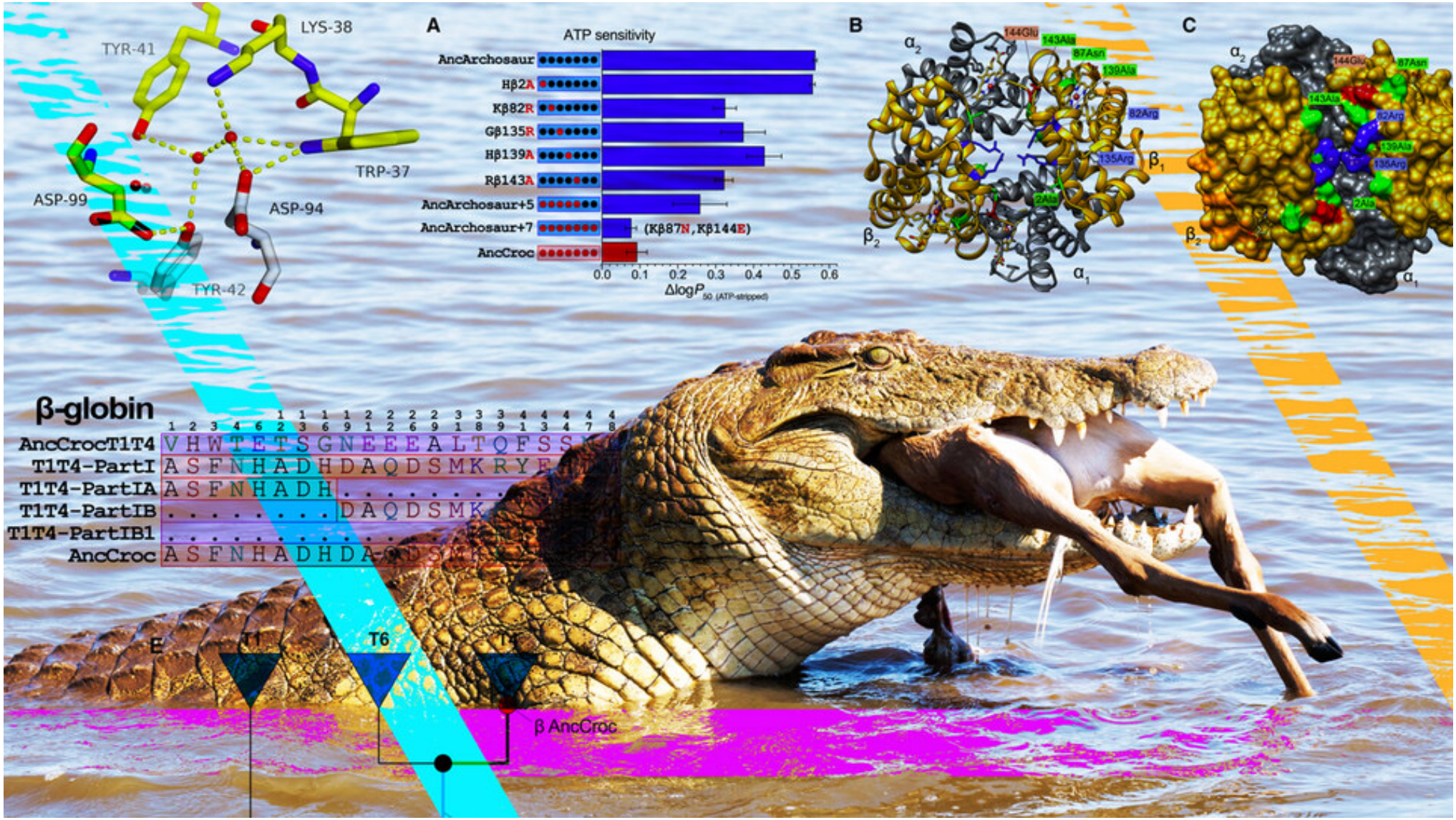
Visual Representation of Data

Chart the right path for your next project

Sobolewski & Woods

2024
PEDIATRIC EMERGENCY MEDICINE
FELLOWS CONFERENCE
CLEVELAND, OH



https://news.unl.edu/sites/default/files/styles/large_aspect/public/media/Hero_279.jpg?itok=Hi_ccWXA

“Effective figures suggest an understanding and interpretation of data; ineffective figures suggest the opposite”

Stephen R. Midway, 2020

https://www.sciencedirect.com/science/article/pii/S2666389920301896#bib11

Objectives

#BloomsTaxonomy

- Review some of the principles of effective visual design for medical figures and graphics
- Develop an effective visual design for a clinical algorithm
- Demonstrate how the visual representation of data can better highlight the data in your work

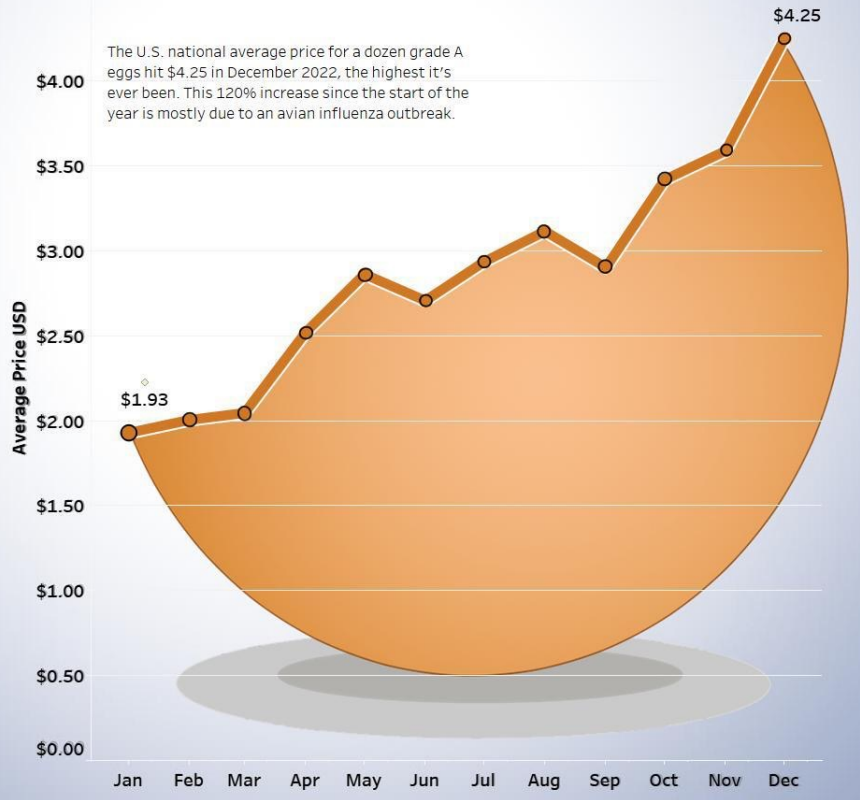
Plan ahead…

…so you can Excel

- Focus on the information and message first
- What is your visual objective? Comparison? Ranking? Growth over time? Composition? A geographic pattern?
- Consider starting with pen and paper
- Save figures and images from journals and presentations that are effective and see if they fit your plan

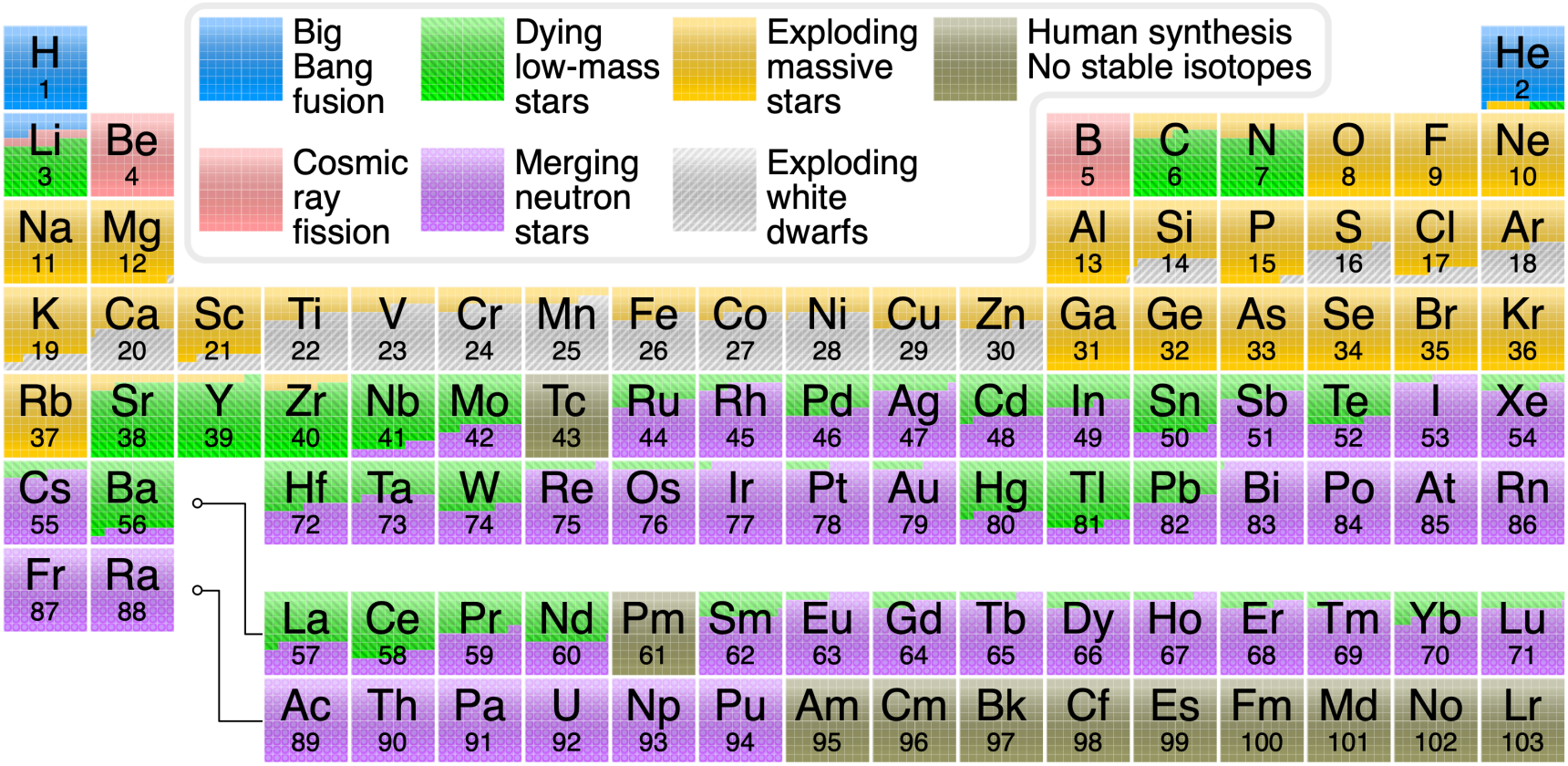
Surge in Egg Prices

2022 rise of avg price for grade A dozen eggs in the U.S.



