



# Cover Your Sneeze, Please!

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January 23, 2023



## Conflicts of interest

- Planning Committee & Faculty Disclosure: The Planning Committee and Faculty have no relevant financial relationships with commercial interests to disclose.
- Dr. Buser: Gilead Foundation grant for hepatitis C study
- Dr. Lew: none



# Topics

- Trends and modeling
- Clinical features of
  - RSV
  - Influenza
- COVID (briefly)

Three  
COVID  
strains...

Two FLU  
bugs...

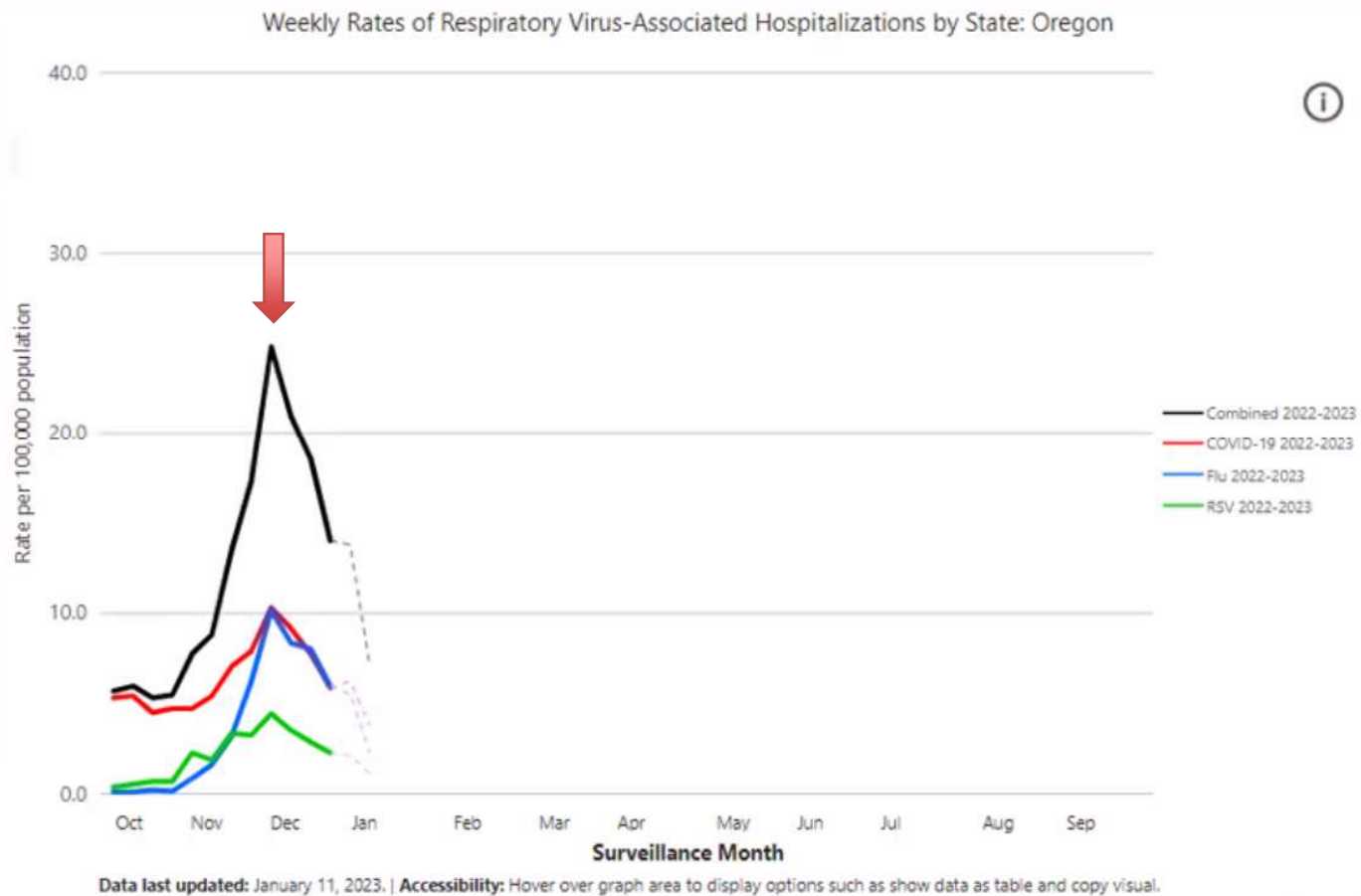
...and an  
outbreak  
of RSV!...

