Brief Resolved Unexplained Events

(~~Apparent Life Threatening Events~~)

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You will learn about…

1. Historical framework and epidemiology
2. ALTE vs BRUE
3. Event characterization: explained vs unexplained
4. Risk stratification and new recommendations
5. Tools to implement change in your practice

Historical Framework and Epidemiology

1

What <u>was</u> an Apparent Life Threatening Event?

Definition of ALTE

An episode in the first year of life that appears potentially life threatening to the observer and is characterized by some combination of:

- Color change
- Apnea
- Alteration in muscle tone
- Choking or gagging

National Institutes of Health (1987) Consensus development conference on infantile apnea and home monitoring 1986. Pediatrics 79: 292-299

Defined decades ago to better understand SIDS

National Institutes of Health
Consensus Development Conference Statement
September 29-October 1, 1986

This statement is more than five years old and is provided solely for historical purposes. Due to the cumulative nature of medical research, new knowledge has inevitably accumulated in this subject area in the time since the statement was initially prepared. Thus some of the material is likely to be out of date, and at worst simply wrong. For reliable, current information on this and other health topics, we recommend consulting the National Institutes of Health's MedlinePlus http://www.nlm.nih.gov/medlineplus/.

This statement was originally published as: Infantile Apnea and Home Monitoring. NIH Consens Statement 1986 Sep 29-Oct 1;6(6):1-10.

Epidemiology

Conservatively

- 1 out of 250-400 children hospitalized for an ALTE

But scary events are very common

- 43% of healthy infants have had 20 sec apnea episode over 3 mo period
- 5% of parents recall seeing apnea event
- Normal in infants: choking, gagging, blue discoloration, tone changes, periodic and irregular breathing

- Monti MC, Borrelli P, Nosetti L, Tajè S, Perotti M, Bonarrigo D, Stramba Badiale M, Montomoli C. Incidence of apparent life-threatening events and post-neonatal risk factors. Acta Paediatr. 2016 Mar 6.
- Kiechl-Kohlendorfer U, Hof D, Peglow UP, Traweger-Ravanelli B, Kiechl S. Epidemiology of apparent life threatening events. Arch Dis Child. 2005 Mar;90(3):297-300.
- Ramanathan R, Corwin MJ, Hunt CE, et al. Cardiorespiratory events recorded on home monitors: comparison of healthy infants with those at increased risk for SIDS. JAMA 2001;285: 2199– 207
- Mitchell EA, Thompson JM. Parental reported apnoea, admissions to hospital and sudden infant death syndrome. Acta Paediatr 2001;90:417– 22.]

ALTE discharge diagnosis

Most common

- Idiopathic (26-50%)
- GER (26-54%)
- Respiratory infection (8-11%)
- Seizure (9-11%)

Less common

- Child maltreatment (<1%)
- Pertussis (0.05-9%)
- Cardiac arrhythmias (<1%)
- Bacterial infection (0-8%)
- Metabolic Disorder (1.5%)

McGovern MC, Smith MB. Causes of apparent life threatening events in infants: a systematic review. Arch Dis Child. 2004 Nov;89(11):1043-8. Review.

AN ALTE IS NOT A WARNING SIGN FOR SIDS!

- No causal relationship of preexisting apnea or ALTE and SIDs
- Interventions to reduce SIDs have not reduced ALTEs (e.g. back to sleep)
- SIDS and ALTEs have different risk factors

- Bonkowsky, J. L., Guenther, E., Filloux, F. M., & Srivastava, R. (2008). Death, child abuse, and adverse neurological outcome of infants after an apparent life- threatening event. Pediatrics, 122(1), 125-131. doi: 10.1542/peds.2007-3376
- Esani N, Hodgman JE, Ehsani N, Hoppenbrouwers T. Apparent life-threatening events and sudden infant death syndrome: comparison of risk factors. J Pediatr. 2008 Mar;152(3):365-70.
- Freed GE, Steinschneider A, Glassman M, Winn K. Sudden infant death syndrome prevention and an understanding of selected clinical issues. Pediatr Clin North Am. 1994 Oct;41(5):967-90. Review.

ALTE…a recipe for a testing/treatment cascade

- Broad differential diagnosis
- Anxiety provoking
- Common
- Low prevalence of disease
- Perceived reassurance from testing or hospitalization
- Poor understanding of true risk
- Use of nonspecific testing prone to false positive results

"Primum non nocere"

"An excellent specimen … symbol of beauty, innocence, and fragile life … hand me the jar of ether."

High Resource Use and Variation

- Multicenter study of patients hospitalized with ALTE
- Mean LOS = **4.4** (SD 5.6) days
- Mean adjusted charges = **$15,567** (SD $28,510)
- Readmission = 2.5% but variable

Variation in Inpatient Resource Utilization and Management of Apparent Life-Threatening Events

Joel S. Tieder, MD, MPH, Charles A. Cowan, MD, Michelle M. Garrison, PHD, and Dimitri A. Christakis, MPH

Objective To report national variations in diagnostic approaches to apparent life-threatening events (ALTEs) and resource utilization.

Study design Using the Pediatric Health Information System, we studied children who were age 3 days to 5 months at admission and were discharged with an *International Classification of Diseases, Ninth* Revision (ICD-9) code potentially identifiable as ALTE. Multiple analysis of variance was used to determine whether the variances in adjusted charges, length of stay (LOS), and diagnostic studies were hospital-related after controlling for other covariates. Logistic regression was used to study the association of readmission rates with discharge diagnosis and specific diagnostic studies.

Results The study group comprised 12,067 patients, with a mean LOS of 4.4 days (standard deviation ± 5.6 days) and mean adjusted charges of $15,567 ($28,510) per admission. The mean in-hospital mortality rate was 0.56% (n = 68), and the rate of 30-day readmission was 2.5%. The most common discharge diagnoses were gastroesophageal reflux 36.9% (48.3%) and lower respiratory tract infection 30.8% (46.2%). Mean LOS, total adjusted charges, and use of diagnostic studies varied considerably across hospitals, and hospital-level differences were a significant contributor to the variance of these outcomes after controlling for covariates ($P < .001$). There was an increased likelihood of readmission for patients discharged with a diagnosis of cardiovascular disorders (odds ratio [OR] = 1.68; 95% confidence interval [CI] = 1.30 to 2.16) and gastroesophageal reflux (OR = 1.32; 95% CI = 1.03 to 1.69) compared with other discharge diagnoses.

Conclusions There is considerable hospital-based variation in care for patients hospitalized for conditions potentially identifiable as ALTE, particularly in the evaluation and diagnosis of gastroesophageal reflux, which may contribute to adverse clinical and financial outcomes. An evidence-based national standard of care for ALTE is needed, as are multi-institutional initiatives to study different diagnostic and management strategies and their effect on patient outcomes. *(J Pediatr 2008;152:629-35)*

An apparent life-threatening event (ALTE) is defined as an episode in the first year of life that appears potentially life-threatening to the observer and is characterized by some combination of color change, apnea, alteration in muscle tone, and choking or gagging.[1] The true incidence of ALTEs is largely unknown, but they may account for 2.3% of hospitalized children and 0.6% to 0.8% of all emergency department visits for children under age 1 year.[2,3] The most frequently reported underlying causes are gastroesphageal reflux (GER), seizures, and lower respiratory tract infection (LRTI); less common causes include pertussis, cardiac arrhythmias, nonaccidental trauma, and bacterial infections. The underlying etiology can be elusive; >50% of ALTEs are considered idiopathic.[3-7]

Infants who present to the clinician because of an ALTE, particularly those who subsequently appear well, pose a diagnostic and management dilemma. ALTEs typically evoke significant anxiety in caretakers, but a treatable diagnosis is seldom found, morbidity and mortality is poorly understood, and the risk of recurrence is unknown. Consequently, many children with ALTE are hospitalized and often undergo an extensive and potentially unfruitful evaluation, presumably to rule out serious underlying conditions. Recent research based in tertiary care academic centers suggests that children presenting to the emergency department with an ALTE may receive excessive medical intervention. A

ALTE	Apparent life-threatening event	LOS	Length of stay
ANOVA	Analysis of variance	LRTI	Lower respiratory tract infection
CI	Confidence interval	OR	Odds ratio
GER	Gastroesophageal reflux	PHIS	Pediatric Health Information System
GI	Gastrointestinal		
ICD-9	*International Classification of Diseases, Ninth Revision*		

See editorial, p 604

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Submitted for publication Mar 5, 2007; last revision received Jul 11, 2007; accepted Nov 12, 2007.

