion" OR "parapneumonic effusions" OR "pleural suppuration" OR "lung effusion" OR "lung effusions" OR "empyema")) OR AB("pleural effusion" OR "pleural effusions" OR "pleura effusion" OR "pleura effusions" OR "parapneumonic effusion" OR "parapneumonic effusions" OR "pleural suppuration" OR "lung effusion" OR "lung effusions" OR "empyema"))	1,826

***Cochrane (Wiley)***

ID	Search	Hits
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#1

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