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# What just happened?

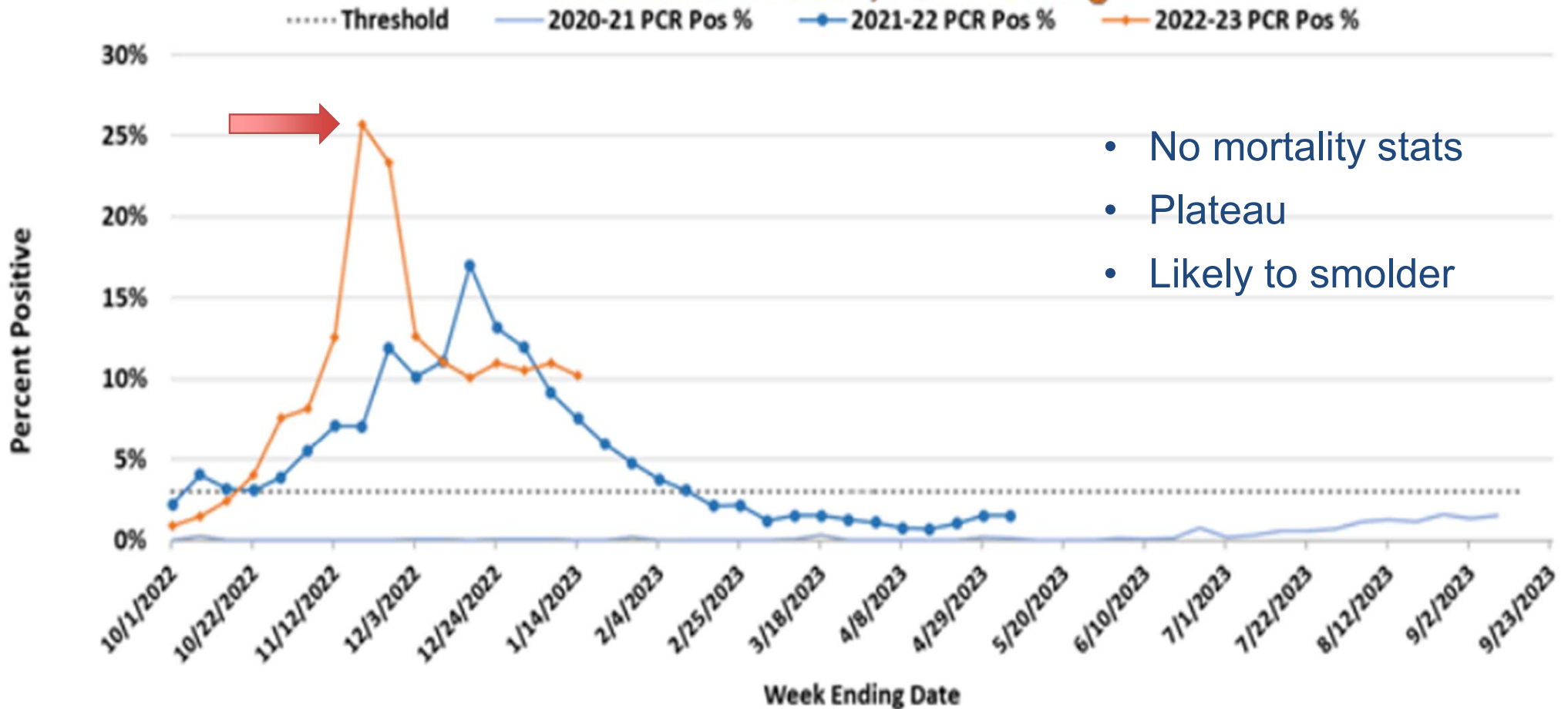
## Respiratory hospitalizations, Oregon





# RSV through Jan 14, 2023

Respiratory Syncytial Virus Surveillance  
Percent Positive RSV by Week, Oregon and SW Washington  
**2022-2023 Season, PCR Testing**