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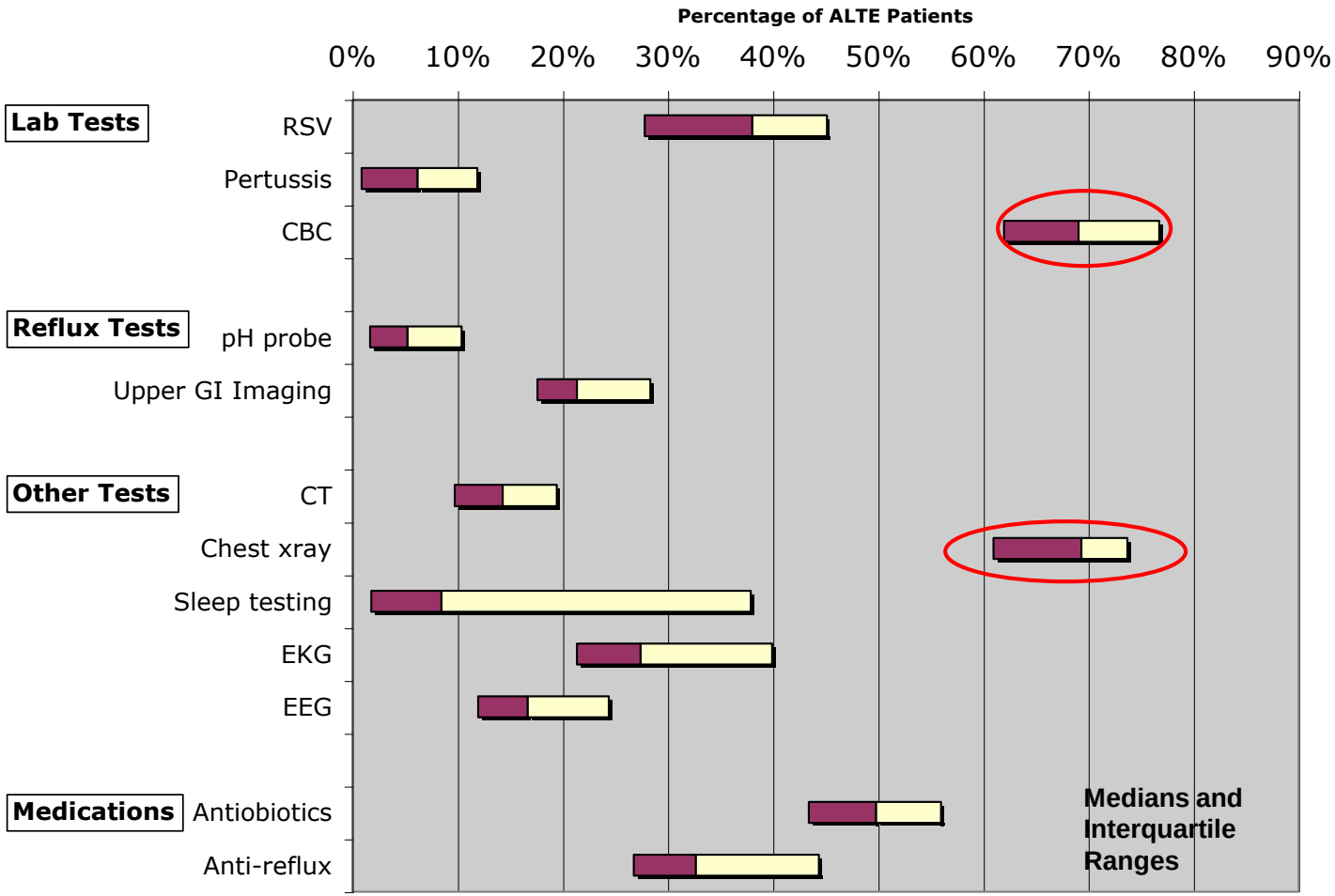
0022-3476/$ - see front matter

10.1016/j.jpeds.2007.11.024

Tieder, JS et al. Variation in inpatient resource utilization and management of Apparent Life-Threatening Events. J Peds. 2008 May;152(5):629-35, 635.

Resource Utilization Across Hospitals



Tieder, JS et al. Variation in inpatient resource utilization and management of Apparent Life-Threatening Events. J Peds. 2008 May;152(5):629-35, 635.

Systematic Review

For infants that are well appearing upon presentation…

- Historical and PE features can identify risk
- Testing tailored to these risks of value
- True risk of a subsequent event or underlying disorder cannot be ascertained
- A more precise definition of an ALTE is needed
- Further research is warranted

THE JOURNAL OF PEDIATRICS • www.jpeds.com ORIGINAL ARTICLES

Management of Apparent Life-Threatening Events in Infants: A Systematic Review

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Objective To determine in patients who are well-appearing and without a clear etiology after an apparent life-threatening event (ALTE): (1) What historical and physical examination features suggest that a child is at risk for a future adverse event and/or serious underlying diagnosis and would, therefore, benefit from testing or hospitalization? and (2) What testing is indicated on presentation and during hospitalization?

Study design Systematic review of clinical studies, excluding case reports, published from 1970 through 2011 identified using key words for ALTE.

Results The final analysis was based on 37 studies; 18 prospective observational, 19 retrospective observational. None of the studies provided sufficient evidence to fully address the clinical questions. Risk factors identified from historical and physical examination features included a history of prematurity, multiple ALTEs, and suspected child maltreatment. Routine screening tests for gastroesophageal reflux, meningitis, bacteremia, and seizures are low yield in infants without historical risk factors or suggestive physical examination findings.

Conclusion Some historical and physical examination features can be used to identify risk in infants who are well-appearing and without a clear etiology at presentation, and testing tailored to these risks may be of value. The true risk of a subsequent event or underlying disorder cannot be ascertained. A more precise definition of an ALTE is needed and further research is warranted. *(J Pediatr 2013;■:■-■).*

An apparent life-threatening event (ALTE) was defined at a consensus development conference convened in 1986 by the National Institutes of Health to address the relationship between sudden infant death syndrome (SIDS) and apnea.[1] An ALTE was defined as "an episode that is frightening to the observer and that is characterized by some combination of apnea (central or occasionally obstructive), color change (usually cyanotic or pallid but occasionally erythematous or plethoric), marked change in muscle tone (usually marked limpness), choking, or gagging."

There are three significant challenges for clinicians managing patients who have experienced an ALTE. First, the infant is often asymptomatic at presentation. Second, although most ALTEs represent a benign event, they can signify a more serious illness, such as sepsis or child maltreatment. Third, the decision to perform tests or hospitalize a patient is fraught with uncertainties. Clinicians may hospitalize the infant to facilitate observation, educate the parents, or complete tests. Yet, this approach may subject the patient to unnecessary risk and increase parental anxiety without improving outcomes.[2,3]

Given a lack of consensus regarding the management of infants who are initially well-appearing and without a clear etiology, an ALTE expert panel systematically reviewed the literature to answer two key questions: (1) What historical and physical examination features on presentation suggest that an infant is at risk for a future adverse event and/or serious underlying diagnosis and would therefore benefit from diagnostic testing and hospitalization? and (2) What testing is indicated on presentation and during hospitalization?

ALTE	Apparent life-threatening event
ED	Emergency department
EEG	Electroencephalogram
GER	Gastroesophageal reflux
RR	Relative risk
SIDS	Sudden infant death syndrome
URI	Upper respiratory tract

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The Society of Hospital Medicine sponsored the conference calls and an online data management platform for this study; however, it was not involved in the study design, writing of the report, decision to submit the manuscript for publication, or collection, analysis, and interpretation of data. The authors declare no conflicts of interest.