Data Source: https://www.bls.gov/charts/consumer-price-index/consumer-price-index-average-price-data.htm

metalytiQ



https://upload.wikimedia.org/wikipedia/commons/3/31/Nucleosynthesis_periodic_table.svg

You don’t have to use your stats software

But you can if you want

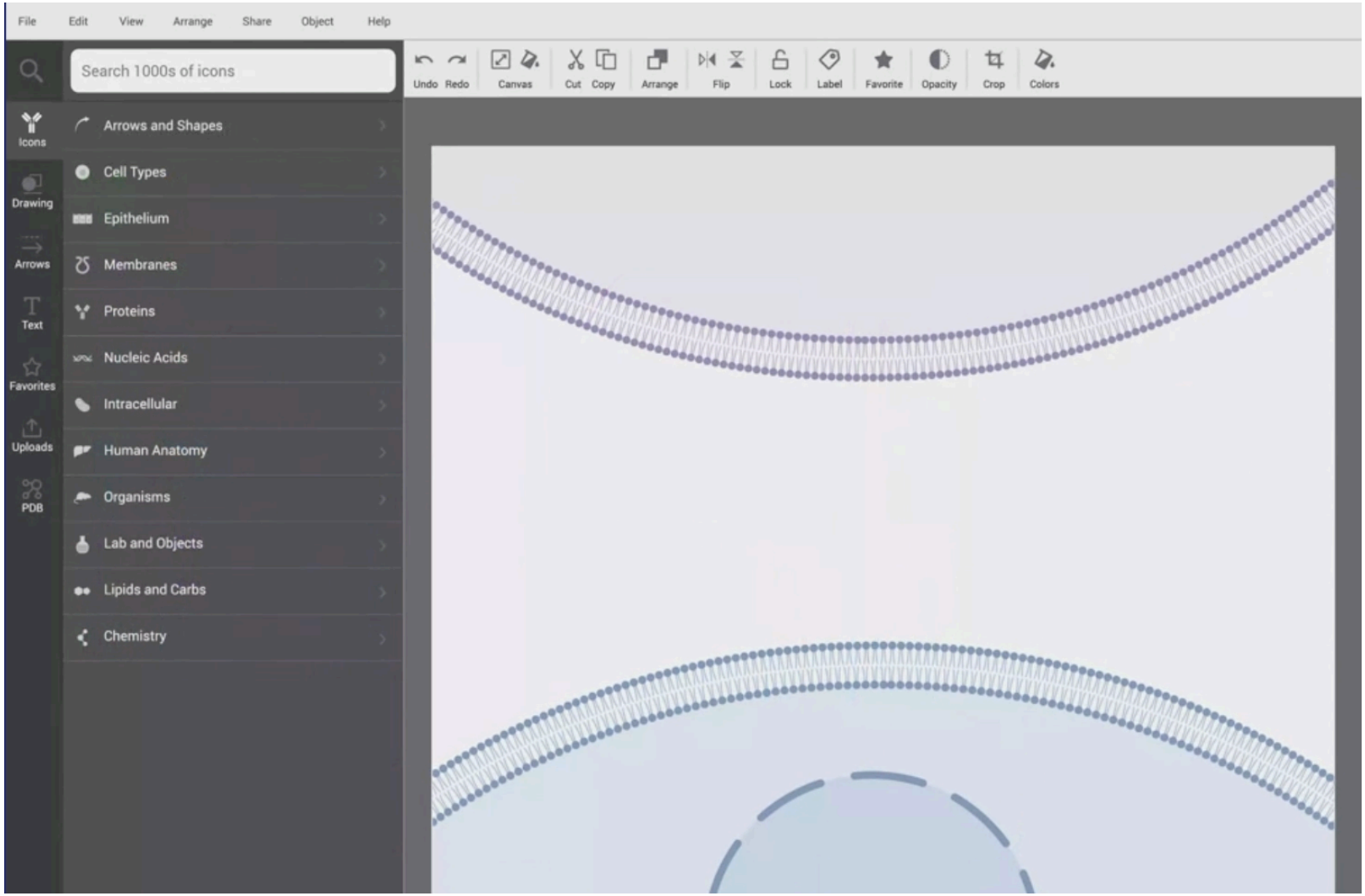
- Simple spreadsheet programs can create a wide array of charts and figures
- Complex technical figures and infographics require other programs either to design the figures or for graphical elements
- Most are not free and you need to be able to collaborate with other users
- Some are now incorporating AI

Data visualization applications and tools

There are a lot more…

- Photoshop / Illustrator
- PowerPoint & Keynote
- BioRender (molecular diagrams)
- Tableau (interactive tables)
- Infogram (threaded multimedia)
- Microsoft Power BI (integrates with Microsoft apps)
- The Noun Project (free icons)

bioRender


File
Edit
View
Arrange
Share
Object
Help
Search 1000s of icons
Undo
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Canvas
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Copy
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Label
Favorite
Opacity
Crop
Colors
Icons
Drawing
Arrows
Text
Favorites
Uploads
PDB
Arrows and Shapes
Cell Types
Epithelium
Membranes
Proteins
Nucleic Acids
Intracellular
Human Anatomy
Organisms
Lab and Objects
Lipids and Carbs
Chemistry


infogram
THE DEEPWATER HORIZON
OIL SPILL
Since the 1969 oil well blowout in Santa Barbara, California, there have been at least 44 oil spills, each over 10,000 barrels (420,000 gallons) affecting US waters. The largest was the 2010 Deepwater Horizon well blowout.
On April 20, 2010, an explosion and fire aboard the Deepwater Horizon oil drilling rig in the Gulf of Mexico, approximately 50 miles off the Louisiana coast kills 11 people and triggers the largest offshore oil spill in American history.
A $560 million oil rig
The $560 million platform was built by Hyundai Heavy Industries in South Korea and completed in

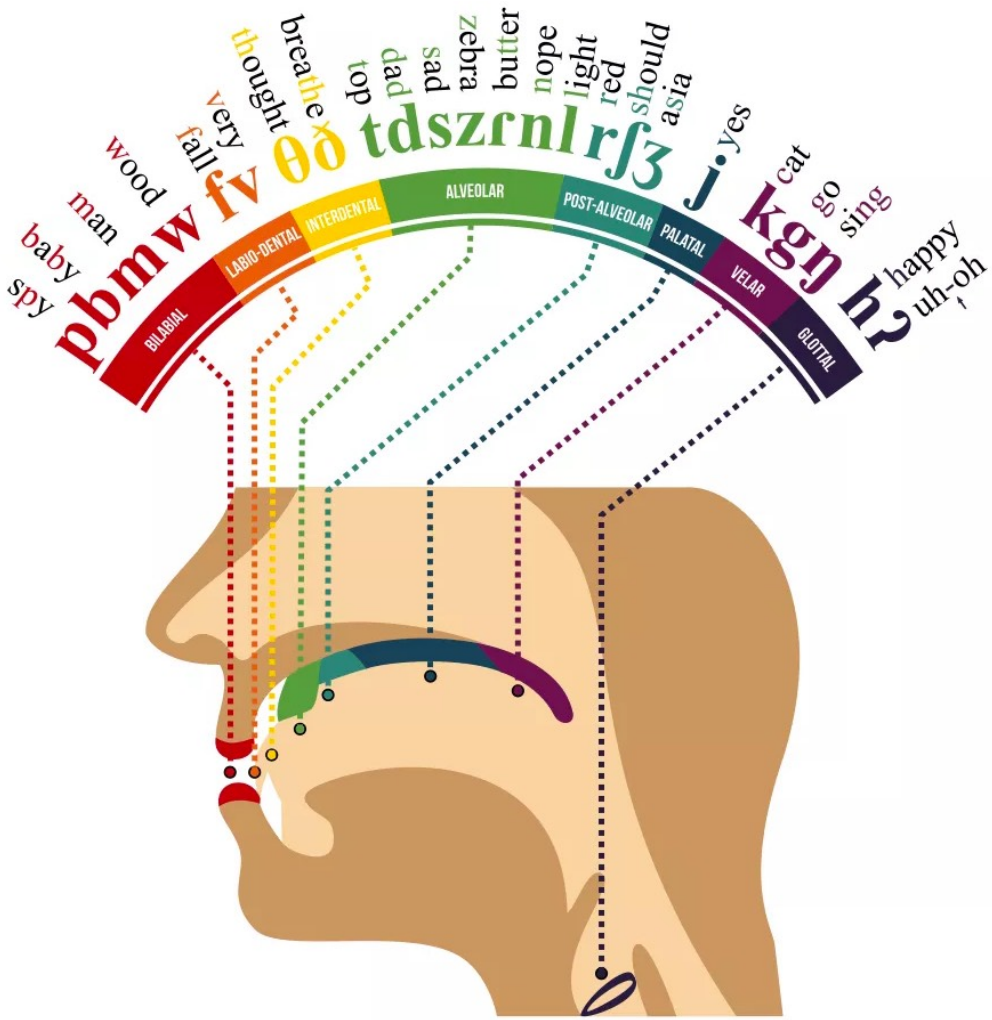
thenounproject.com

Icons and Photos For Everything

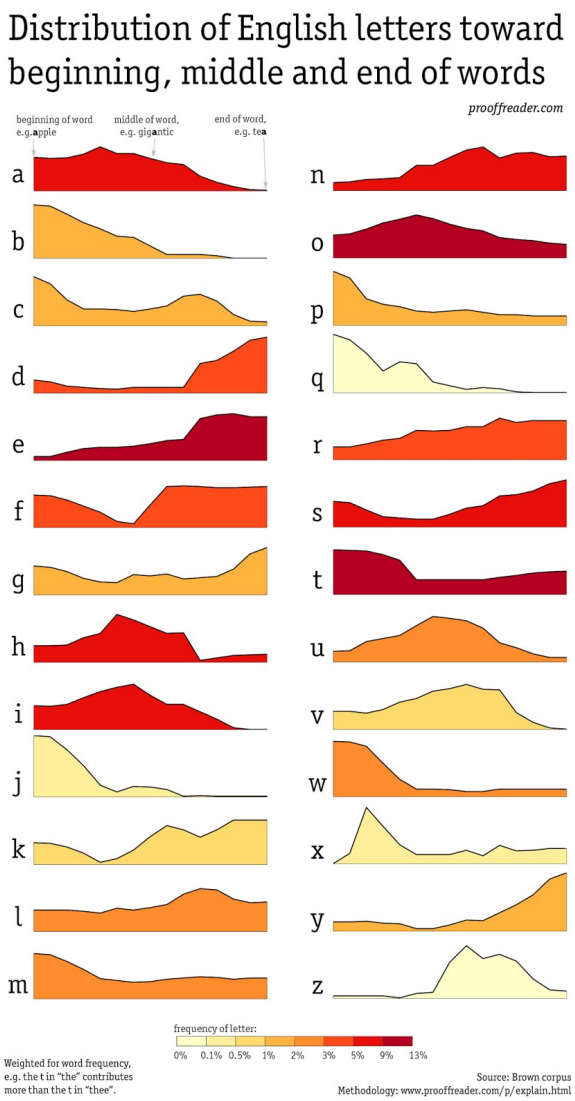
Infographics on a manuscript?

It's a figure, it's a table, it's a fable? Not, that's dumb…

- There's no rule that says you can't submit an infographic as a figure/ table in a paper
- This graphic could also be shown online (social media), in presentations or posters, and serve as a synopsis of the study's data



http://www.languagebasecamp.com/linguistics-for-language-learners-what-is-the-ipa/



http://prooffreaderplus.blogspot.com/2014/05/methodology-and-analysis-of-letter.html

PECARN
Pediatric Emergency Care Applied Research Network

younger than 2 years

CT Head Recommended

AMS
or
GCS < 15
or
Palpable skull fx

NONE

Observation vs. CT Head

LOC > 5 sec
or
Non-frontal hematoma
or
Not acting normally
or
Severe mechanism*

NONE

Discharge

No CT Required!

***SEVERE MECHANISMS**

2 years or older

CT Head Recommended

AMS
or
GCS < 15
or
Signs of basilar skull fx

NONE

Observation vs. CT Head

History of LOC
or
History of vomiting
or
Severe headache
or
Severe mechanism*

NONE

Discharge

No CT Required!