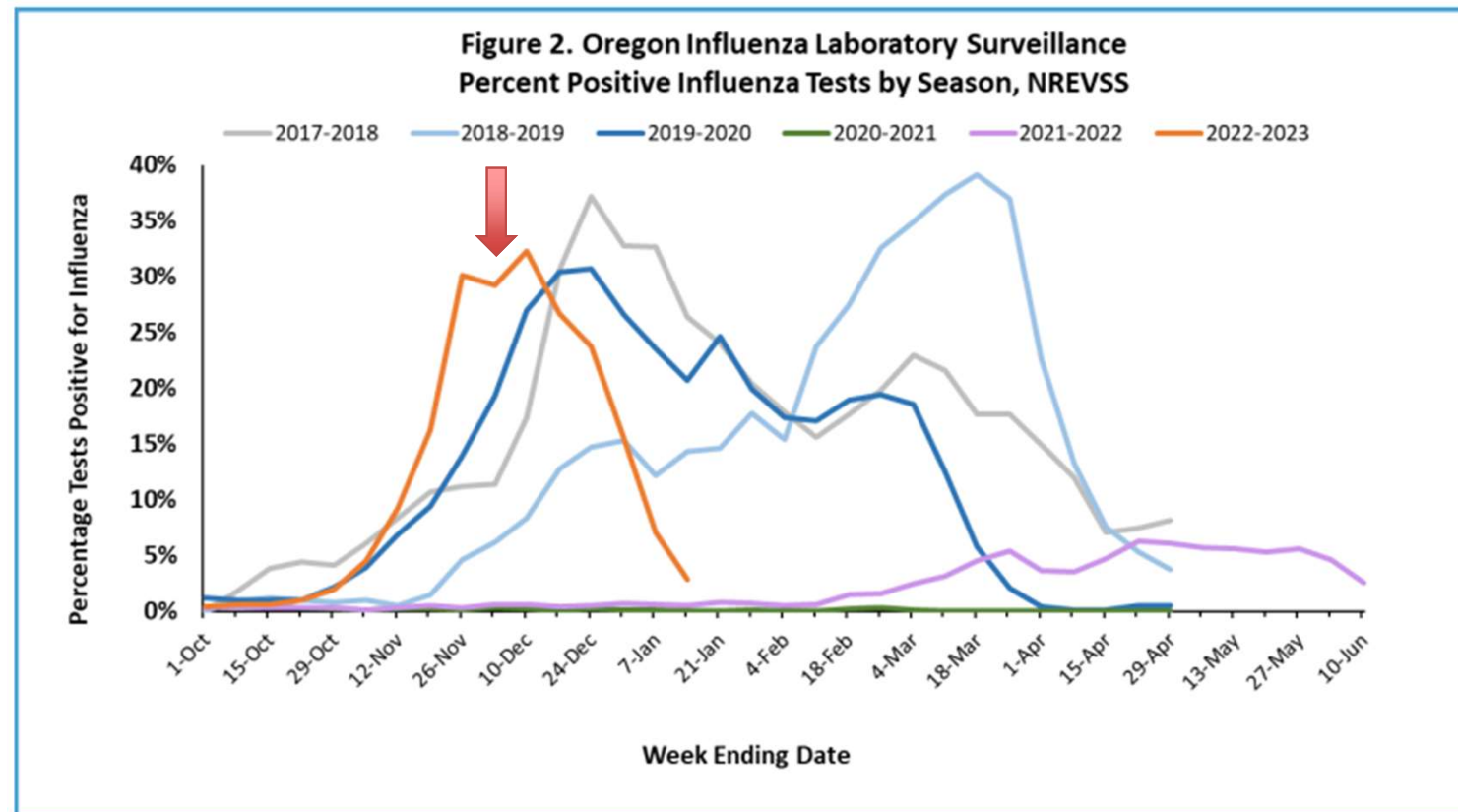
- No mortality stats
- Plateau
- Likely to smolder