CLINICAL PRACTICE GUIDELINE Guidance for the Clinician in Rendering Pediatric Care

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Brief Resolved Unexplained Events (Formerly Apparent Life-Threatening Events) and Evaluation of Lower-Risk Infants: Executive Summary

Joel S. Tieder, MD, MPH, FAAP, Joshua L. Bonkowsky, MD, PhD, FAAP, Ruth A. Etzel, MD, PhD, FAAP, Wayne H. Franklin, MD, MPH, MMM, FAAP, David A. Gremse, MD, FAAP, Bruce Herman, MD, FAAP, Eliot S. Katz, MD, FAAP, Leonard R. Krilov, MD, FAAP, J. Lawrence Merritt II, MD, FAAP, Chuck Norlin, MD, FAAP, Jack Percelay, MD, MPH, FAAP, Robert E. Sapién, MD, MMM, FAAP, Richard N. Shiffman, MD, MCIS, FAAP, Michael B.H. Smith, MB, FRCPCH, FAAP, SUBCOMMITTEE ON APPARENT LIFE THREATENING EVENTS

EXECUTIVE SUMMARY

This clinical practice guideline has 2 primary objectives. First, it recommends the replacement of the term "apparent life-threatening event" (ALTE) with a new term, "brief resolved unexplained event" (BRUE). Second, it provides an approach to evaluation and management that is based on the risk that the infant will have a repeat event or has a serious underlying disorder.

Clinicians should use the term BRUE to describe an event occurring in an infant younger than 1 year when the observer reports a sudden, brief, and now resolved episode of ≥1 of the following: (1) cyanosis or pallor; (2) absent, decreased, or irregular breathing; (3) marked change in tone (hyper- or hypotonia); and (4) altered level of responsiveness. Moreover, clinicians should diagnose a BRUE only when there is no explanation for a qualifying event after conducting an appropriate history and physical examination (see Tables 2 and 3 in www.pediatrics.org/cgi/doi/10.1542/peds.2016-0590). Among infants who present for medical attention after a BRUE, the guideline identifies (1) lower-risk patients on the basis of history and physical examination, for whom evidence-based guidelines for evaluation and management are offered, and (2) higher-risk patients, whose history and physical examination suggest the need for further investigation, monitoring, and/or treatment, but for whom recommendations are not offered (because of insufficient evidence or the availability of guidance from other clinical practice guidelines specific to their presentation or diagnosis). Recommendations in this guideline apply only to lower-risk patients,

DOI: 10.1542/peds.2016-0291

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

To cite: Tieder JS, Bonkowsky JL, Etzel RA, et al. Brief Resolved Unexplained Events (Formerly Apparent Life-Threatening Events) and Evaluation of Lower-Risk Infants: Executive Summary. *Pediatrics*. 2016;137(5):e20160591

The Event Formerly Known as ALTE

2

ALTE vs BRUE

ALTE

- An episode in the first year of life that appears potentially life threatening to the observer and is characterized by some combination of…

BRUE

- Event occurring in an infant < 1 year where the observer reports a sudden, brief period of one or more of the following…
- No explanation for event after appropriate history and PE

ALTE vs BRUE

ALTE

- Color change
- Apnea
- Alteration in muscle tone
- Choking or gagging

BRUE

- Cyanosis or pallor
- Absent, decreased, or irregular breathing
- Marked change in tone (hyper- or hypotonia)
- Altered level of responsiveness

ALTE vs BRUE

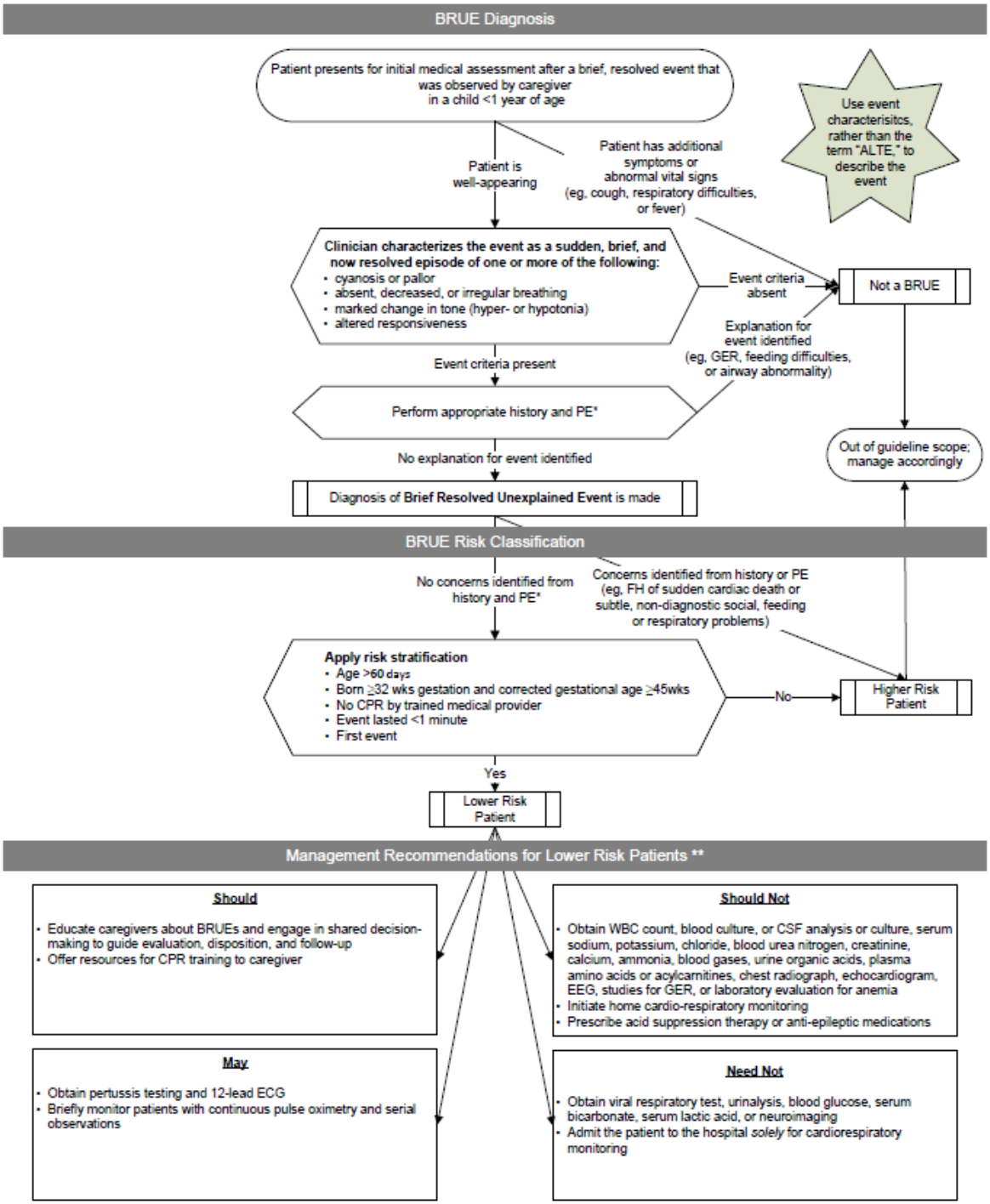
ALTE

- Both chief complaint and diagnosis
- Not always life-threatening
- Can have ongoing symptoms (e.g., fever, URI)
- Can have a diagnosis (e.g., meningitis, bronchiolitis)