***SEVERE MECHANISMS**

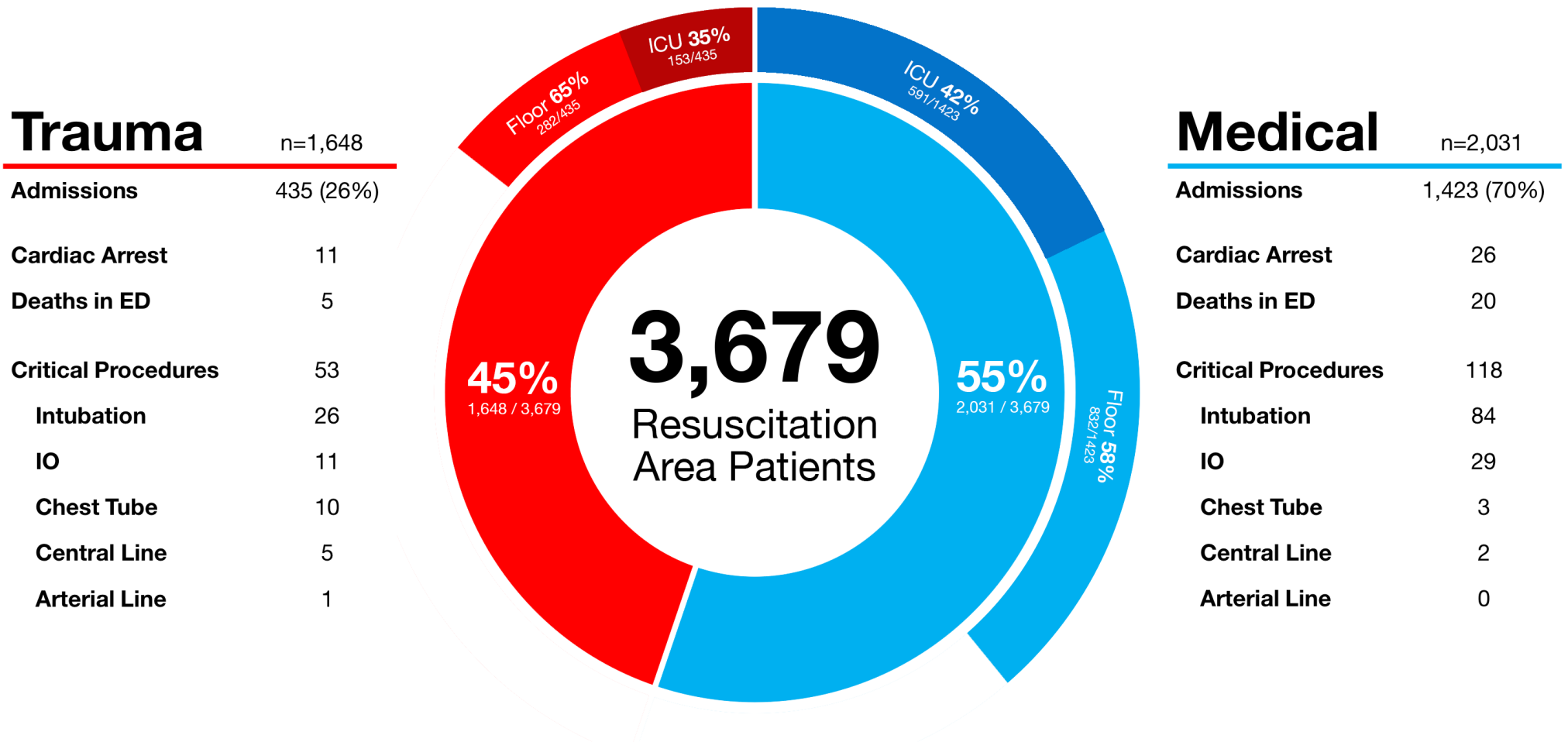


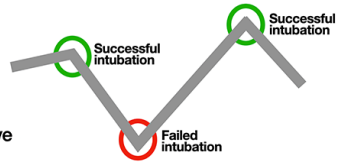
Figure 1 Medical versus trauma patients

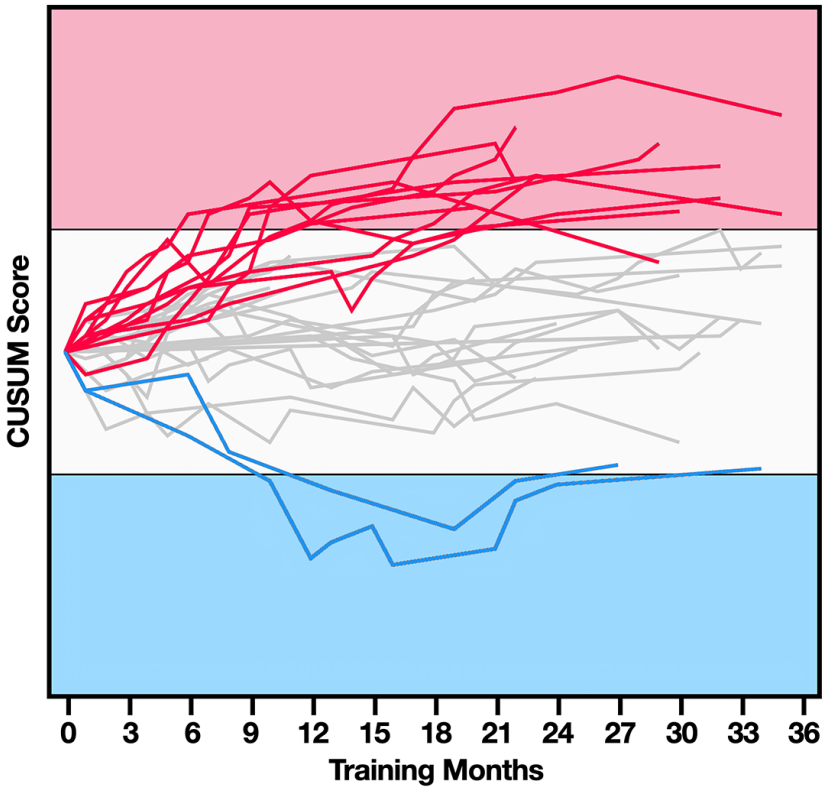
PEM Fellow Cumulative Summation (CUSUM) charts for endotracheal intubation attempt success

Successful intubation attempt

- Passage of endotracheal tube through the vocal cords
- Confirmation of $ETCO_2$ capnometry

- Each line is a single fellow
- A rising point indicates a successful intubation
- A falling point indicates a failed intubation
- CUSUM charts indicate cumulative trends over time





Passed

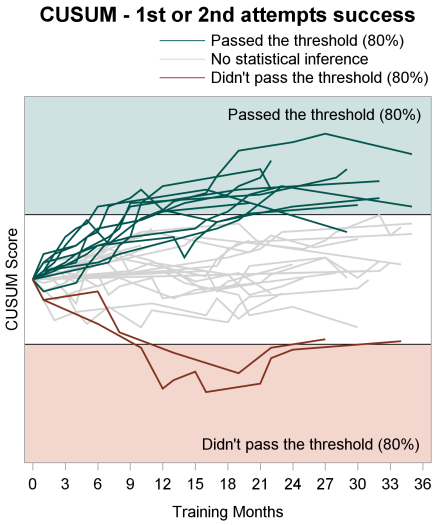
- 11 (31%) PEM Fellows passed the threshold for ≥80% first or second attempt success rate
- Threshold reached at median of 10 months of training
- Median patient age was 3.9 (IQR 1.3 - 14.9)

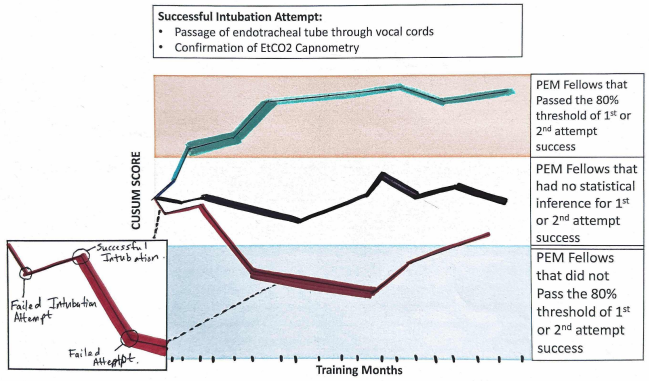
No statistical inference

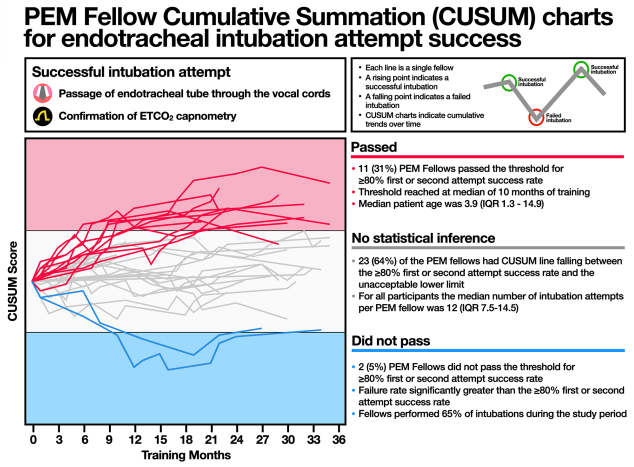
- 23 (64%) of the PEM fellows had CUSUM line falling between the ≥80% first or second attempt success rate and the unacceptable lower limit
- For all participants the median number of intubation attempts per PEM fellow was 12 (IQR 7.5-14.5)

Did not pass

- 2 (5%) PEM Fellows did not pass the threshold for ≥80% first or second attempt success rate
- Failure rate significantly greater than the ≥80% first or second attempt success rate
- Fellows performed 65% of intubations during the study period







Multiple mockups and iterations later…

Principles of effective design

More on the custom website we put together for this workshop

- There are lots of different types of “geometries” like bar graphs, histograms, line plots to consider
- Practice color-blind sensitive design
- Tables should be straightforward, well-aligned, and easy to follow

Design

- What is your message?
- Make a diagram
- Save examples of figures you like
- Pick the best software/ application for you needs

Production

- Use the correct geometry/figure style to show your data
- Utilize color effectively
- Include relevant metrics of uncertainty
- Distinguish models (curve fitting) from data (scatterplot)
- Include a detailed, standalone caption

Review

- Consider an infographic
- Solicit independent reviews

Activity 1

Let’s design a better algorithm

Which technique is more likely to be successful in reducing a nursemaid's elbow, hyperpronation or supination/flexion?

A Comparison of Supination/Flexion to Hyperpronation in the Reduction of Radial Head Subluxations

Charles G. Macias, MD; Joan Bothner, MD; Robert Wiebe, MD

PEDIATRICS®,1998 102 (1): e10

Spoiler: Its hyperpronation

A prospective RCT of 90 children with a clinical diagnosis of radial head subluxation

- Randomized to one of the two methods and were followed every 5 minutes for return of elbow function
- The initial procedure was repeated if baseline functioning did not return 15 minutes after the initial attempt
- Continued assessment every 5 minutes
- Failure of the first technique 30 minutes after the initial attempt resulted in a cross-over to the alternate method
- Continued assessment every 5 minutes
- The alternate procedure was repeated if baseline functioning did not return 15 minutes after the alternate procedure was attempted
- If the patient failed both techniques, X-Rays were ordered

Activity 1

Using this study's methods, design an algorithm / care pathway to be used in an ED or Urgent Care using digital tools or the flip charts

Algorithm design

Best practices

- Clear steps and order
- Easy to follow
- Delineate junction (yes/no) points effectively
- Limit extraneous information
- Use color effectively - watch for color blind individuals

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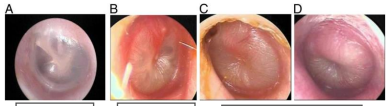
Activity 1

Show & Tell

Acute Otitis Media Algorithm: Emergency Department/Urgent Care
Age ≥ 2 months – 12 years

Child with ear pain tugging, fever, or other symptom concerning for AOM presents to ED/UC

Diagnose AOM only if middle ear effusion is present (redness without effusion is not AOM)



- A: No bulging
- B: Mild bulging
- C/D: Moderate/severe bulging

No bulging → Not AOM → No antibiotic warranted. Consider analgesics, evaluate other causes of ear pain, and give instructions for follow-up

Mild bulging → AOM: Mild bulging with < 48h ear pain or intense erythema

Moderate/severe bulging → AOM: If mod-severe bulging or otorrhea not due to OE

Assess for severe signs and symptoms:

Severe AOM if ANY:
- Fever ≥ 39
- Moderate to severe otalgia
- Otalgia >48 hours
- Otorrhea from perforation

Are symptoms severe?

