

Critically Appraised Topic (CAT):
Aspiration Pneumonia and Anaerobic Antibiotic Coverage

Specific Care Question

In pediatric patients who are hospitalized due to suspected aspiration pneumonia, does antibiotic treatment with anaerobic coverage versus antibiotic treatment without anaerobic coverage improve clinical outcomes?

Plain Language Summary

The intent of this review is not to provide a clinical recommendation, but to give a summary of evidence to inform clinical decisions. Such decisions should consider not only this evidence, but also benefits, harms, value, feasibility, and acceptability.

Pediatric literature comparing the efficacy of specific antibiotic regimens for aspiration pneumonia is sparse. Research in this area is complicated by a lack of clear diagnostic criteria, overlapping symptoms with viral respiratory infections, the inclusion of medically complex patients with multiple chronic conditions, and the common presence of medical devices that can harbor different microbes (e.g., feeding tubes, tracheostomies).¹⁻³

This review was based on 2 non-randomized studies (4,783 participants) and 1 consensus statement.⁴⁻⁶ The overall certainty of the evidence in the non-randomized studies was very low due to diagnostic uncertainty, medically complex patient populations, unbalanced or inadequate control groups, subjective or ambiguous endpoints, significant institutional variation in prescribing patterns, and inconsistent outcomes across studies. The single consensus statement provides recommendations for empiric therapy in patients with neurologic impairment (NI) and a diagnosis of pneumonia.⁴ Patients at high risk for aspiration (based on clinical judgment) are recommended to receive antibiotic coverage for both anaerobic and gram-negative organisms. This recommendation was based on low-quality evidence and the consensus of the expert panel.

The evidence is inconclusive regarding which empiric antibiotic regimen is superior in pediatric patients with suspected aspiration pneumonia. Special consideration should be given to a patient's severity of illness at presentation, risk factors for multi drug-resistant infection, technology dependence, and prior colonization and susceptibility results. Further research is needed to establish diagnostic criteria and recommendations for empiric management of aspiration pneumonia in pediatric patients.

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Rationale for Question Asked

Empiric antibiotics for suspected aspiration pneumonia have traditionally included anaerobic coverage for all age groups. This practice is based on older literature and is no longer recommended in adults.^{7,8} Current guidelines for pediatric patients are lacking.

Characteristics of Included Studies by Outcomes

- Outcome 1: Acute respiratory failure (Table 1)
- Outcome 2: ICU transfer (Table 2)
- Outcome 3: Length of stay (LOS) (Table 3)
- Outcome 4: Treatment failure (Table 4)
- Outcome 5: Bacterial isolates (Table 5)

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Table 1. Acute respiratory failure

Author (year)	Study Design	Population	N	Intervention	Control	Results
Thomson et al (2020) ⁵	Retrospective cohort	Patients with NI and hospitalized with primary diagnosis of aspiration pneumonia (from PHIS database July 1, 2007-June 30, 2015)	N = 4,733 Median age = 5 years (IQR 2 – 11 years)	Gram-negative ^a coverage alone -OR- Gram-negative + anaerobic ^b coverage -OR- Gram-negative + anaerobic + <i>P. aeruginosa</i> coverage ^c	Anaerobic coverage alone ^d	<i>Note: patients with tracheostomy, chronic ventilator dependence, or who received chemotherapy during their hospitalization were excluded</i> Acute respiratory failure (adjusted analysis): - Gram-negative coverage alone had increased odds vs. anaerobic coverage alone (<i>OR</i>, 2.15; 95% CI, 1.41-3.27) - Gram-negative + anaerobic coverage had increased odds vs. anaerobic coverage alone (<i>OR</i>, 1.65; 95% CI, 1.19-2.28) - Gram-negative + anaerobic + <i>P. aeruginosa</i> coverage vs. anaerobic coverage alone did not differ significantly (<i>OR</i> not reported)

^a Gram-negative coverage alone = first, second, and third generation cephalosporins