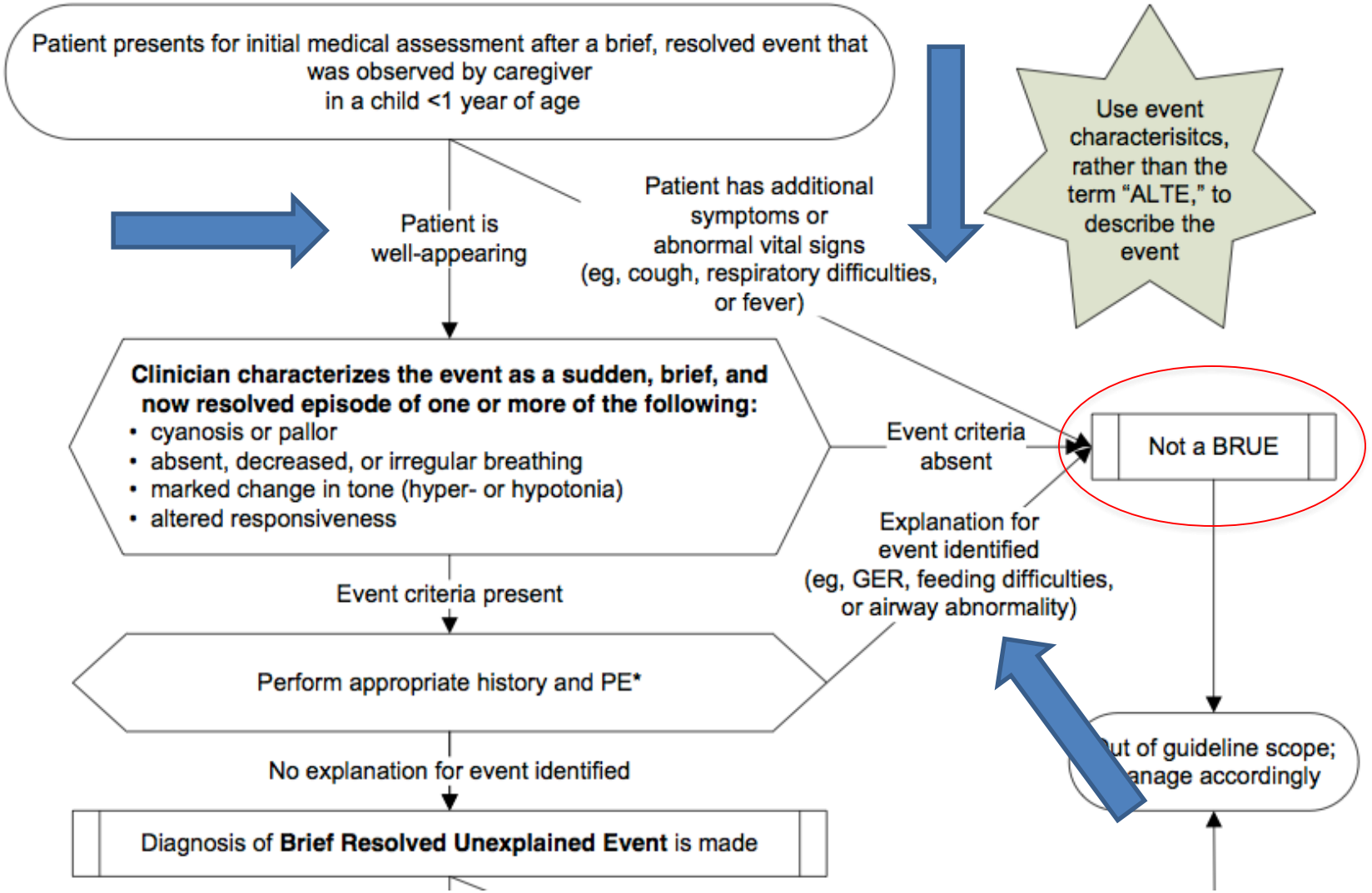
BRUE

- Diagnosis of exclusion
- Excludes patients with an explanation or diagnosis (e.g., GER)
- Excludes symptomatic infants (i.e., just an event)

Event characterization
Explained vs Unexplained
3


BRUE Diagnosis
Patient presents for initial medical assessment after a brief, resolved event that was observed by caregiver in a child <1 year of age
Use event characterisitcs, rather than the term "ALTE," to describe the event
Patient is well-appearing
Patient has additional symptoms or abnormal vital signs (eg, cough, respiratory difficulties, or fever)
Clinician characterizes the event as a sudden, brief, and now resolved episode of one or more of the following:
• cyanosis or pallor
• absent, decreased, or irregular breathing
• marked change in tone (hyper- or hypotonia)
• altered responsiveness
Event criteria absent
Not a BRUE
Explanation for event identified (eg, GER, feeding difficulties, or airway abnormality)
Event criteria present
Perform appropriate history and PE*
Out of guideline scope; manage accordingly
No explanation for event identified
Diagnosis of Brief Resolved Unexplained Event is made
BRUE Risk Classification
No concerns identified from history and PE*
Concerns identified from history or PE (eg, FH of sudden cardiac death or subtle, non-diagnostic social, feeding or respiratory problems)
Apply risk stratification
• Age >60 days
• Born ≥32 wks gestation and corrected gestational age ≥45wks
• No CPR by trained medical provider
• Event lasted <1 minute
• First event
No
Higher Risk Patient
Yes
Lower Risk Patient
Management Recommendations for Lower Risk Patients **
Should
• Educate caregivers about BRUEs and engage in shared decision-making to guide evaluation, disposition, and follow-up
• Offer resources for CPR training to caregiver
Should Not
• Obtain WBC count, blood culture, or CSF analysis or culture, serum sodium, potassium, chloride, blood urea nitrogen, creatinine, calcium, ammonia, blood gases, urine organic acids, plasma amino acids or acylcarnitines, chest radiograph, echocardiogram, EEG, studies for GER, or laboratory evaluation for anemia
• Initiate home cardio-respiratory monitoring
• Prescribe acid suppression therapy or anti-epileptic medications
May
• Obtain pertussis testing and 12-lead ECG
• Briefly monitor patients with continuous pulse oximetry and serial observations
Need Not
• Obtain viral respiratory test, urinalysis, blood glucose, serum bicarbonate, serum lactic acid, or neuroimaging
• Admit the patient to the hospital solely for cardiorespiratory monitoring

BRUE Diagnosis



SUPPLEMENTAL TABLE 6 Differential Diagnosis of an Infant Presenting With a Lower- or Higher-Risk BRUE

- Otolaryngologic
  - Maxillary hypoplasia
  - Micrognathia
  - Macroglossia
  - Choanal atresia
  - Pyriform aperture stenosis
  - Laryngomalacia/anomalies
  - Subglottic stenosis
  - Tracheomalacia/anomalies
  - Adenotonsillar hypertrophy
  - OSA
  - Vaso-vagal response
  - Unintentional suffocation
- Gastrointestinal
  - GER
  - Dysphagia/choking
  - Esophageal dysmotility
  - Laryngeal chemoreflex
  - Bowel obstruction
  - Gastroenteritis
  - Tracheoesophageal fistulas
  - Esophageal foreign body
  - Intussusception
- Cardiovascular
  - Channelopathies (prolonged QT syndromes, Brugada syndrome, short QT syndrome)
  - Congenital heart disease
  - Cardiomyopathy/myocarditis
  - Vascular ring/sling/compression
  - Ventricular pre-excitation (Wolff-Parkinson-White syndrome)
  - Arrhythmia
  - Sepsis
  - Syncope
- Neurologic
  - Seizures
  - Stroke
  - Intracranial mass lesion
  - Brain/intracranial structural or vascular abnormality
  - Intracranial hemorrhage
  - Hydrocephalus
  - Neuromuscular disorder
  - Congenital central hypoventilation syndrome
  - Apnea of prematurity
  - Infant botulism
  - Demyelinating disorder (transverse myelitis, multiple sclerosis, acute disseminated encephalomyelitis)
- Pulmonary
  - Aspiration
  - Asthma
  - Foreign body
  - Congenital airway anomalies/malacia
  - Infection
  - Hemorrhage
  - Upper and lower respiratory tract infection
- Infectious
  - Bronchiolitis
  - Pneumonia
  - Croup
  - Upper respiratory infection
  - UTI
  - Sepsis
  - Meningitis
  - Gastroenteritis
  - Viral syndrome
  - Specific organisms (pertussis, RSV, and other respiratory viruses)
- Genetic/metabolic
  - IEMs (fatty acid oxidations disorders, urea cycle disorders)
  - Mitochondrial disorders
  - Electrolyte disturbance
  - Hypocalcemia
  - Hypoglycemia
- Child maltreatment
  - Abusive head trauma
  - Caregiver-fabricated illness (also known as Münchausen by proxy and medical child abuse)
  - Intentional suffocation
  - Poisoning
  - Medical neglect
- Toxin exposure
  - Medication adverse effect
  - Substance exposure via human milk
  - Environmental exposure
  - Vaccine reaction
- Miscellaneous
  - Acrocyanosis
  - Hypothermia
  - Breath-holding spell
  - Idiopathic