- **No** → Non-severe symptoms
  - < 6 mos
  - 6 – 23 mos
    - Bilateral
    - Unilateral
  - ≥ 2 yrs
- **Yes** → Prescribe Antibiotics

Shared decision-making with family:
Prescribe antibiotics **OR**
Offer rescue script **OR**
Offer observation with PCCP follow-up in 48-72 hours

Definitions
- Severe AOM: AOM with moderate to severe otalgia or fever ≥ 39
- Non-severe AOM = AOM with mild otalgia and temp < 39
- Recurrent AOM: 3 or more well documented separate episodes in the past 6 months (or 4 in 12 months including 1 in 6 months)
- Treatment failure: no clinical improvement in 48-72 hours

Antibiotic selection:

Amoxicillin 90 mg/kg/day divided BID to max 4000 mg/day
- **<2: 10 days**
- **2-5 years: 7 days (10 for severe AOM)**
- **≥ 6 years: 5-7 days (10 for severe AOM)**

- **Severe = AOM with moderate to severe otalgia or fever >39.**
- **Single dose ceftriaxone is adequate therapy for untreated AOM in child who cannot take po's (rare)**

Special situations (Use durations above by age):
- **PCN allergy: cefdinir (or cefpodoxime)**
- **With associated purulent conjunctivitis: Augmentin**
- **Amox in last 30 days: Augmentin**

Treatment failure:
- **No clinical improvement in 48-72 hours** (note – evaluate whether ongoing symptoms are from treatment failure or concomitant viral infection: effusions can take weeks to resolve on exam)
- **Failed high dose amoxicillin ->** 10 days Augmentin (high dose)
- Failed high dose Augmentin or oral Cephalosporin:
  -Ceftriaxone IV/IM q24 hours **X 3**
  -Can consider clindamycin +/- oral cephalosporin

Azithromycin, Bactrim, and po cephalosporins alone are not adequate therapy for AOM that has failed other antibiotics

Other considerations
- Consult ENT immediately for associated facial nerve paralysis
- ENT referral criteria (usually done by PCP not ED/UC): 3 episodes of recurrent AOM in 6 months; or 4 episodes in past year with 1 in past 6 months

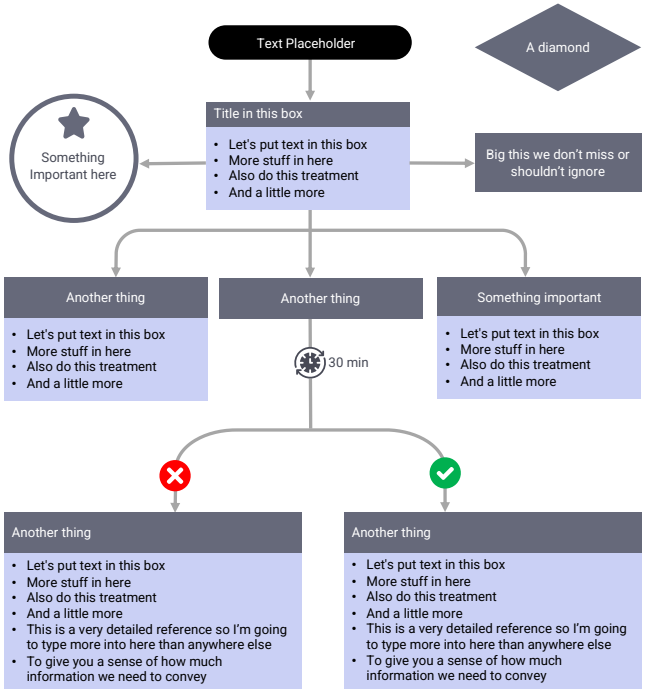
References

The Diagnosis and Management of Acute Otitis Media
Pediatrics (2013) 131 (3): e964–e999.

11092023

Title of Algorithm

Key information subtitle about using it



Title of table

Title	Header	Thing
Drug name	Dosing parameters 5 mg/kg for people	• Time for information • Into this box we will put stuff • That will help you with the title
Drug name	10mg/kg for others and so on	• Time for information • Into this box we will put stuff • That will help you with the title
Drug name	I had to type something into this	• Time for information • Into this box we will put stuff • That will help you with the title

Title of Algorithm

Key information subtitle about using it

Title of Algorithm

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Title of Algorithm

Key information subtitle about using it

Text sections

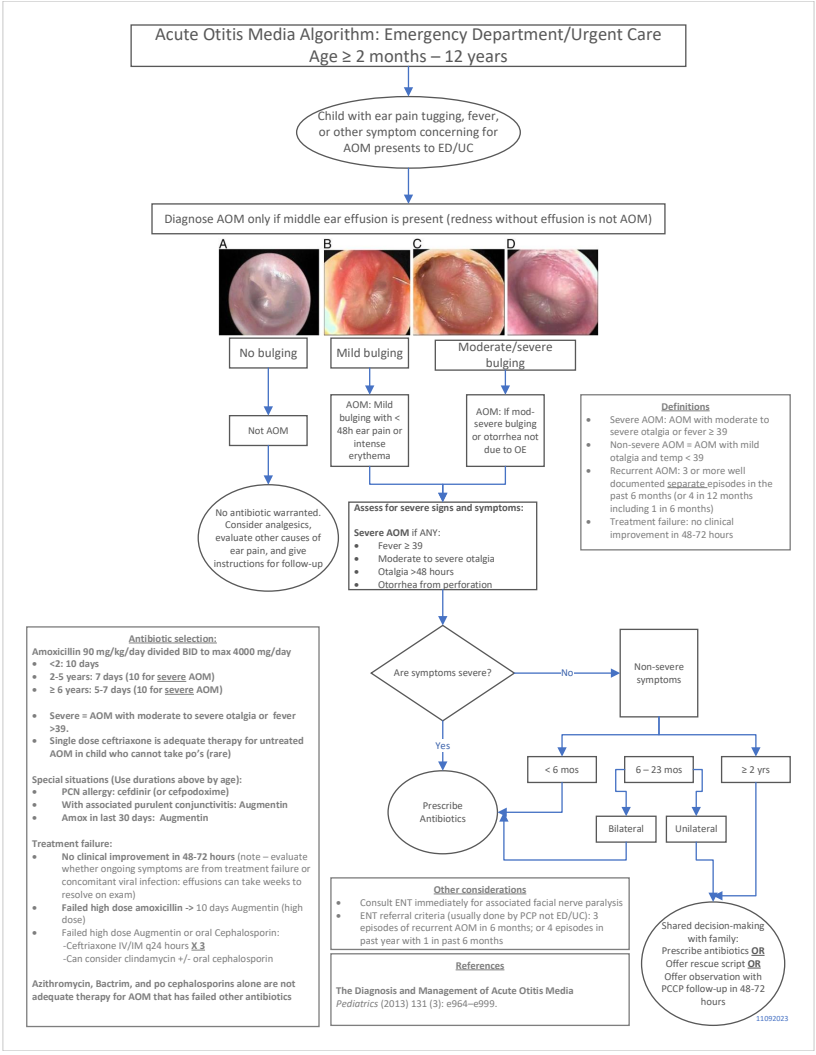
Key In the vast world of canines, dogs come in all shapes, sizes, and personalities, each with their own unique tail-wagging charm. From the energetic and playful to the calm and regal, dogs have captured the hearts of humans for centuries. Let's embark on a delightful journey celebrating these wonderful companions.

1. Labrador Retriever: Known for their friendly and outgoing nature, Labradors are versatile and make excellent family pets, assistance dogs, and service dogs.
2. German Shepherd: Revered for their intelligence and loyalty, German Shepherds are often employed in roles such as police and military work, search and rescue, and as service animals.
3. Golden Retriever: These gentle and affectionate dogs are highly favored as family pets and are also commonly seen as therapy and assistance dogs due to their friendly disposition.
4. Bulldog: With their distinctive appearance and affectionate nature, Bulldogs have become popular pets. Despite their stocky build, they are known for their gentle and friendly temperament.
5. Beagle: Beagles are beloved for their playful and sociable nature. They are often sought after as family pets and are known for their exceptional sense of smell, making them popular as scent detection dogs.

Subheading

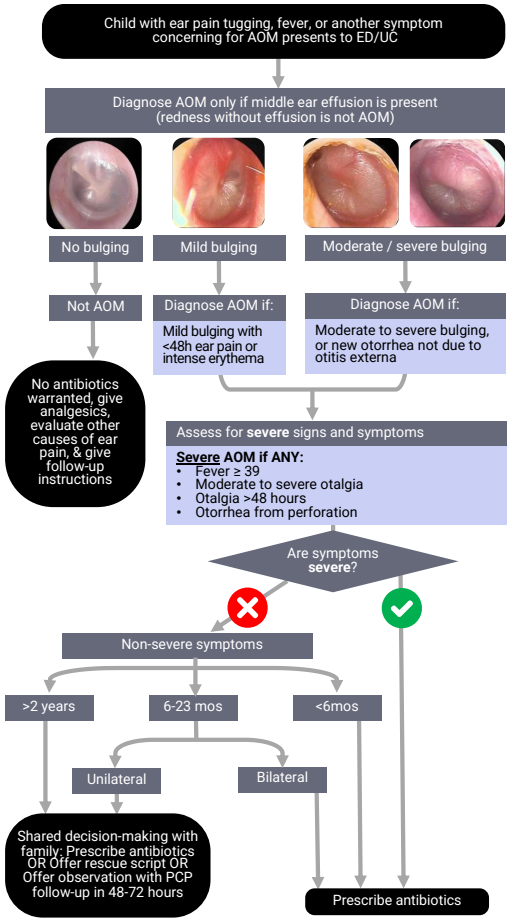
There are more types of pets out there, but dogs are the best ones naturally

- Cats
- Birds
- Fish
- Chinchillas even?



Acute Otitis Media Algorithm

Emergency Department / Urgent Care – Age 2 months – 12 years



AOM Definitions

Severe - moderate to severe otalgia or fever ≥ 39

Non-severe - mild otalgia & temp < 39

Recurrent - ≥3 or more well documented separate episodes in the past 6 months (4 in 12 months including 1 in 6 months)

Preferred treatment - Amoxicillin

90 mg/kg/day divided BID w/ max 4000 mg/day

- <2 yrs - 10 days
- 2-5 yrs: 7 days (10 for severe)
- ≥ 6 yrs: 5-7 days (10 for severe)

Special situations

Use durations above by age / severity:

PCN allergy - cefdinir (or cefpodoxime)

With associated purulent conjunctivitis - Augmentin

Amox in last 30 days - Augmentin

Child cannot take po (rare) - Single dose **ceftriaxone** is adequate therapy for untreated AOM

Treatment failure

No clinical improvement in 48-72 hours, evaluate whether ongoing symptoms are from treatment failure or concomitant viral infection. Effusions can take weeks to resolve on exam

Failed high dose amoxicillin - 10 days Augmentin (high dose)

Failed high dose Augmentin or oral Cephalosporin - Ceftriaxone IV/IM q24 hours X 3

Can **consider** clindamycin +/- oral cephalosporin

Azithromycin, TMP/SMX, and PO cephalosporins alone **are not adequate** therapy for AOM that has failed other antibiotics

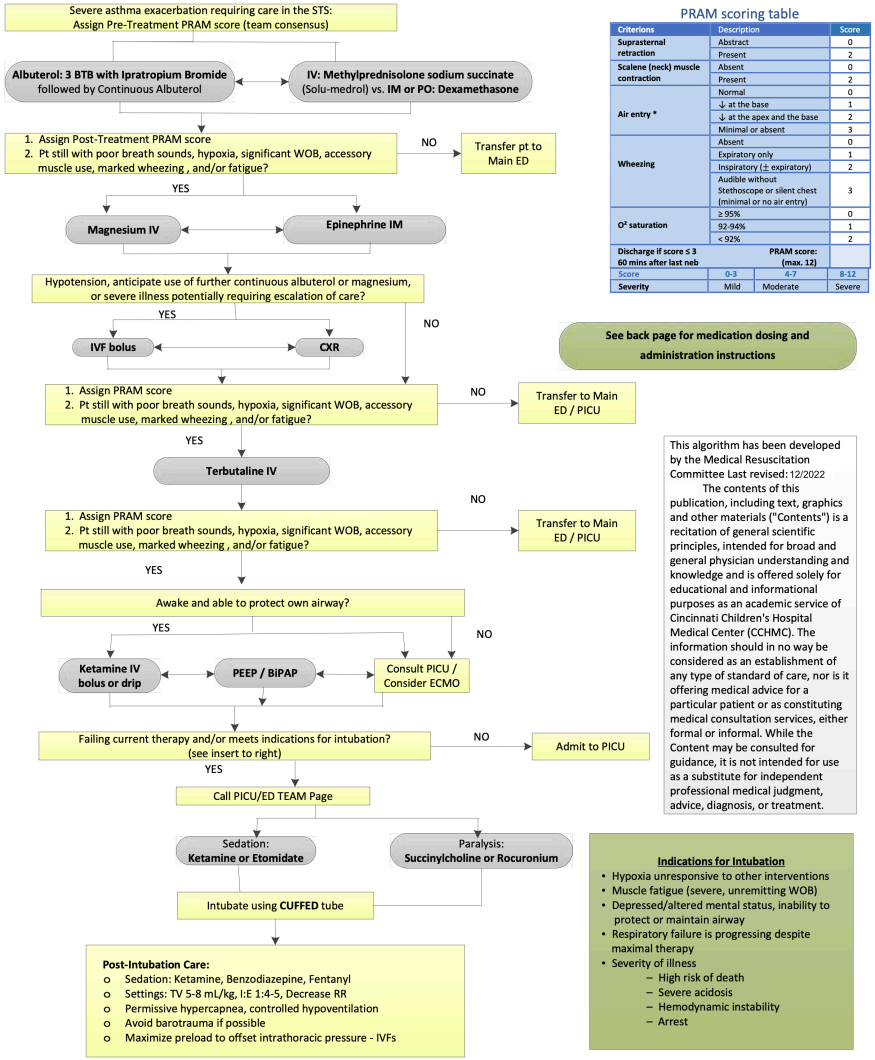
When to involve Otolaryngology

Consult ENT immediately for associated facial nerve paralysis

ENT referral criteria
usually done by PCP not ED/UC

- 3 episodes of recurrent AOM in 6 months or
- 4 episodes in past year with 1 in past 6 months