^b Gram-negative + anaerobic coverage = amoxicillin-clavulanate, ampicillin-sulbactam, tetracyclines, tigecycline OR combinations of anaerobic and gram-negative coverage

^c Gram-negative + anaerobic + *P. aeruginosa* coverage = fluoroquinolones, piperacillin-tazobactam, ticarcillin clavulanate, carbapenems

^d Anaerobic coverage alone = clindamycin, linezolid, metronidazole, penicillins (G and V)

Summary and Certainty of Evidence for Acute Respiratory Failure (defined as the presence of Clinical Transaction Classification (CTC) or ICD-9 procedure code for noninvasive or invasive mechanical ventilation on day two or later of hospitalization, with or without the need for respiratory support on day 0 or day 1)

One cohort study measured acute respiratory failure in pediatric patients with aspiration pneumonia (*n* = 4733).⁵ Patients who received gram-negative coverage alone (except *P. aeruginosa*) or in combination with anaerobic coverage had higher odds of acute respiratory failure compared to those receiving

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anaerobic coverage alone. Patients who received the broadest coverage (including *P. aeruginosa*) did not differ significantly from those who received anaerobic coverage alone.

Certainty of Evidence for Acute Respiratory Failure

The certainty of evidence for acute respiratory failure was low. The evidence was downgraded for serious risk of bias due to inadequate control groups, differences between baseline groups and missing or incomplete data.

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Table 2. ICU transfer

Author (year)	Study Type	Population	N	Intervention	Control	Results
Thomson et al (2020) ⁵	Retrospective cohort	Patients with NI and hospitalized with primary diagnosis of aspiration pneumonia (from PHIS database July 1, 2007-June 30, 2015)	N = 4,733 Median age = 5 years (IQR 2 – 11 years)	Gram-negative ^a coverage alone -OR- Gram-negative + anaerobic ^b coverage -OR- Gram-negative + anaerobic + <i>P. aeruginosa</i> coverage ^c	Anaerobic coverage alone ^d	<i>Note: patients with tracheostomy, chronic ventilator dependence, or who received chemotherapy during their hospitalization were excluded</i> ICU transfer (adjusted analysis): - Gram-negative coverage alone had increased odds vs. anaerobic coverage alone (<i>OR</i>, 1.80; 95% CI, 1.03-3.14) - Gram-negative + anaerobic coverage (with or without <i>P. aeruginosa</i> coverage) vs. anaerobic coverage alone did not differ significantly (<i>OR</i> not reported)

^a Gram-negative coverage alone = first, second, and third generation cephalosporins

^b Gram-negative + anaerobic coverage = amoxicillin-clavulanate, ampicillin-sulbactam, tetracyclines, tigecycline OR combinations of anaerobic and gram-negative coverage

^c Gram-negative + anaerobic + *P. aeruginosa* coverage = fluoroquinolones, piperacillin-tazobactam, ticarcillin clavulanate, carbapenems

^d Anaerobic coverage alone = clindamycin, linezolid, metronidazole, penicillins (G and V)

Summary and Certainty of Evidence for ICU transfer (defined as the requirement for ICU level care on day two or later of hospitalization without initial ICU admission)

One cohort study measured ICU transfers in pediatric patients with aspiration pneumonia (*N* = 4733).⁵ Patients receiving gram-negative coverage alone had increased odds of ICU transfer versus those who received anaerobic coverage alone. However, patients receiving gram-negative plus anaerobic coverage (with or without *P. aeruginosa* coverage) did not differ significantly from those receiving anaerobic coverage alone.

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Certainty of Evidence for ICU Transfer.

The certainty of evidence for ICU transfer was low. The evidence was downgraded due to a serious risk of bias from inadequate control groups, differences between baseline groups, and missing or incomplete data.