Color

ALTE

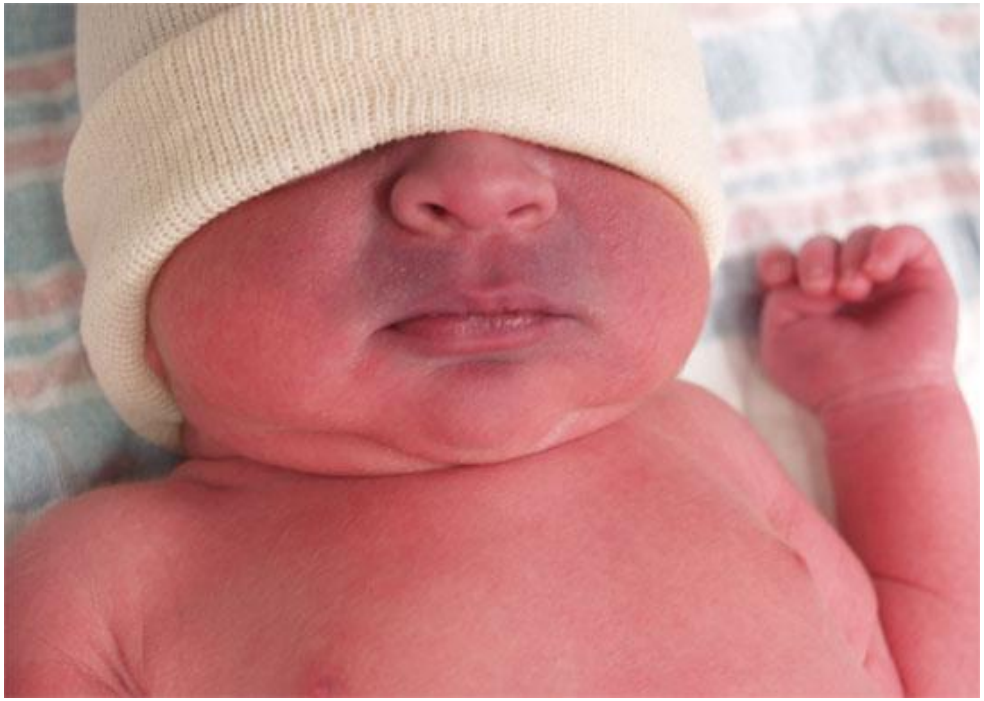
- Color change
- Apnea
- Alteration in muscle tone
- Choking or gagging

BRUE

- Cyanosis or pallor
- Absent, decreased, or irregular breathing
- Marked change in tone (hyper- or hypotonia)
- Altered level of responsiveness

Color change-red, white, and blue

Normal explanations of turning blue briefly



Peripheral cyanosis

- increased O2 extraction by peripheral tissue or vasoconstriction (e.g. shock)

Acrocyanosis

- vasomotor instability

http://newborns.stanford.edu/PhotoGallery/PerioralCyanosis1.html

Blue episode can indicate something serious

Central cyanosis

- bluish discoloration of oral mucous membranes

What about red and white episodes?

- Plethora: red is a normal in infants.
- Pallor: White or ashen can be normal or a sign of decreased perfusion
- Skin color difficult to determine in different skin tones and lighting

Apnea or changes to breathing

ALTE

- Color change
- Apnea
- Alteration in muscle tone
- Choking or gagging

BRUE

- Cyanosis or pallor
- Absent, decreased, or irregular breathing
- Marked change in tone (hyper- or hypotonia)
- Altered level of responsiveness

Normal explanations for episodic change in breathing

- Periodic breathing
  - Typically developing infants have periods of cyclic breathing with pauses
  - Occurs in nearly all pre-term infants and most term infants
  - Decreases dramatically after 2 months of age
  - Not a precursor for SIDS
- Irregular respirations
  - Hallmark of active sleep (REM or dream sleep)
  - Present at all ages
- Breath holding spell
- Acute decreases in oxygen saturation >10% from baseline are observed in most infants briefly during sleep

Concerning change in breathing

- Cessation of airflow x 20-30 sec
- Central
  - absence of respiratory effort from central respiratory center
- Obstructive
  - paradoxical inverse movements of the chest wall and abdomen with decreased saturation
- Apnea of prematurity
  - <37 weeks post-conceptional age
  - may persist in infants < 28 wk

Muscle tone change

ALTE

- Color change
- Apnea
- Alteration in muscle tone
- Choking or gagging

BRUE

- Cyanosis or pallor
- Absent, decreased, or irregular breathing
- Marked change in tone (hyper- or hypotonia)
- Altered level of responsiveness

Normal explanations for episodic changes in tone

- Stimulation (i.e., laryngospasm) from coughing, gagging, choking, crying
- Startle and fencing reflex
- LOC from Breath holding spell

Concerning causes for episodic change in tone

Seizure:

- Rhythmic and not extinguishable
- Eye deviation
- Limp
- Rigid
- Post-ictal
- Generalized/Altered mental status
- Infantile spasm

Apnea or changes to breathing

ALTE

- Color change
- Apnea
- Alteration in muscle tone
- Choking or gagging

BRUE

- Cyanosis or pallor
- Absent, decreased, or irregular breathing
- Marked change in tone (hyper- or hypotonia)
- Altered level of responsiveness

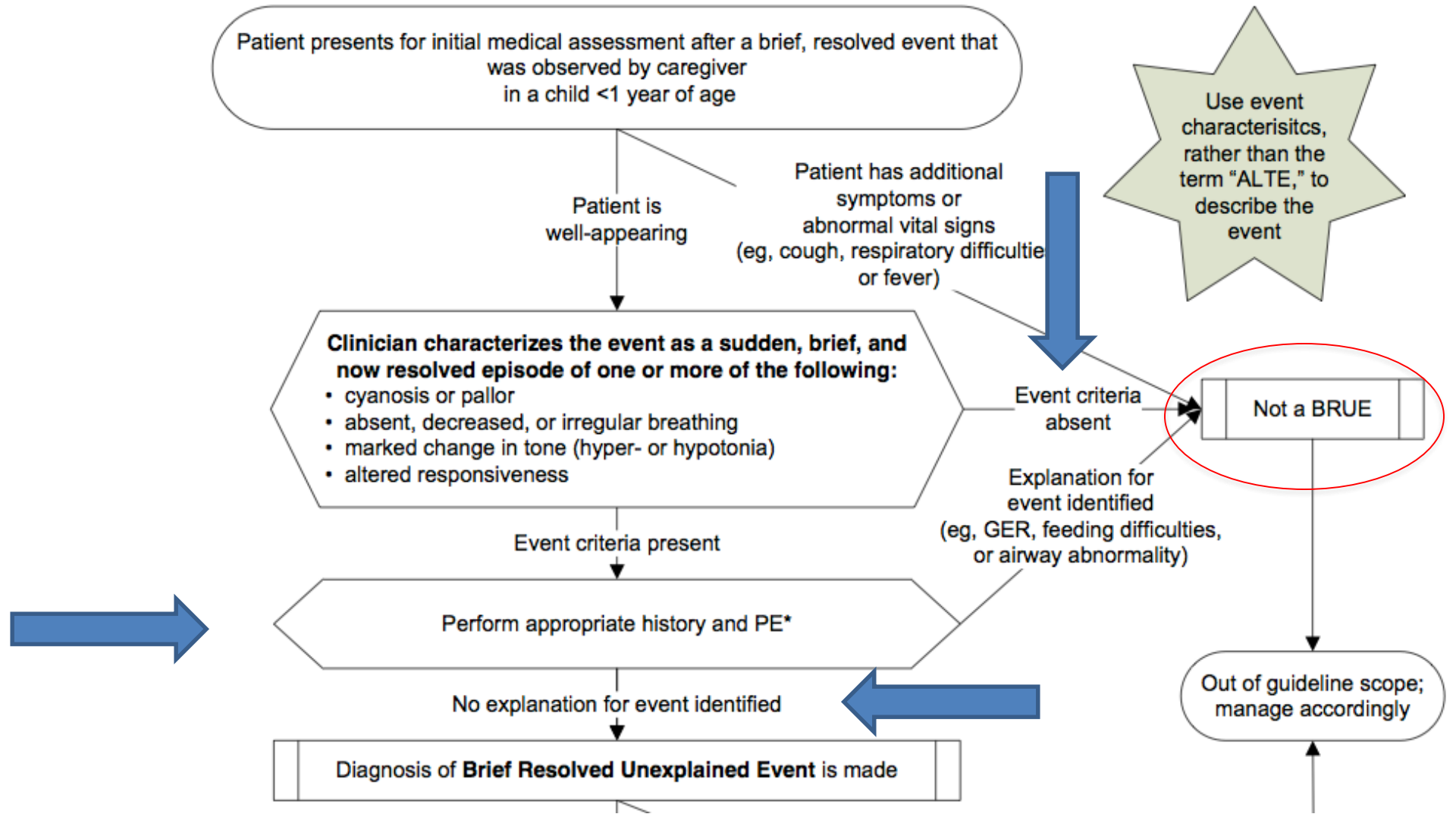
Normal explanation for episode of altered responsiveness