Therapy of Severe Status Asthmaticus in the STS



Status Asthmaticus

Standard Therapies

Albuterol administered continuously (AFTER 3 BTB albuterol treatments with 3 doses of 0.5 mg ipratropium bromide)

Corticosteroids:

- Methylprednisolone sodium succinate (SoluMedrol™): 1 mg/kg (max 125 mg) IV
- If no IV access: Dexamethasone: 0.6 mg/kg (max 10 mg) IM or PO (using the IV for PO solution OR tablets)

Additional Therapies

Magnesium sulfate (smooth muscle relaxation at bronchial level)

Route	Dose	Notes
IV – Bolus	50 mg/kg (max 2 gm)	***Bags in ED Pyxis; Prepare at medication counter;*** Infuse over 20 min; a concurrent NS bolus is recommended
IV – Continuous	Start at 10 mg/kg/hr (max 1000 mg/hr)	***Bags in ED Pyxis; Prepare at medication counter;*** Use 40 mg/mL concentration; max 25 mL/hr Check magnesium level 6 hours after start of infusion

Epinephrine IM (nonspecific beta-agonist, alpha-agonist)

- **0.01 mg/kg every 5-15 minutes** as needed: use the 0.1 mg/mL concentration IM as described in the code book (for dilution reasons) **Administer intramuscular** in anterolateral thigh
  - **<10 kg**: 0.01 mg/kg / **10-25kg**: 0.15 mg IM / **≥25kg**: 0.3 mg IM

Terbutaline (β_2 agonist) **NOT compatible w/ Mag sulfate** ***Flush with at least 20 mL in between doses given in the same line**

Route	Dose	Notes
IV – Bolus	0.01 mg/kg (max 0.4 mg for child <12 yrs, 0.75 mg in adolescent)	***Vials in ED Pyxis; Prepare at medication counter*** Administer over 5 minutes; may dilute in NS for adequate volume (2-3 mL; concentration is then Xmg in XmL)
IV - Continuous infusion	start at 1 mcg/kg/min, titrate by 1 mcg/kg/min per MD order usual effective range 3-6 mcg/kg/min	***Comes from pharmacy (in syringe) (place order in EPIC)*** Takes considerable amount of time to prepare Administer with a carrier fluid of NS @ 3 mL/hr
SQ – if No IV Access	0.01 mg/kg (max 0.25 mg)	**May repeat every 15 minutes for 3 doses**

Alternate Therapies

Ketamine (smooth muscle relaxation at bronchial level); Use therapeutically to help relax the patient for application of BiPAP if needed. Consult PICU if this is needed.

Route	Dose	Notes
IV – Bolus **(subdissociative dose)**	0.3 mg/kg aliquots (max single dose 50 mg) using 10 mg/mL concentration	***Syringes in ED Pyxis; Prepare at medication counter*** Administer over 60 seconds; Consult PICU
IV – Continuous Infusion	start at 0.25 mg/kg/hr and titrate by 0.5 mg/kg/hr, max 2 mg/kg/hr	***Comes from pharmacy (place order in EPIC)*** Administer with a carrier fluid
IM – if No IV Access	4 mg/kg using 100 mg/mL concentration	***Comes from pharmacy (place order in EPIC)***

PEEP/BiPaP (in conscious patient able to protect airway)

- Direct bronchodilator effect, reduces WOB and energy expenditure
- Obtain BiPAP tote and apparatus, if possible
- Can provide CPAP w/ Mapleson bag as pt breathes spontaneously while continuous albuterol is administered via T-piece

IVFs – Normal Saline or Lactated Ringers (Bolus)

- For current or anticipated hypotension from magnesium, albuterol, dehydration, or increased intra-thoracic pressure from obstructive process, etc.
- Goal: increase preload, especially if considering intubation

Intubation (**Caution: Avoid** if at all possible due to risk of complications and difficulty with ventilation)

Sedation/Induction

- Ketamine IV (Etomidate is also an acceptable choice)
- Induction dose: 2 mg/kg
- Continuous IV infusion: start at 0.25 mg/kg/hr; titrate by 0.5 mg/kg/hr to effect

Paralysis

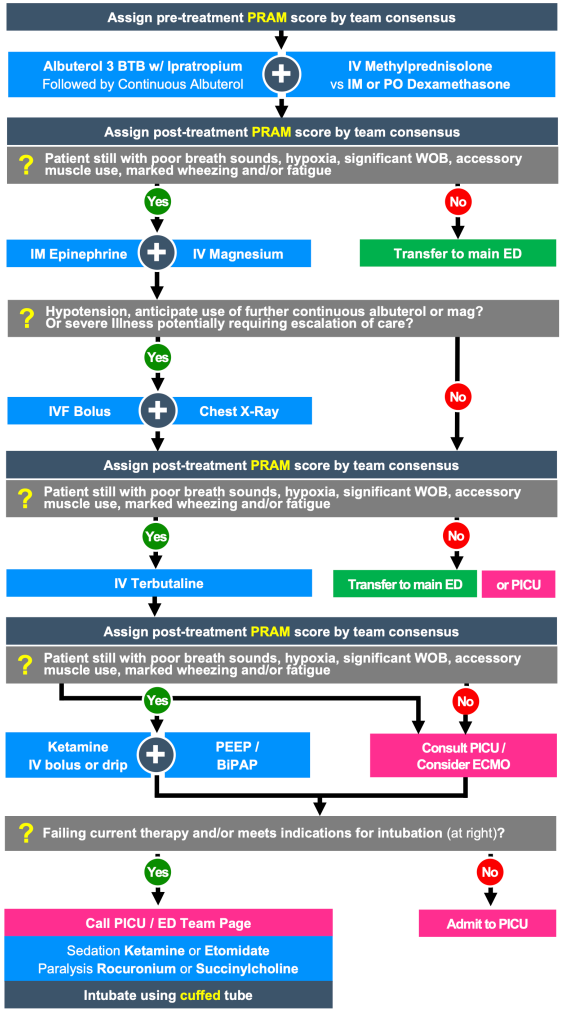
- **Evidence supports RSI** with sedative and paralytic to maximize chances of success on first attempt; acceptable alternative would be ketamine alone with succinylcholine drawn up / ready for administration in case of laryngospasm
- Succinylcholine or rocuronium, doses per SafeDose

Intubation – most experienced operator should intubate with a cuffed ETT, anticipating deterioration and need for high pressures

Post-Intubation management

- Sedation w/ ketamine VS benzodiazepine + fentanyl (non-histamine-releasing opioid)
- Controlled hypoventilation: Tidal volume 5-8 mL/kg, instead of normal 10 mL/kg
- Decrease I-to-E ratio to allow prolonged expiration (1:4 or 1:5)
- Decreased ventilation rate to avoid air stacking and to maximize expiratory time
- Complications: pneumothorax, hypotension, arrest (have low threshold for repeat CXR if patient decompensates)

Severe Acute Status Asthmaticus in the STS



PRAM Scoring Table

Criterion	Description	Score
Suprasternal retractions	Absent	0
	Present	2
Scalene (neck) muscle retractions	Absent	2
	Present	2
Air entry	Normal	2
	↓ at the base	1
	↓ at the apex and the base	2
	Minimal or absent	3
Wheezing	Absent	0
	Expiratory only	1
	Inspiratory (± expiratory)	2
	Audible w/o stethoscope or silent chest (minimal / no air entry)	3
Oxygen saturation	≥95%	0
	92-94%	1
	<92%	2

PRAM Score: MAX 12

Score	0-3	4-7	8-12
Severity	Mild	Moderate	Severe

Indications for intubation

Hypoxia unresponsive to other interventions

Muscle fatigue (severe, unremitting WOB)

Depressed/altered mental status, inability to protect, or maintain airway

Respiratory failure is progressing despite maximal therapy

Severity of illness
- High risk of death
- Severe acidosis
- Hemodynamic instability
- Cardiac arrest

Post-intubation care

Sedation: Ketamine, benzodiazepine, fentanyl

Settings TV 5-8 mL/kg I:E 1:4-5 Decrease RR

Permissive hypercapnia, controlled hypoventilation

Avoid barotrauma if possible

Maximize preload to offset intrathoracic pressure with IV fluids

This is a guideline only and has been developed by the Medical Resuscitation Committee of the Division of Emergency Medicine of CCHMC. *Last updated Mar 2023* - **see page 2 for more details on medication dosing and administration**.

Cincinnati Children's
changing the outcome together

Severe Acute Status Asthmaticus in the STS

Standard Therapies

Albuterol
Administered continuously (AFTER 3 BTB albuterol treatments with 3 doses of 0.5 mg ipratropium bromide)

Corticosteroids

Methylprednisolone sodium succinate (SoluMedrol™) 0.5 mg/kg (max 30 mg) IV
Dexamethasone 0.6 mg/kg (max 10 mg) IM or PO (using the IV for PO solution OR tablets)

Additional Therapies

Magnesium Sulfate
Smooth muscle relaxation at bronchial level

IV bolus 50 mg/kg (max 2g)	Bags in ED Pyxis; Prepare at medication counter; Infuse over 20 min; a concurrent NS bolus is recommended
IV Continuous Start at 10 mg/kg/hr (max 1000 mg/hr)	Bags in ED Pyxis; Prepare at medication counter; Use 40 mg/mL concentration; max 25 mL/hr Check magnesium level 6 hours after start of infusion

Epinephrine IM
Nonspecific beta-agonist, alpha-agonist

0.01 mg/kg every 5-15 minutes as needed administered IM in the anterolateral thigh		
<10 kg: 0.1 mg IM	**10-25kg: 0.15 mg IM**	**≥25kg: 0.3 mg IM**

Terbutaline
β2 agonist - NOT compatible w/ Mag sulfate - Flush with at least 20 mL in between doses given in the same line

IV Bolus	0.01 mg/kg (max 0.4 mg for child < 12 yrs, 0.75 mg in adolescent)	Vials in ED Pyxis; Prepare at medication counter Administer over 5 minutes; may dilute in NS for adequate volume (2-3 mL; concentration is then Xmg in XmL)
IV Continuous infusion	Start at 1 mcg/kg/min, titrate by 1 mcg/kg/min per MD order; usual effective range 3-6 mcg/kg/min	Comes from pharmacy in a syringe. Place order in EPIC. Takes considerable amount of time to prepare. Administer with a carrier fluid of NS @ 3 mL/hr
Subcutaneous	If no IV access 0.01 mg/kg (max 0.25 mg) - May repeat every 15 minutes for 3 doses	

Alternate Therapies

Ketamine
Bronchial smooth muscle relaxation, Use to relax patient for BiPAP, contact PICU

IV Bolus Sub-dissociative	0.3 mg/kg aliquots (max single dose 50 mg) using 10 mg/mL concentration	Syringes in ED Pyxis; Prepare at medication counter Administer over 60 seconds
IV Continuous infusion	Start at 0.25 mg/kg/hr and titrate by 0.5 mg/kg/hr, max 2 mg/kg/hr	Comes from Pharmacy – place order in EPIC Administer with carrier fluid
IM If no IV access	4 mg/kg using 100 mg/mL concentration	Comes from Pharmacy – place order in EPIC