# Influenza through Jan 14, 2023

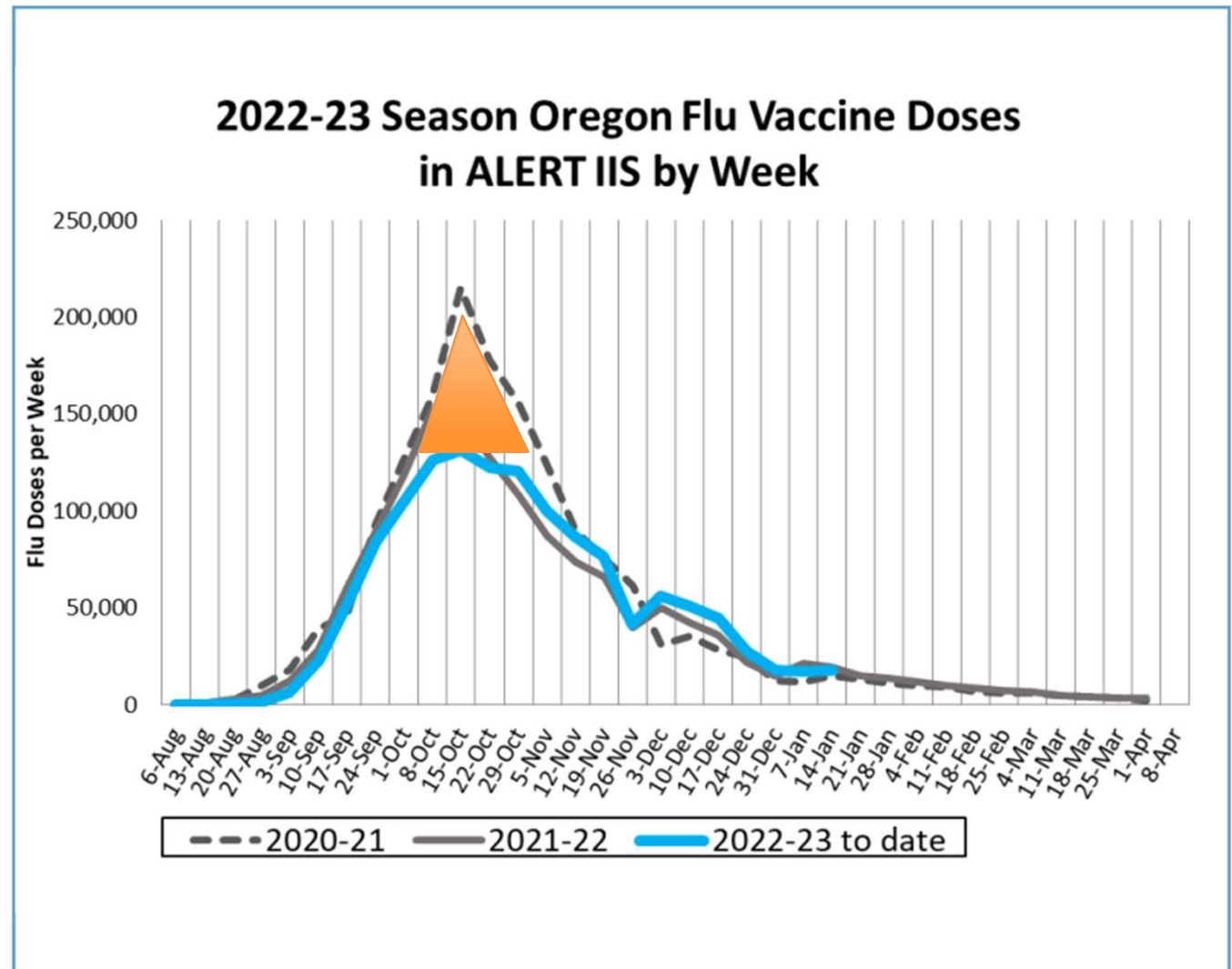
- % positive influenza tests: 15.6% → 7.1% → **2.8%**
- ER influenza-like illness: 2.6% → **1.2%**
- Pediatric admissions: **9%** of total (N=88)
- No pediatric mortality in Oregon





## Influenza through Jan 14, 2023 (2)

- Number of administered influenza vaccines = area under the curve
- Significantly less than 2020-2021 season
- Vaccine beneficial for future FluB surge