- Immature nervous system
- Somnolence
- LOC with Breath holding spell

Concerning explanation for episode of altered responsiveness

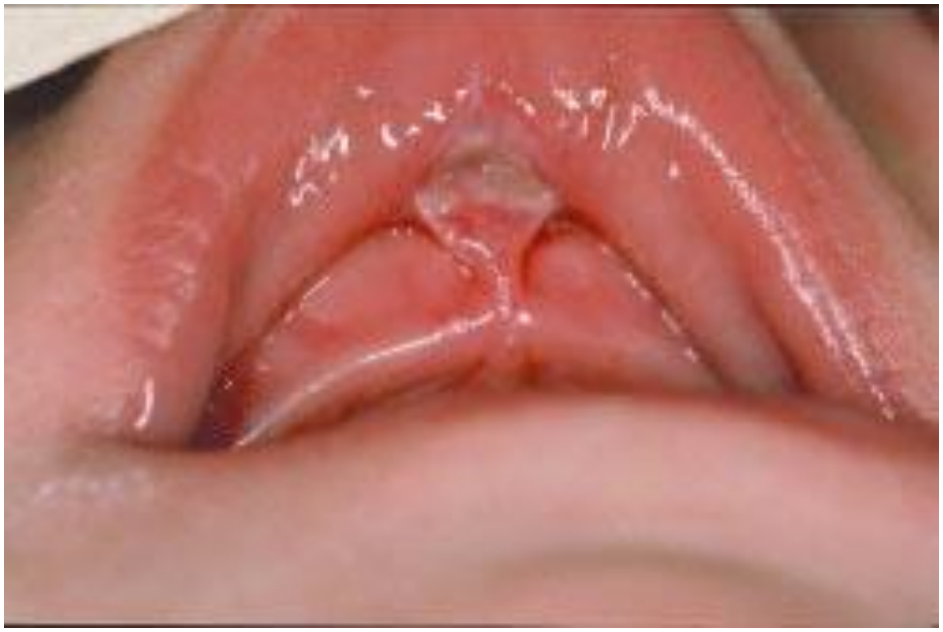
- Seizure
- LOC
- Hypoxemia
- Hypoglycemia

BRUE Diagnosis



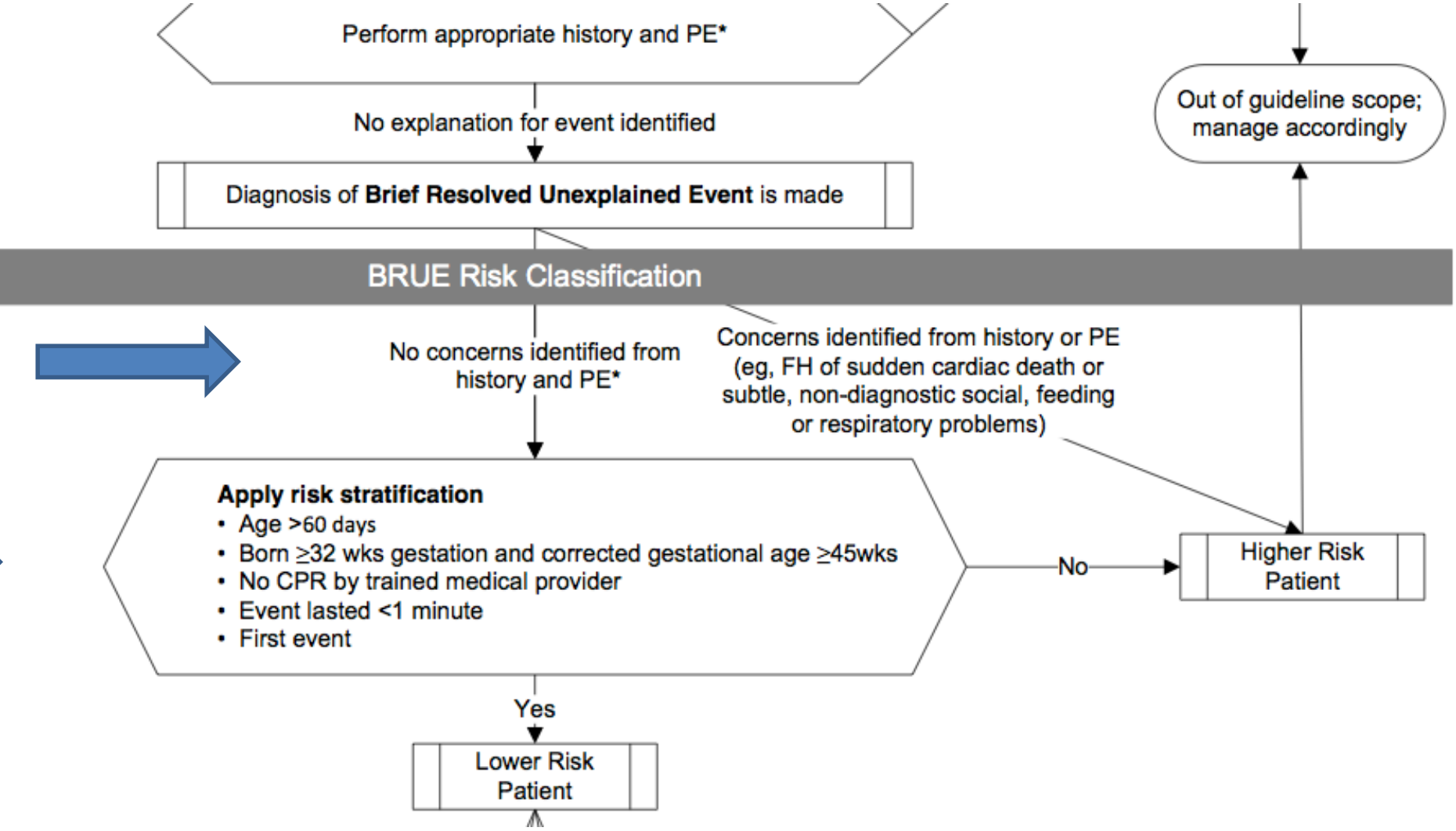
History and PE are critical to diagnose BRUE!

https://www.studyblue.com/notes/note/n/review-for-test-2-family-assessment/deck/8041126



https://www.bda.org/childprotection/Recognising/Pages/Physical.aspx

Risk Stratification and Recommendations for Lower-Risk 4


Perform appropriate history and PE*
No explanation for event identified
Diagnosis of **Brief Resolved Unexplained Event** is made
Out of guideline scope; manage accordingly
BRUE Risk Classification
No concerns identified from history and PE*
Concerns identified from history or PE (eg, FH of sudden cardiac death or subtle, non-diagnostic social, feeding or respiratory problems)
Apply risk stratification
• Age >60 days
• Born ≥32 wks gestation and corrected gestational age ≥45wks
• No CPR by trained medical provider
• Event lasted <1 minute
• First event
No
Higher Risk Patient
Yes
Lower Risk Patient

Lower-Risk Criteria

- Age >60 days
- Prematurity: gestational age ≥32 weeks and postconceptional age ≥45 weeks
- First BRUE (no prior BRUE ever and not occurring in clusters)
- Duration of event <1 minute
- No CPR required by trained medical provider
- No concerning historical features
- No concerning physical examination findings