PEEP / BiPAP
In conscious patient able to protect airway
- Direct bronchodilator effect, reduces WOB and energy expenditure
- Obtain BiPAP tote and apparatus, if possible
- Can provide CPAP w/ Mapleson bag as patient breathes spontaneously while continuous albuterol is administered via T-piece

IV Fluids – Normal Saline or Lactated Ringers (Bolus)
- For current or anticipated hypotension from mag, albuterol, dehydration, or increased intra-thoracic pressure from obstructive process
- Goal: increase preload, especially if considering intubation

Intubation
Avoid if possible due to risk of complications and difficulty with ventilation

Sedation	• Ketamine IV (Etomidate is also an acceptable choice) • Induction dose: 2 mg/kg • Continuous IV infusion: start at 0.25 mg/kg/hr; titrate by 0.5 mg/kg/hr to effect
Paralysis	• Evidence supports RSI with sedative and paralytic to maximize chances of success on first attempt; acceptable alternative would be ketamine alone with succinylcholine drawn up / ready for administration in case of laryngospasm • Succinylcholine or rocuronium, doses per SafeDose
Intubation	• Most experienced operator should intubate with a cuffed ETT, anticipating deterioration and need for high pressures • Contact PICU ED Team
Post-Intubation Management	• Sedation w/ ketamine VS benzodiazepine + fentanyl (non-histamine-releasing opioid) • Controlled hypoventilation: Tidal volume 5-8 mL/kg, instead of normal 10 mL/kg • Decrease I-to-E ratio to allow prolonged expiration (1:4 or 1:5) • Decreased ventilation rate to avoid air stacking and to maximize expiratory time • Complications: pneumothorax, hypotension, arrest (have low threshold for repeat CXR if patient decompensates)

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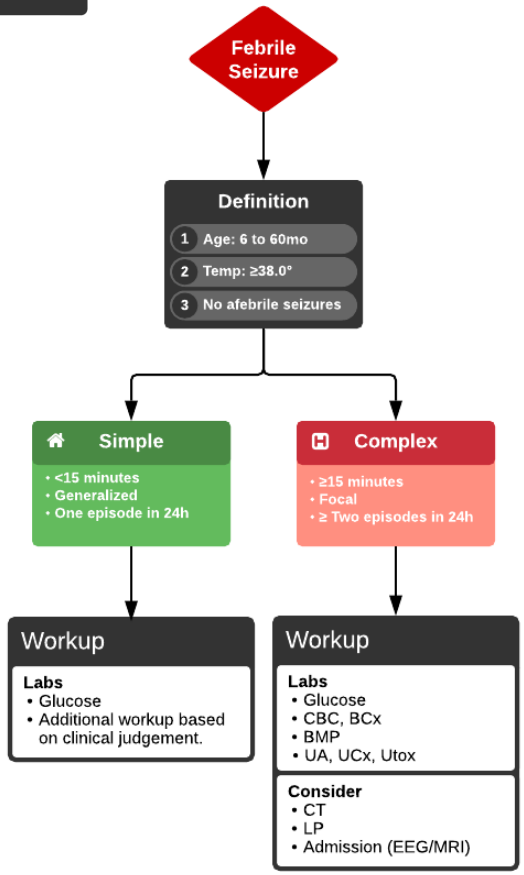
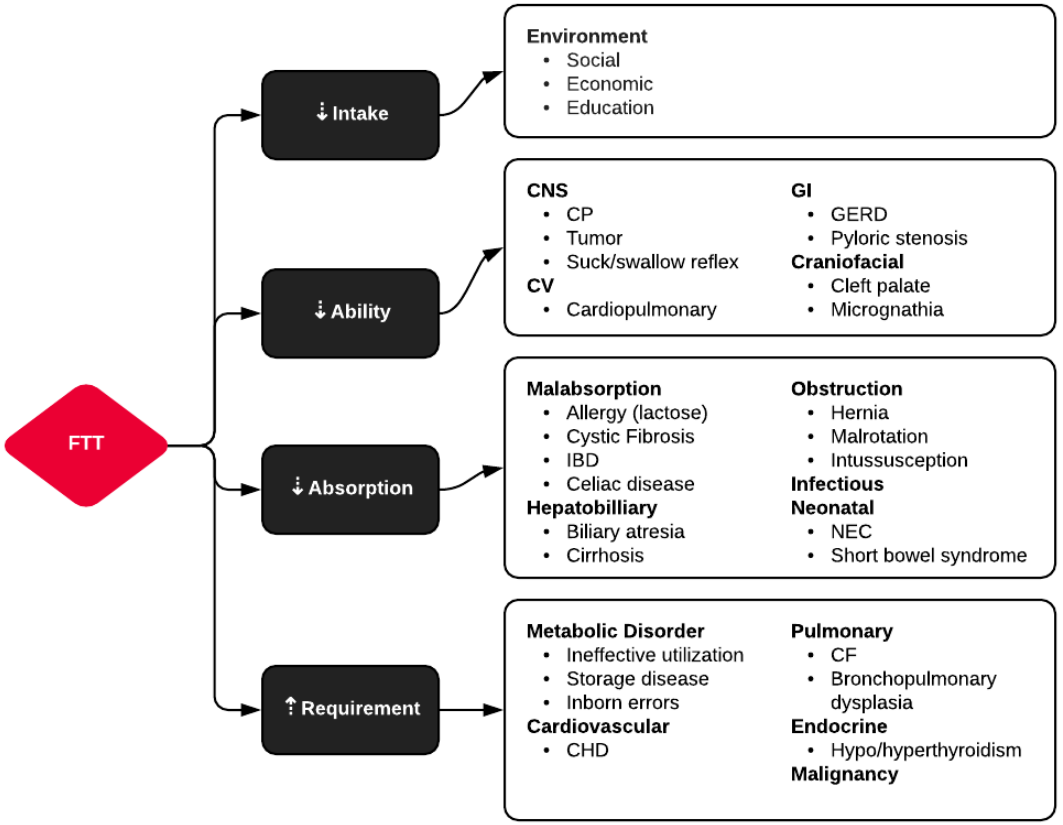

Febrile Seizure
Definition
1 Age: 6 to 60mo
2 Temp: ≥38.0°
3 No afebrile seizures
Simple
• <15 minutes
• Generalized
• One episode in 24h
Complex
• ≥15 minutes
• Focal
• ≥ Two episodes in 24h
Workup
Labs
• Glucose
• Additional workup based on clinical judgement.
Workup
Labs
• Glucose
• CBC, BCx
• BMP
• UA, UCx, Utox
Consider
• CT
• LP
• Admission (EEG/MRI)


FTT
Intake
Environment
• Social
• Economic
• Education
Ability
CNS
• CP
• Tumor
• Suck/swallow reflex
CV
• Cardiopulmonary
GI
• GERD
• Pyloric stenosis
Craniofacial
• Cleft palate
• Micrognathia
Absorption
Malabsorption
• Allergy (lactose)
• Cystic Fibrosis
• IBD
• Celiac disease
Hepatobilliary
• Biliary atresia
• Cirrhosis
Obstruction
• Hernia
• Malrotation
• Intussusception
Infectious
Neonatal
• NEC
• Short bowel syndrome
Requirement
Metabolic Disorder
• Ineffective utilization
• Storage disease
• Inborn errors
Cardiovascular
• CHD
Pulmonary
• CF
• Bronchopulmonary dysplasia
Endocrine
• Hypo/hyperthyroidism
Malignancy

Children's Hospital of Philadelphia®

Emergency Department and Inpatient Clinical Pathway for Evaluation/Treatment of Febrile Infants ≤ 56 Days Old with Community Onset Fever

Goals and Metrics

Provider Resources

Related Pathway

Urinary Tract Infection (UTI), All Settings
Bronchiolitis, Inpatient
Bronchiolitis, ED
Sepsis, ED, Inpatient, PICU
Sepsis, N/IICU

Summary of Pathway Updates
Adapted from AAP Guidelines 2021

Febrile Young Infant ≤ 56 Days Old with Community Onset Fever

Triage (Critical/Acute)
ED nursing pathway standing order set: Febrile Young Infant

Ill-appearing or as clinically indicated:
Sepsis Huddle
Sepsis Pathway
Sepsis N/IICU
Sepsis ED, Inpatient, PICU

ED Team Assessment and Bedside Procedure
History and Physical
IV and Laboratory Studies
POC glucose as needed
Consider HSV and Other Diagnostic Testing
If 0-21 days old: LMX to LP site, LP tray at bedside

Inclusion Criteria
0 to 56 days of age
Recorded temp ≥ 38.0° C (100.4° F) in past 24 hrs
Well-appearing

The following infants may have higher risk of invasive bacterial infection. IMs alone should not be used for risk stratification:
Premature birth < 37 wks gestation
Prolonged N/IICU stay
Complex Medical History
Physical Exam with Concern for Focal Bacterial Infection

Lab Study	Definition of Abnormal
Procalcitonin	> 0.5 ng/mL
Absolute Neutrophil Count	> 4000 neutrophils/μL < 1000 neutrophils/μL
Urinalysis with Reflex to Microscopy	Any leukocyte esterase (LE) on dipstick **or** > 5 WBCs per hpf
CSF	0-28 days: ≥ 15 WBC/μL 29-56 days: ≥ 9 WBC/μL

Antimicrobials: Recommendations, Dosing, and Rationale

Infants 0-21 Days Old

Blood culture
UA, urine culture
HSV Testing
Perform LP

Antimicrobials
Acyclovir

Infants 22-28 Days Old

CBC, blood culture
Inflammatory Markers (IMs): Procalcitonin, ANC
UA, urine culture
Consider HSV Testing

Abnormal UA
or
≥ 1 abnormal IM
Perform LP

Antimicrobials

Normal UA
Normal IMs
No LP

No antimicrobials

Infants 29-56 Days Old

CBC, blood culture
Inflammatory Markers (IMs): Procalcitonin, ANC
UA, urine culture
Consider HSV Testing

Infants with Bronchiolitis

Normal UA
≥ 1 abnormal IM
Perform LP

Antimicrobials

Abnormal UA
Normal IMs
No LP

Abnormal UA
Abnormal IMs
LP Guidance

Antimicrobials

Normal UA
Normal IMs
No LP

Discharge home w/follow-up
or
Admit w/o antimicrobials as indicated for etiologies other than serious bacterial infections

Admit from Emergency Department

LP Indicated, but No CSF Obtained

Any Positive Culture or HSV PCR

Discharge Criteria

Evidence

Evaluation and Management of Well-Appearing Febrile Infants 8 to 60 Days Old

Use of Procalcitonin Assays to Predict Serious Bacterial Infection in Young Febrile Infants

Time to Pathogen Detection for Non-ill Versus Ill-Appearing Infants ≤60 Days Old With Bacteremia and Meningitis

Prevalence of Bacterial Meningitis Among Febrile Infants Aged 29-60 Days With Positive Urinalysis Results: A Systematic Review and Meta-analysis

Validation of the "Step-by-Step" Approach in the Management of Young Febrile Infants

View All Evidence

Educational Media

Approach to the Febrile Young Infant (FYI)

Episode 8: The Febrile Infant - Join host Dr. Bob Belfer as he talks to PEM Experts Dr. Rich Scarfone and Dr. Prashant Majahan About how to Approach the Infant with a Fever

Activity 2

Display your data in a compelling fashion

Activity 2

We will share some data from a study, and it's up to you to work in small groups to design a unique way to tell the story using digital tools or the flip charts

ABC

Easy as 1, 2, 3? Not so fast…

- Describe, using video review, the performance of the rapid cardiopulmonary assessment by 71 categorical pediatric residents in the resuscitation area of a pediatric Emergency Department
- **Primary Outcome:** Performance of a complete RCPA (exam + assessment of airway, breathing and circulation)
- **Secondary Outcome:** Performance of individual components of airway, breathing, and circulation exam and assessment

The data you'll use to make your figure

The entire rapid cardiopulmonary assessment

- 2/71 (3%) of residents performed a complete RCPA (exam + assessment for airway, breathing, and circulation
- 45/71 (63%) did at least one exam element for airway, breathing, and circulation
- 4/71 (6%) verbalized an assessment for airway, breathing, and circulation