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Table 3. Length of stay (LOS)

Author (year)	Study Type	Population	N	Intervention	Control	Results
Thomson et al (2020) ⁵	Retrospective cohort	Patients with NI and hospitalized with primary diagnosis of aspiration pneumonia (from PHIS database July 1, 2007-June 30, 2015)	N = 4,733 Median age = 5 years (IQR 2 – 11 years)	Gram-negative ^a coverage alone -OR- Gram-negative + anaerobic ^b coverage -OR- Gram-negative + anaerobic + <i>P. aeruginosa</i> coverage ^c	Anaerobic coverage alone ^d	<i>Note: patients with tracheostomy, chronic ventilator dependence, or who received chemotherapy during their hospitalization were excluded</i> Length of stay (adjusted analysis): - Gram-negative coverage alone had a longer LOS (<i>RR</i>, 1.28; 95% CI, 1.16-1.41) vs. anaerobic coverage alone - Gram-negative + anaerobic + <i>P. aeruginosa</i> coverage had a shorter LOS (<i>RR</i>, 0.83; 95% CI, 0.76-0.90) vs. anaerobic coverage alone - Gram-negative + anaerobic vs. anaerobic coverage alone did not differ significantly in LOS (<i>RR</i> not reported)

^a Gram-negative coverage alone = first, second, and third generation cephalosporins

^b Gram-negative + anaerobic coverage = amoxicillin-clavulanate, ampicillin-sulbactam, tetracyclines, tigecycline OR combinations of anaerobic and gram-negative coverage

^c Gram-negative + anaerobic + *P. aeruginosa* coverage = fluoroquinolones, piperacillin-tazobactam, ticarcillin clavulanate, carbapenems

^d Anaerobic coverage alone = clindamycin, linezolid, metronidazole, penicillins (G and V)

Summary and Certainty of Evidence for Length of Stay

One cohort study measured LOS in pediatric patients with aspiration pneumonia (*N* = 4733).⁵ Patients receiving gram-negative coverage alone had a longer LOS than those receiving anaerobic coverage alone. However, patients receiving gram-negative, anaerobic, and *P. aeruginosa* coverage had a shorter LOS than those receiving anaerobic coverage alone. Finally, patients receiving gram-negative plus anaerobic coverage did not differ significantly from those receiving anaerobic coverage alone.

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Certainty of Evidence for Length of Stay

The certainty of evidence for the length of stay was low. The evidence was downgraded due to a serious risk of bias from inadequate control groups, differences between baseline groups, and missing or incomplete data.

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Table 4. Treatment failure

Author (year)	Study Type	Population	N	Intervention	Results
Ashkenzai-Hoffnung et al (2016) ⁶	Prospective cohort	Children < 18 yrs with a high aspiration risk ^a who were hospitalized for aspiration pneumonia from 2009-2014	N = 50 children; 235 hospital admissions Median age = 4.6 years (range 4 months – 18 years)	Monotherapy Ceftriaxone = 130 Piperacillin/tazobactam = 27 Ceftazidime = 25 Cefuroxime = 18 Amoxicillin-clavulanate = 13 Ciprofloxacin = 3 Penicillin = 1 Combination therapy Piperacillin/tazobactam + amikacin = 4 Piperacillin/tazobactam + cefazolin = 2 Ceftazidime+ amikacin = 1 Piperacillin/tazobactam + vancomycin+ ceftazidime = 1 Piperacillin/tazobactam + cloxacillin = 1	Treatment failure (monotherapy): Ceftriaxone = 31/130 (24%) Piperacillin/tazobactam = 4/27 (15%) Ceftazidime = 3/25 (12%) Cefuroxime = 2/18 (11%) Amoxicillin-clavulanate = 2/13 (15%) Ciprofloxacin = 0/3 (0%) Penicillin 1/1 = (100%) Treatment failure (combination therapy): Piperacillin/tazobactam + amikacin = 0/4 (0%) Piperacillin/tazobactam + cefazolin = 1/2 (50%) Ceftazidime+ amikacin = 0/1 (0%) Piperacillin/tazobactam + vancomycin + ceftazidime = 0/1 (0%) Piperacillin/tazobactam + cloxacillin = 0/1 (0%)