AAP and strength of recommendations

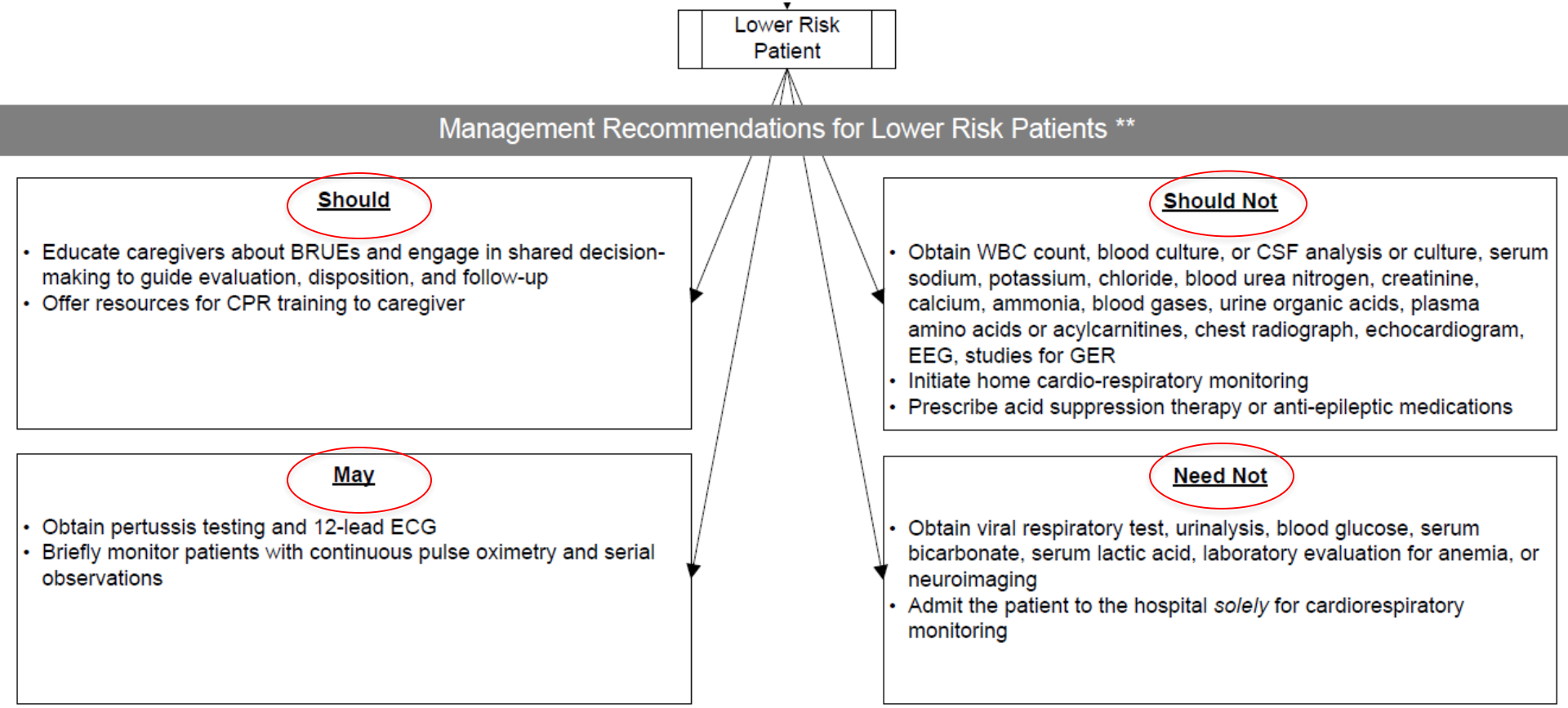


Table 1. Summary of Key Action Statements for Lower-Risk BRUEs

When managing an infant who is >60 days and <1 year of age and who, on the basis of a thorough history and physical examination, meets criteria for having experienced a **lower-risk BRUE**, clinicians…		
1. Cardiopulmonary Evaluation		Evidence Quality; Strength of Recommendation
1A	Need not admit infants to the hospital *solely* for cardiorespiratory monitoring.	B; Weak
1B	May briefly monitor patients with continuous pulse oximetry and serial observations.	D; Weak
1C	Should not obtain chest radiography.	B; Moderate
1D	Should not obtain a measurement of venous or arterial blood gas.	B; Moderate
1E	Should not obtain overnight polysomnography.	B; Moderate
1F	May obtain a 12-lead electrocardiography.	C; Weak
1G	Should not obtain an echocardiography.	C; Moderate
1H	Should not initiate home cardiorespiratory monitoring.	B; Moderate
2. Child Abuse Evaluation		
2A	Need not obtain neuroimaging (CT, MRI, or ultrasonography) to detect child abuse.	C; Weak
2B	Should obtain an assessment of social risk factors to detect child abuse.	C; Moderate
3. Neurologic Evaluation		
3A	Should not obtain neuroimaging (CT, MRI, or ultrasonography) to detect neurologic disorders	C; Moderate
3B	Should not obtain electroencephalogram to detect neurologic disorders.	C; Moderate
3C	Should not prescribe antiepileptic medications.	C; Moderate
4. Infectious Disease Evaluation		
4A	Should not obtain a white blood cell (WBC) count, blood culture, or cerebrospinal fluid analysis or culture to detect an occult bacterial	B; Strong

Pulmonology

- **Need not** admit the patient to the hospital *solely* for cardiorespiratory monitoring (B, Weak)
- **May** briefly monitor patients with continuous pulse oximetry and serial observations (D, Weak)
- **Should not** obtain a chest radiograph (B, Mod)
- **Should not** obtain measurement of blood gases (B, Mod)
- **Should not** initiate home cardio-respiratory monitoring (B, Mod)
- **Should not** obtain overnight polysomnography (B, Mod)

Cardiology

- **May** obtain a 12-lead electrocardiogram. (C, Weak)
- **Should not** obtain echocardiography (C, Moderate)

Child abuse

- **Need not** obtain neuroimaging (CT, MRI, US) to detect child abuse (C, Weak)
- **Should** obtain an assessment of social risk factors to detect child abuse (C, Weak)

Neurology

- **Should not** obtain neuroimaging (CT, MRI, US) to detect neurologic disorders (C, Mod)
- **Should not** obtain an EEG (electroencephalography) (C, Mod)
- **Should not** prescribe anti-epileptic medications

Infectious Disease

- **Should not** obtain a WBC, blood culture, or CSF analysis or culture to identify an occult bacterial infection (B, Strong)
- **Should not** obtain a chest radiograph to assess for pulmonary infection (B, Mod)
- **Need not** obtain a UA (C, Weak)
- **Need not** obtain respiratory viral testing in infants (C, Weak)
- **May** obtain test for pertussis (B, Weak)

Gastroenterology

Gastroenterology

- **Should not** obtain investigations for GER (C, Mod)
- **Should not** prescribe acid suppression therapy (C, Mod)

Inborn Error of Metabolism

- **Need not** obtain blood glucose (C, Weak)
- **Need not** obtain serum lactic acid or bicarbonate (C, Weak)
- **Should not** obtain serum sodium, potassium, chloride, BUN, creatinine, calcium, or ammonia (C, Mod)
- **Should not** obtain venous or arterial blood gas (C, Mod)
- **Should not** obtain urine organic acids, plasma amino acids or plasma acylcarnitines (C, Mod)

Anemia

- **Should not** obtain laboratory evaluations for anemia (C. Mod)