Airway

- 34/71 (48%) did at least one exam element
- 31/71 (44%) verbalized an assessment

Breathing

- 68/71 (96%) did at least one exam element
- 34/71 (48%) verbalized an assessment

Circulation

- 34/71 (93%) did at least one exam element
- 7/71 (10%) verbalized an assessment

Activity 2

Show & Tell

Resident Performance of the Rapid Cardiopulmonary Assessment in the Emergency Department

Sobolewski, Brad MD, MEd; Taylor, Regina G. MA; Geis, Gary L. MD; Kerrey, Benjamin T. MD, MS

Pediatric Emergency Care 36(6):p e304-e309, June 2020

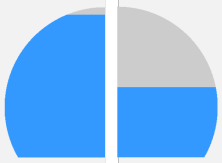
Airway

Breathing

Circulation

	Definition of Examination	Definition of Assessment
Airway 	Visual and/or auditory evidence of an attempt to get the patient to vocalize and/or or physical inspection of the airway	Verbalization of one or more of the following; airway patency, maintenance, potential deterioration and difficult airway
Breathing 	Visual and/or auditory evidence of auscultation of the thorax, assessment of respiratory rate, and/or evaluation of work of breathing	Verbalization of the respiratory status as normal, distress or failure
Circulation 	Visual and/or auditory evidence of auscultation over the heart, palpation of pulses, and assessment of capillary refill, heart rate, skin color, mental status and/or blood pressure	Verbalization as normal or evidence of shock
	A complete examination consisted of performance of at least one element of all three examination components	**A complete assessment consisted of a verbalized assessment of all three components.**

3% Complete RCPA

Exam		Assessment
48% 34/71		44% 31/71
96% 68/71		48% 34/71
93% 66/71		10% 7/71

All Exam Components	All Assessment Components
63% 45/71	6% 4/71

Airway

Examination

Component	n of 71	%
Vocalization		
Spontaneous	20	28
Speaks to patient	32	45
Unable to vocalize	10	14
Physical exam	5	7

Assessment

Component	n of 71	%
Patency	30	42
Protect	3	4
Maintain	1	1
Potential deterioration	0	0

Breathing

Examination

Auscultation	68	96
Expansion	2	3
Respiratory rate	2	3
Work of breathing	13	18

Assessment

Normal	19	27
Distress	14	20
Failure	0	0
Apnea/Arrest	1	1

Circulation

Examination

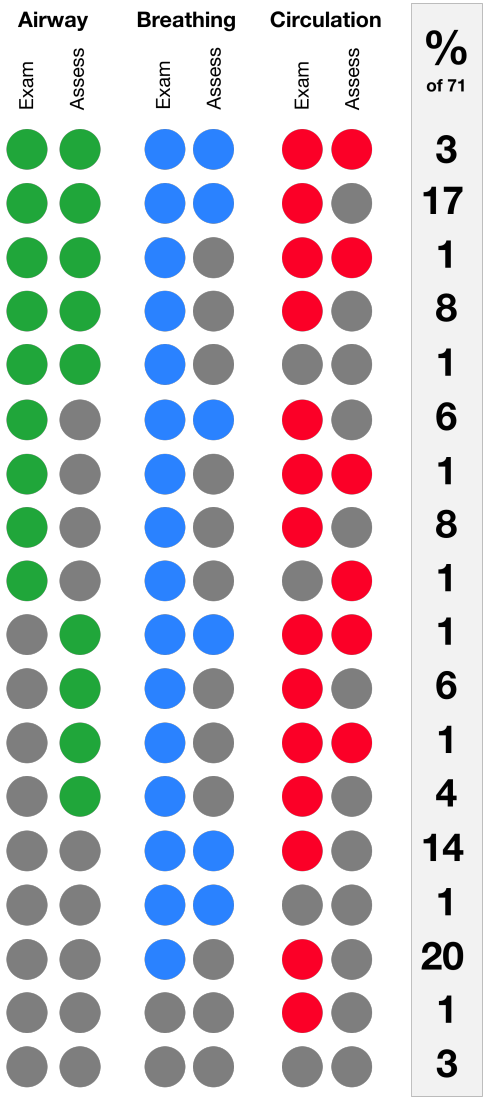
Auscultation	59	83
Skin	8	11
Pulses	60	85
Capillary refill	40	56
Heart rate	16	23
Mental status	9	13
Blood Pressure	0	0

Assessment

Normal	5	7
Shock	2	3

										Airway				Breathing				Circulation			
				Complete RCPA		Complete Exam		Complete Assess		Exam		Assess		Exam		Assess		Exam		Assess	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Year in Training	PL2	40	56	2	3	16	40	3	8	17	43	19	48	39	98	22	55	39	98	5	13
	PL3	31	44	0	0	16	52	0	0	17	55	12	39	29	94	12	39	27	87	2	6
	p	- - -		0.314		0.119		0.173		0.112		0.146		0.325		0.076		0.098		0.23	
Previous ED Rotation Months*	≤1	43	61	1	2	18	42	2	5	18	42	18	42	41	93	22	51	42	98	2	5
	≥1.5	28	39	1	4	14	50	1	4	16	57	13	46	27	96	12	43	24	86	5	18
	p	- - -		0.484		0.154		0.442		0.088		0.18		0.442		0.152		0.068		0.067	

* Breakdown of previous rotation experience by number of months worked in the ED
0: n=4 (6%), ½: 20 (28%), 1: n=19 (27%), 1½: n= 9 (12%), 2: n=15 (21%), 2½: n=4 (6%)


Airway
Exam
Assess
Breathing
Exam
Assess
Circulation
Exam
Assess
%
of 71
3
17
1
8
1
6
1
8
1
1
6
1
4
14
1
20
1
3

PAS
2015

Pediatric resident performance of the rapid cardiopulmonary assessment in the Emergency Department

Brad Sobolewski, MD, MEd; Regina Taylor, MA; Gary Geis, MD; Benjamin Kerrey, MD, MS

Cincinnati Children's | University of Cincinnati

Take Home

For patients evaluated in the resuscitation area of a busy academic pediatric ED, video review revealed that senior pediatric residents typically performed part of the breathing and circulatory exam but struggled to verbalize an assessment

Background

The rapid cardiopulmonary assessment (RCPA) is a focused exam and assessment of a patient's airway, breathing and circulation and is the foundation of the initial management of the critically ill child

Pediatric resident exposure to critical illness, especially the initial assessment, is increasingly limited

Limited exposure to critical illness and reliance on single day, annual training, i.e., PALS, may limit resident competency with the RCPA

The assessment of critically ill patients is a core competency of residency training and a basic societal expectation of all physicians

Very few studies describe performance of the RCPA, specifically by pediatric residents

Data collection is difficult without direct observation

Aim

To describe, using video review, the performance of the RCPA by pediatric residents in the resuscitation area of a pediatric ED

Methods

Observational study of senior pediatric resident performance of the RCPA on non-trauma patients evaluated in the resuscitation area of a busy pediatric ED

Subjects: 2nd and 3rd year categorical pediatric residents

Residents are tasked with initial RCPA for all patients

All encounters in the resuscitation area are video recorded (departmental standard)

One randomly selected encounter for residents rotating through the ED from January 2013 - June 2013

Data collection by video review using a standard form

Outcomes:

Primary: Performance of a complete RCPA (exam + assessment of airway, breathing and circulation)

Secondary: Performance of individual components of airway, breathing and circulation exam/assessment

Analysis: Descriptive statistics

Definitions

Airway

Exam Resident attempted to get patient to vocalize or physically inspected the airway

Assessment Resident verbalized as either patent, protected, maintained, or potential deterioration/difficulty

Breathing

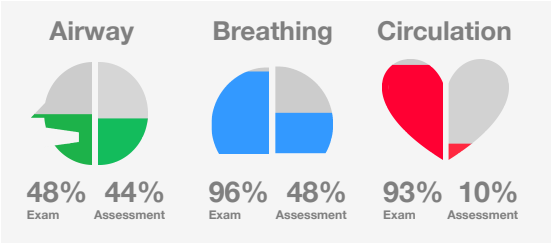
Exam Resident auscultated or verbalized rate/work of breathing

Assessment Resident verbalized as normal or abnormal (respiratory distress or failure)

Circulation

Exam Resident auscultated over heart, checked pulses, or capillary refill or verbalized heart rate

Assessment Resident verbalized as normal or evidence of shock



3% of residents performed a complete RCPA (2/71)

Exam

	Component	%
A	Vocalization	
	Spontaneous	28
	Speaks to patient	45
	Unable to vocalize	14
	Physical exam	7
B	Auscultation	96
	Expansion	3
	Respiratory rate	3
	Work of breathing	18
C	Auscultation	83
	Skin	11
	Pulses	85
	Capillary refill	56
	Heart rate	23
	Mental status	13
	Blood Pressure	0

Assessment

Component	%
Patency	42
Protect	4
Maintain	1
Potential deterioration	0
Normal	27
Distress	20
Failure	0
Apnea/arrest	1
Normal	7
Shock	3

Measure: Percentage of residents out of 71

Resident Performance of the Rapid Cardiopulmonary Assessment in the Emergency Department

Brad Sobolewski, MD, MEd, Regina G. Taylor, MA,* Gary L. Geis, MD,† and Benjamin T. Kerrey, MD, MS†*

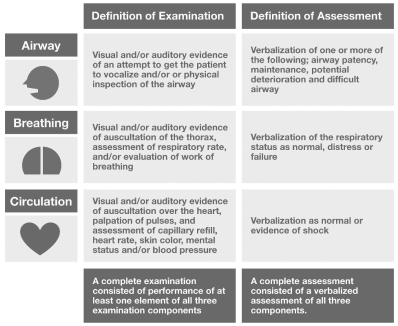


FIGURE 1. Definitions for the 3 components of the RCPA examination and assessment. Originally adapted from 2010 American Heart Association PALS guidelines.

and a 95% confidence interval as well as a χ^2 test. The level of significance was $P < 0.05$. All calculations and analyses were performed using SAS 9.3 (SAS Institute Inc, Cary, NC).

RESULTS

Study Subjects

One video was reviewed for 71 (95%) of 75 eligible senior pediatric residents (between January and June 2013), representing 55% of all senior pediatric residents at our institution (129 total). Most residents were PGY2: 42 (59%) PGY2s versus 39 (41%) PGY3s. The 4 residents not included did not participate in the care of a medical team patient during the study period. These 71 residents participated in an average (SD) of 7 (4.66) medical team patients per PED rotation, with a range of 1 to 23. The 71 patient encounters represented 13% of the medical team patients during the study period (540 total).

Main Outcome

Two (3%) of 71 residents (95% confidence interval, 0.8%–9.7%) performed a complete RCPA. The physician team leader performed the RCPA in concert with the trainee in 8 (11%) cases. The resident's RCPA was interrupted in 10 other encounters (14%), most often by therapeutic interventions (8 of 10), including intravenous placement, bag mask ventilation, and bedside ultrasound. The resident did not return to complete additional RCPA elements after any of these interruptions. In 9 (13%) of 71 encounters, the resident was prompted by the team leader to perform part of the RCPA. None of the prompts were associated with the team leader assisting in completion of the RCPA.

Nearly two thirds of the 71 residents performed at least one examination element of the 3 RCPA components; verbalization of a complete assessment was rare (Fig. 2). A summative description of resident performance of individual examination and assessment components are displayed in Table 1. Nearly all residents performed at least one aspect of the breathing and circulation examination; only half performed an airway examination. Approximately half of all residents verbalized an assessment of the airway and breathing; assessment of circulation was uncommon.

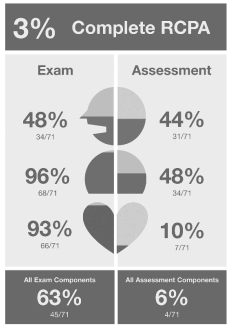


FIGURE 2. Main outcomes for the performance of the RCPA by 71 senior pediatric residents in a PED.