^a Risk factors for aspiration included neurological dysphagia, neuromuscular diseases, pharyngo-laryngeal dysfunction, and esophageal dysfunction

Summary and Certainty of Evidence for Treatment Failure (defined as a change from the initial antibiotic regimen due to continued fever and respiratory signs or pneumonia-related death during initial treatment)

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One cohort study measured treatment failure in pediatric patients with aspiration pneumonia ($N = 50$ patients with 235 encounters).⁶ Failure rates are summarized in Table 4. Subgroup analysis for anaerobic coverage versus no anaerobic coverage was not done.

Certainty of Evidence for Treatment Failure

The certainty of evidence for treatment failure was very low. The evidence was downgraded for serious risk of bias due to ambiguity in study endpoints and possible subjectivity in assessment of endpoints. The evidence was also downgraded for indirectness because of the study population (small sample size of children in Israel).

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Table 5. Bacterial isolates

Author (year)	Study Type	Population	N	Data Collected	Results
Ashkenzai-Hoffnung et al (2016) ⁶	Prospective cohort	Children < 18 yrs with a high aspiration risk ^a who were hospitalized for aspiration pneumonia from 2009-2014	<i>N</i> = 50 children; 183 cultures from 235 hospital admissions Median age = 4.6 years (range 4 months – 18 years)	Semi-quantitative aerobic cultures of respiratory tract specimens with more than 25 leukocytes and fewer than 10 squamous cells per low-power field were performed in the first 48 hours of admission	- Respiratory cultures were positive for bacteria in 110 of 183 cases (60%); 80 (73%) of these contained more than one pathogen - Of the 169 bacterial isolates, 138 (78%) were gram-negative and 31 (18%) were gram-positive - The most common isolates were: <i>P. aeruginosa</i> (<i>n</i> = 56) <i>Klebsiella</i> sp. (<i>n</i> = 27) <i>Enterobacter</i> sp. (<i>n</i> = 17) <i>E. coli</i> (<i>n</i> = 15) <i>S. aureus</i> (<i>n</i> = 12) <i>S. pneumoniae</i> (<i>n</i> = 9)

^a Risk factors for aspiration included neurological dysphagia, neuromuscular diseases, pharyngo-laryngeal dysfunction, and esophageal dysfunction

Summary and Certainty of Evidence for Bacterial Isolates (nasopharyngeal or oropharyngeal specimens were collected by a qualified physiotherapist during chest physiotherapy by the induced sputum technique)

One cohort study reported on bacterial isolates in pediatric patients with aspiration pneumonia (*N* = 50 patients with 235 encounters).⁶ Culture results are summarized in Table 5. The most common bacteria isolated from these patients was *P. aeruginosa*.

Certainty of Evidence for Bacterial Isolates

The certainty of evidence for treatment failure was very low. The evidence was downgraded for serious risk of bias due to ambiguity in study endpoints and possible subjectivity in assessment of endpoints. The evidence was also downgraded for indirectness because of the study population (small sample size of children in Israel).

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Search Methods

We searched EMBASE and PubMed from January 1, 2016 – May 27, 2026. This 10-year window was selected to reflect the evolving nature of medical practice, technology, and laboratory methodology over time, with more recent publications considered more likely to reflect current clinical practice.

Selection Criteria

Studies were eligible for inclusion if they were randomized controlled trials, observational (non-randomized) studies, clinical practice guidelines, or consensus statements in children and adolescents with aspiration pneumonia and reported outcomes based on antibiotic use or provided antibiotic recommendations for the treatment of aspiration pneumonia. Studies were excluded if they were narrative reviews, reported only descriptive characteristics, did not differentiate between types of pneumonia, were specific to toxic ingestions, or were done in neonates or adults only.