Patient- and Family-Centered Care

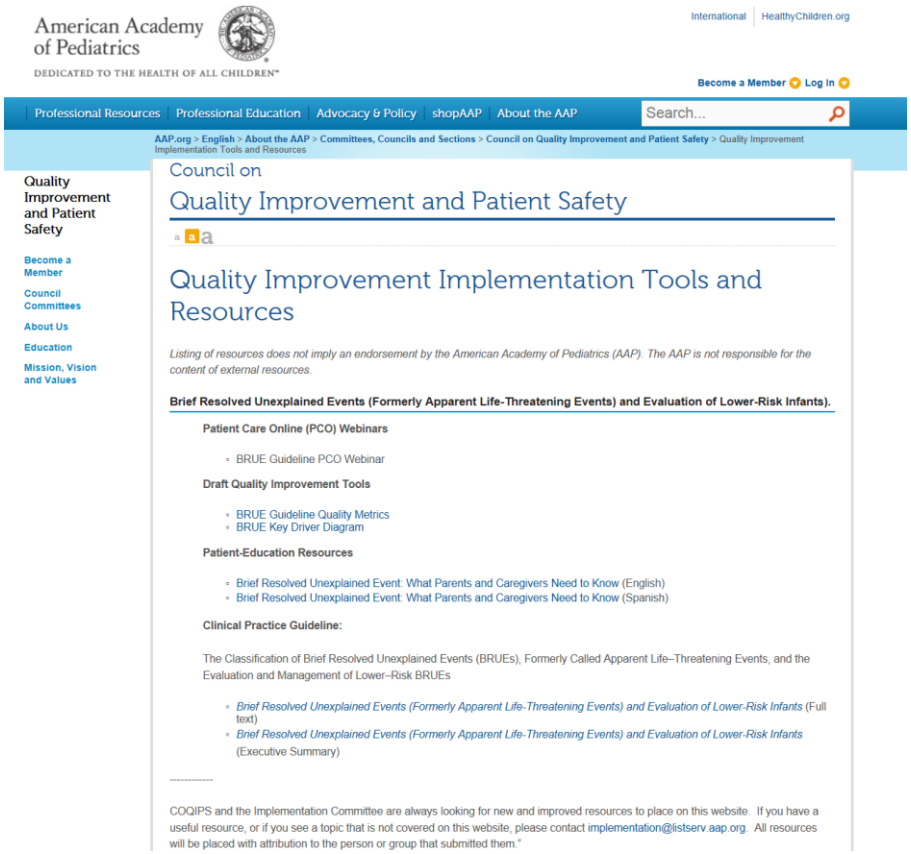
- **Should** offer resources for CPR training to caregiver (C, Mod)
- **Should** educate caregivers about BRUEs (D, Weak)
- **Should** use shared decision making (C. Mod)

Implementation and Improvement

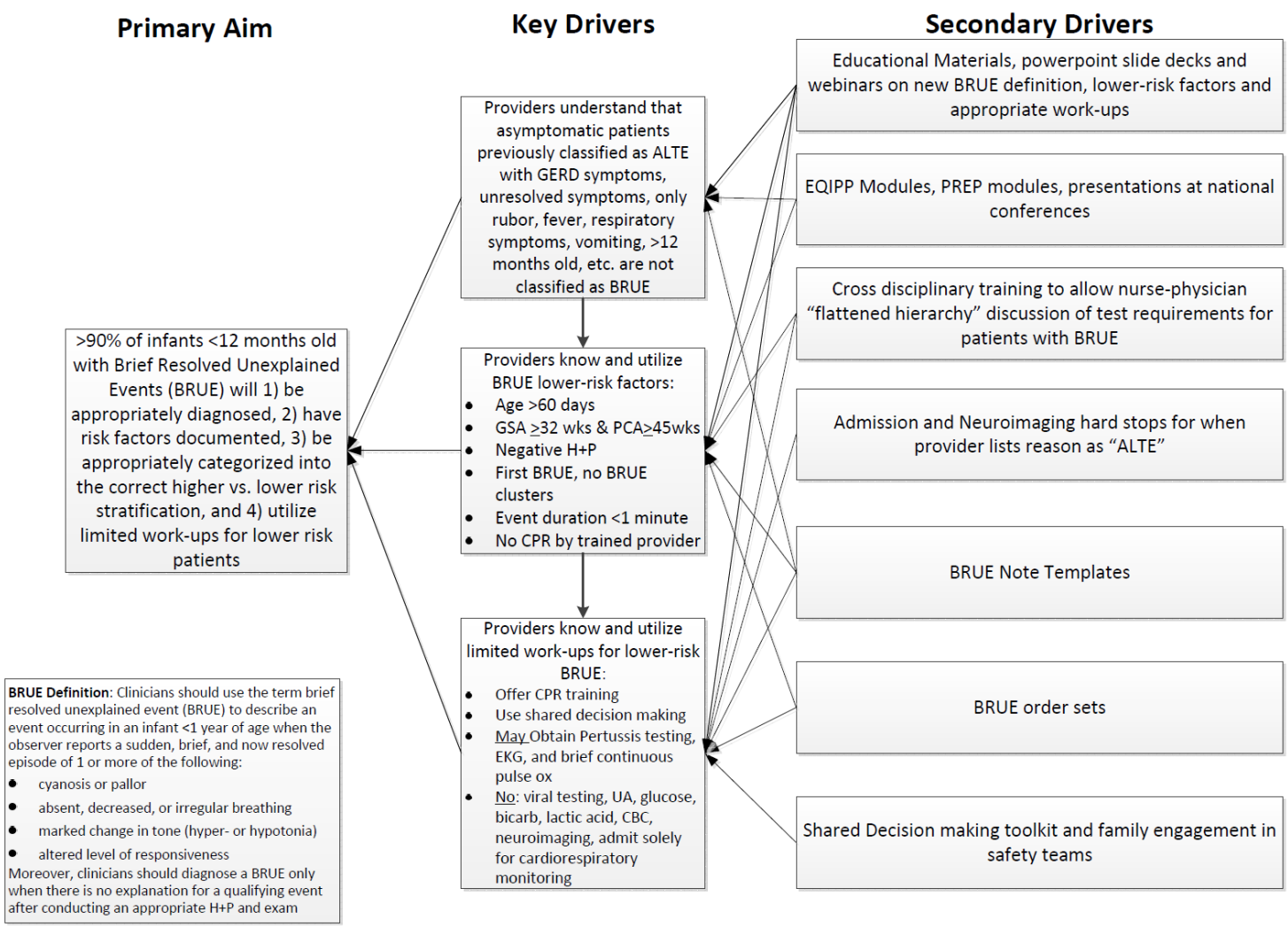
5

Implementation & Improvement: AAP.org

- Education
  - AAP, AAFP, ACEP, ABP, SHM news and conference outlets
  - Caregiver handout
  - Webinar
- Work flow integration
  - Crowdsourcing of orderset, H&P templates, algorithm
- QI, research, billing
  - ICD-9/10 codes, MOC collaborative with QuIIN/VIP/PEMCRC
  - Proposed quality measures
  - Key Driver Diagram



Key Driver Diagram: AAP.org



Caregiver Handouts: AAP.org

Evento breve inexplicable resuelto:
lo que los padres y cuidadores deben saber

(Brief Resolved Unexplained Event)

¿Qué es un evento breve inexplicable resuelto?

Un evento breve inexplicable resuelto (brief resolved unexplained event, BRUE por sus siglas en Inglés) se produce repentinamente y puede ser aterrador para los padres y cuidadores. Un evento breve inexplicable resuelto es un diagnóstico realizado después de que el pediatra o el profesional de

P: ¿Al tener un evento breve inexplicable resuelto, aumenta el riesgo de que mi bebé sufra el síndrome de muerte súbita del lactante (*sudden infant death syndrome,* SIDS)?

R: No, si bien no se conocen las causas del SIDS, los eventos como estos no aumentan el riesgo de tal síndrome. Para todos los bebés, es importante crear un

Brief Resolved Unexplained Event:
What Parents and Caregivers Need to Know

What is a brief resolved unexplained event?

A brief resolved unexplained event (or BRUE for short) occurs suddenly and can be scary for parents and caregivers. A brief resolved unexplained event

environments. Visit **www.HealthyChildren.org/safesleep** to learn more about how to create a safe sleeping environment for your baby.

Q: What should I do if it happens again?

Future Directions

- Guidance on Higher-Risk BRUEs
- Better identification of child abuse
- Understand epidemiology and risk
- Understand patient- and family-centered outcomes
- Empiric GER treatment

Take home points

- ALTEs are very different from SIDS
- Can you explain the event with careful history and physical exam?
- Remember child abuse can present as an ALTE/BRUE
- Is the patient asymptomatic and well-appearing?
- Is the patient in the lower-risk group?
- Perform diagnostic tests based on true, rather than perceived risk
- Use shared decision making and inform caregivers of potential harm to testing/hospitalization
- Goodbye ALTE…Hello BRUE

A special thanks to…

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Ruth Etzel
Wayne Franklin
David Gremse
Bruce Herman
Eliot Katz
Leonard Krilov
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Raymond Pitteti
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Questions and Discussion

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