TABLE 1. Performance of the Examination and Assessment Components of the RCPA by 71 Senior Pediatric Residents in a PED

	Examination			Assessment		
	Component	n	n/71 %	Component	n	n/71 %
Airway						
	Vocalization			Patency	30	42
	Spontaneous	20	28	Protect	3	4
	Speaks to patient	32	45	Maintain	1	1
	Unable to vocalize	10	14	Potential deterioration	0	0
	Physical exam	5	7			
Breathing						
	Auscultation	68	96	Normal	19	27
	Expansion	2	3	Distress	14	20
	Respiratory rate	2	3	Failure	0	0
	Work of breathing	13	18	Apnea/Arrest	1	1
Circulation						
	Auscultation	59	83	Normal	5	7
	Skin	8	11	Shock	2	3
	Pulses	60	85			
	Capillary refill	40	56			
	Heart rate	16	23			
	Mental status	9	13			
	Blood pressure	0	0			

The percentages reflect the proportion of patients that received each component of the RCPA examination.

There was no association between performance of RCPA components (examination and assessment) and either resident year of training or the number of previous PED rotations (all $P > 0.05$; Table 2).

DISCUSSION

Despite a liberal definition, senior pediatric resident completion of the RCPA in our PED was poor. Although nearly all residents performed at least one examination element for breathing and circulation, performance of more than one element was uncommon, making an accurate assessment difficult. Verbalization of basic assessment of the breathing and circulation was also rarely completed. Our residents' performance is concerning given their primary role in the care team and sole responsibility for bedside assessment. Moreover, exploratory analyses found no association with measures of PED experience, despite 94% of these residents having prior PED experience and residents experiencing a mean of 7 medical resuscitations per rotation. To our knowledge, this is the first study reporting pediatric resident performance of the RCPA on actual patients.

Unlike critical procedures, many of which pediatric residents are no longer required to learn, the initial assessment of a critically ill patient should always be an essential aspect of pediatric residency training.[5] General and community pediatricians, especially in rural settings, will regularly see patients to whom mastery of the RCPA applies.[16] Sudden patient deterioration is possible in any setting, and a provider trained in general pediatrics ought to have basic resuscitation skills. Our results indicate that we were not meeting this expectation at our institution during the period of study. The very low rate of RCPA completion, combined with the relevant literature, suggests that pediatric residents in general may not be achieving competency with the RCPA.

There are several reasons why we suspect that performance of the RCPA was so poor. First, most patients encountered by our residents are not as sick as those seen in the resuscitation area. In the PED, patients present with variable levels of acuity with most encountered in examination rooms rather than the trauma bay. Switching from a more gradual patient encounter, where one first builds rapport, gains trust, and obtains a history, to immediately performing the RCPA takes practice. Second, although the "sick versus not-sick" differentiation is ideally made during every encounter, there may also be environmental factors in the resuscitation area that make successful completion of the RCPA more challenging. Residents are rarely on service long enough to have worked with all the team members and become intimately familiar with all PED processes and thus may be timid, or uncertain of the accuracy of their findings. In this critical care setting, multiple providers may piecemeal the RCPA and communicate their findings or concerns to the team leader, which could further inhibit a resident's ability to complete their examination and verbalize their assessment. For example, a respiratory therapist may immediately attend to the patient's airway and/or breathing, react to the patient's status, and place oxygen on the patient. Despite potential distractions and interruptions, residents are expected to complete all elements of the RCPA. This, we feel, assures that they perform both a complete examination and assessment for our sickest patients as well as practice valuable skills that will be useful regardless of their career destination.

TABLE 2. Performance of the RCPA by Year in Training and Previous Amount of PED Rotation Experience

				Complete RCPA		Complete Examination		Complete Assess		Airway				Breathing				Circulation			
										Examination		Assess		Examination		Assess		Examination		Assess	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Year in training	PL2	40	56	2	3	16	40	3	8	17	43	19	48	39	98	22	55	39	98	5	13
	PL3	31	44	0	0	16	52	0	0	17	55	12	39	29	94	12	39	27	87	2	6
	P	– – –		0.314		0.119		0.173		0.112		0.146		0.325		0.078		0.098		0.23	
Previous ED rotation months*	≤1	43	61	1	2	18	42	2	5	18	42	18	42	41	93	22	51	42	98	2	5
	≥1.5	28	39	1	4	14	50	1	4	16	57	13	46	27	96	12	43	24	86	5	18
	P	– – –		0.484		0.154		0.442		0.089		0.18		0.442		0.152		0.068		0.067	

*Breakdown of previous rotation experience by number of months worked in the ED:
0, n=4 (6%); ½, n=20 (28%); 1, n=19 (27%); 1½, n= 9 (12%); 2=n=15 (21%); and 2½, n=4 (6%).*

The percentages reflect the proportion of patients that received each component of the RCPA examination. Level of significance was defined as $P < 0.05$.

THE JOURNAL OF Allergy AND Clinical Immunology

Preparing Patients for Oral Immunotherapy (PPOINT): International Delphi consensus for procedural preparation and consent

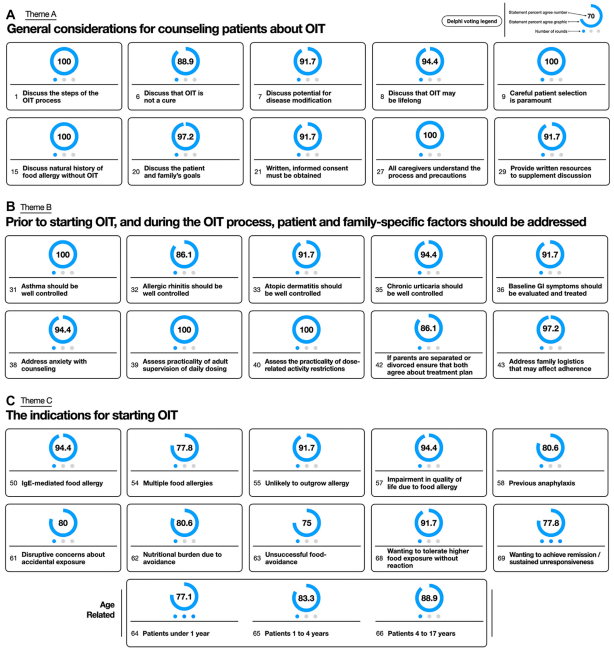


FIG 1. **(A)** Theme A key statements regarding general considerations for counseling patients about OIT. **(B)** Theme B key statements regarding general considerations for counseling patients about OIT. **(C)** Theme C key statements regarding general considerations for counseling patients about OIT. Statement number and statement are listed. Percentage of participants who voted for statement is represented by number and graphically as *blue circle*. *Blue dots* represent number of rounds to reach consensus. Full list of statements is provided in Tables E2–E4.

psychological disorders (86.1%; 1) (including eating disorders—83.3%; 1, anxiety—83.3%; 1, and obsessive-compulsive disorder—86.1%; 2) were considered contraindications if poorly controlled but were not considered contraindications if controlled. Social factors, including parental discord (94.4%; 1), poor parental communication (86.1%; 1), language barriers (77.8%; 1), and poor prior adherence (94.4%; 1), were all considered contraindications. Unwillingness to use epinephrine was a contraindication (97.2%; 1), with 94.3% considering this an absolute contraindication (Fig 2).

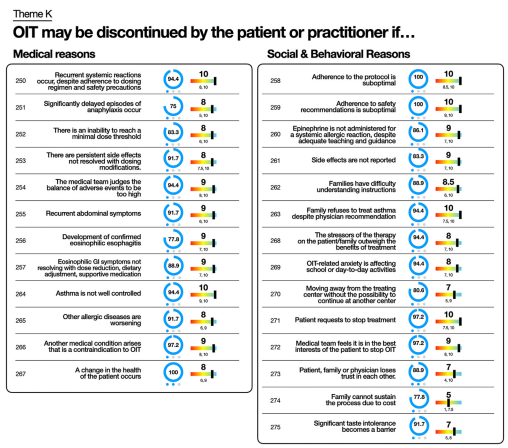


FIG 5. Theme K key statements regarding "OIT may be discontinued by patient or practitioner if…" Statement number and statement are listed. Percentage of participants who voted for statement represented by number and graphically as *blue circle*. *Blue dots* represent number of rounds to reach consensus. Median priority to include statement on consent form represented with number and rainbow lever graphic representation. Interquartile range listed below. Full list of statements is provided in Table E12.

of 4 to 17 years.[5] However, several studies have identified younger age groups as priority targets of OIT.[12,20,21] Our group recognized that OIT could be considered in younger age groups, even under 1 year of age, although the level of agreement was highest for the approved indication. While our group did not reach a consensus on patients over the age of 18, we recognize that this group may be suitable if adequately informed and prepared. We note most participants were pediatric allergists, thus potentially biasing the consideration of adult patients.

The benefits of OIT have been evaluated in multiple studies and meta-analyses and include reduced risk of reaction and reaction severity and potentially improved quality of life and anxiety, which also have aligned with prior research defining patient preferences and goals of therapy.[3-7,26] Our panel recognized and agreed that these outcomes may be variable and depend on patient characteristics, such as age, baseline degree of sensitization, and protocol. While patients may want to understand success rates, variability in baseline patient characteristics and protocols makes such determinations challenging to specify to patients.

Contraindications, risk mitigation, and OIT discontinuation

One of the major outcomes of this study was delineating OIT contraindications, as well as delineating whether experts considered contraindications to be absolute or relative. Performing proper clinical trials to specifically assess contraindications is potentially unethical, so contraindications can primarily be based on expert opinion or safety outcomes from trials and real-world data.[4,20] Opinions regarding these designations vary, and a lack of clarity on such heterogeneity may affect OIT outcomes. Panelists agreed on a few absolute contraindications: unwillingness to use epinephrine, uncontrolled asthma, and pregnancy. However, there were differences in agreement regarding the degree of contraindication (relative vs absolute) with other potential concerns, such as active EoE, concurrent β-blocker receipt, control of other allergic comorbidities, and prior severity of reactions. While other groups have attempted to define absolute and relative contraindications for OIT, this is the first published data to add granularity to these contraindications.[4,20]

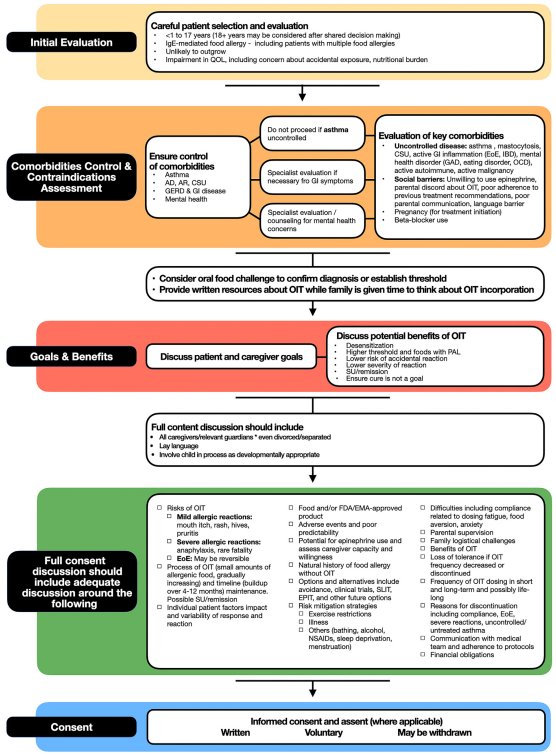


FIG 6. Proposed flow diagram resulting from procedural and consent elements of PPOINT study. *AD*, Atopic dermatitis; *AR*, allergic rhinitis; *CSU*, chronic spontaneous urticaria; *EMA*, European Medicines Agency; *FDA*, US Food and Drug Administration; *GAD*, general anxiety; *GERD*, gastroesophageal reflux disease; *GI*, gastrointestinal; *IBD*, inflammatory bowel disease; *NSAID*, nonsteroidal anti-inflammatory; *OCD*, obsessive-compulsive disorder; *QOL*, quality of life; *SLIT*, sublingual immunotherapy.

Design

- What is your message?
- Make a diagram
- Save examples of figures you like
- Pick the best software/ application for you needs

Production

- Use the correct geometry/figure style to show your data
- Utilize color effectively
- Include relevant metrics of uncertainty
- Distinguish models (curve fitting) from data (scatterplot)
- Include a detailed, standalone caption

Review

- Consider an infographic
- Solicit independent reviews

Please evaluate this workshop

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