Identification of Studies

A. Wirtz and K. Berg reviewed the 115 titles and/or abstracts found in the search and identified 1 consensus statement and 13 single studies believed to answer the question. After an in-depth review, 1 consensus statement⁴ and 2 non-randomized studies^{5,6} answered the question.

Search Strategy and Results

See Appendix:

Appendix 1. Search Strategy

Appendix 2. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)

Findings from this review were presented with the question originator on September 1, 2026.

Question Originator

A. Wirtz, PharmD, BCPPS

Medical Librarian Responsible for the Search Strategy

K. Swaggart, MLIS, AHIP

EBP Team Members Responsible for Analyzing Literature

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Appendix 1

Search Strategy (PubMed, Embase; January 1, 2016 – May 27, 2026)

PubMed

No.	Query	Results
#7	#6 NOT (casereports[Filter])	51
#6	#5 AND (2016:2026[pdat])	90
#5	#4 AND (adolescent[Filter] OR allchild[Filter] OR allinfant[Filter] OR child[Filter] OR newborn[Filter] OR preschoolchild[Filter] OR pediatr*)	222
#4	#1 AND #2 AND #3	1242
#3	"Hospitalization"[Mesh] OR "Inpatients"[Mesh] OR "Adolescent, Hospitalized"[Mesh] OR "Child, Hospitalized"[Mesh] OR "hospital admission" OR "inpatient care" OR hospitalized OR inpatient	8,613,553

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#2	"Anti-Bacterial Agents"[Mesh] OR "Anti-Infective Agents"[Mesh] OR "antibiotic agent" OR antibiotic OR "anti-infective agent" OR antimicrobial OR antibacterial	2,451,674
#1	"Pneumonia, Aspiration"[Mesh] OR "Alveolitis, Extrinsic Allergic"[Mesh] OR "aspiration pneumonia"[tiab] OR "aspiration pneumonitis"[tiab] OR "chemical pneumonitis"[tiab] OR (aspiration[tiab] AND (pneumonia[tiab] OR pneumonitis[tiab]))	19,552

Embase

No.	Query	Results
#8	#7 NOT 'case report'/de	74
#7	#6 AND ('Article'/it OR 'Clinical Trial'/it OR 'Letter'/it OR 'Note'/it OR 'Review'/it)	137
#6	#4 AND ('adolescent':ag OR 'child':ag OR 'infant':ag OR 'preschool':ag OR 'school':ag OR pediatric*) AND [2016-2026]/py	170
#5	#4 AND ('adolescent':ag OR 'child':ag OR 'infant':ag OR 'preschool':ag OR 'school':ag OR pediatric*)	252

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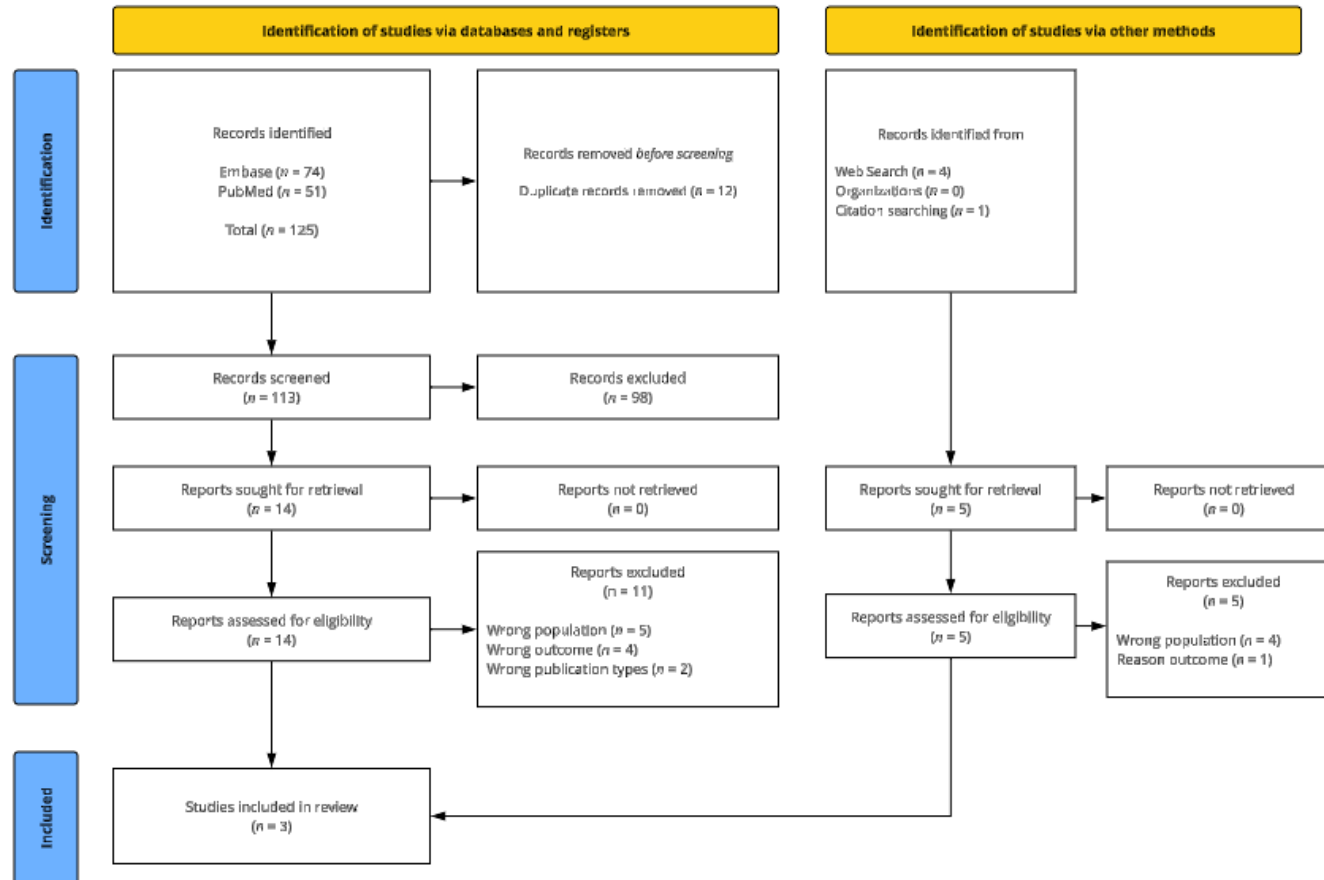
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#4	#1 AND #2 AND #3	1214
#3	'inpatient care'/exp OR 'inpatient care' OR 'inpatient'/exp OR inpatient OR 'hospital patient'/exp OR 'hospital patient' OR 'hospitalized child'/exp OR 'hospitalized child' OR 'hospitalized infant'/exp OR 'hospitalized infant' OR 'hospitalized adolescent'/exp OR 'hospitalized adolescent' OR 'hospital admission'/exp OR 'hospital admission' OR hospitalized	913766
#2	'antibiotic agent'/exp OR 'antibiotic agent' OR 'antibiotic'/exp OR antibiotic OR 'antiinfective agent'/exp OR 'antiinfective agent' OR 'antimicrobial'/exp OR antimicrobial OR 'antibacterial'/exp OR antibacterial	6175126
#1	'aspiration pneumonia'/exp OR 'aspiration pneumonia':ti,ab,kw OR 'aspiration pneumonitis'/exp OR 'aspiration pneumonitis':ti,ab,kw OR 'chemical pneumonitis'/exp OR 'chemical pneumonitis':ti,ab,kw OR (aspiration:ti,ab,kw AND (pneumonia:ti,ab,kw OR pneumonitis:ti,ab,kw))	32230

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Appendix 2

 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)⁹


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