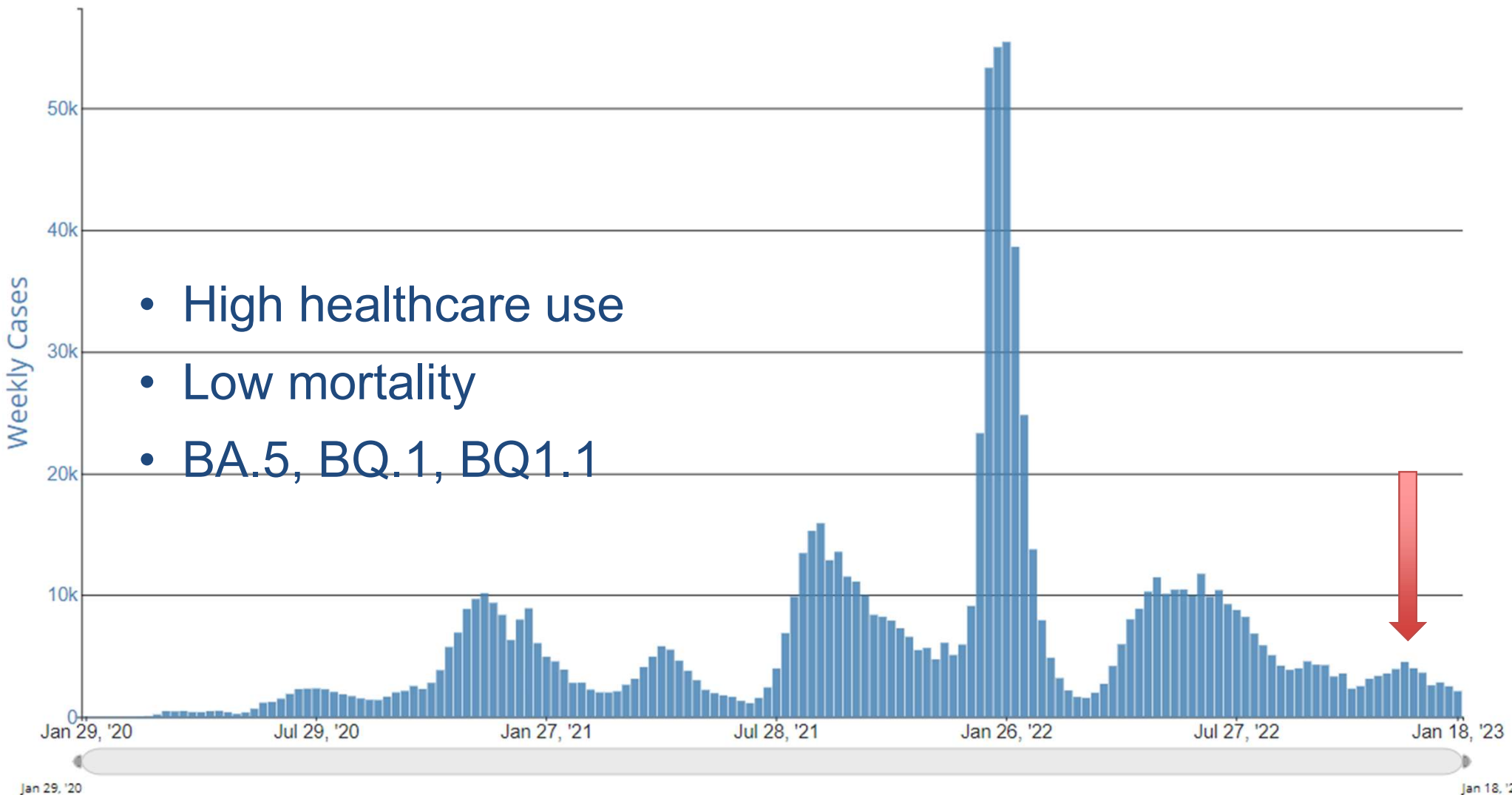




# COVID through Jan 18, 2023 (Oregon)

Weekly Trends in Number of COVID-19 Cases in Oregon Reported to CDC

- High healthcare use
- Low mortality
- BA.5, BQ.1, BQ1.1



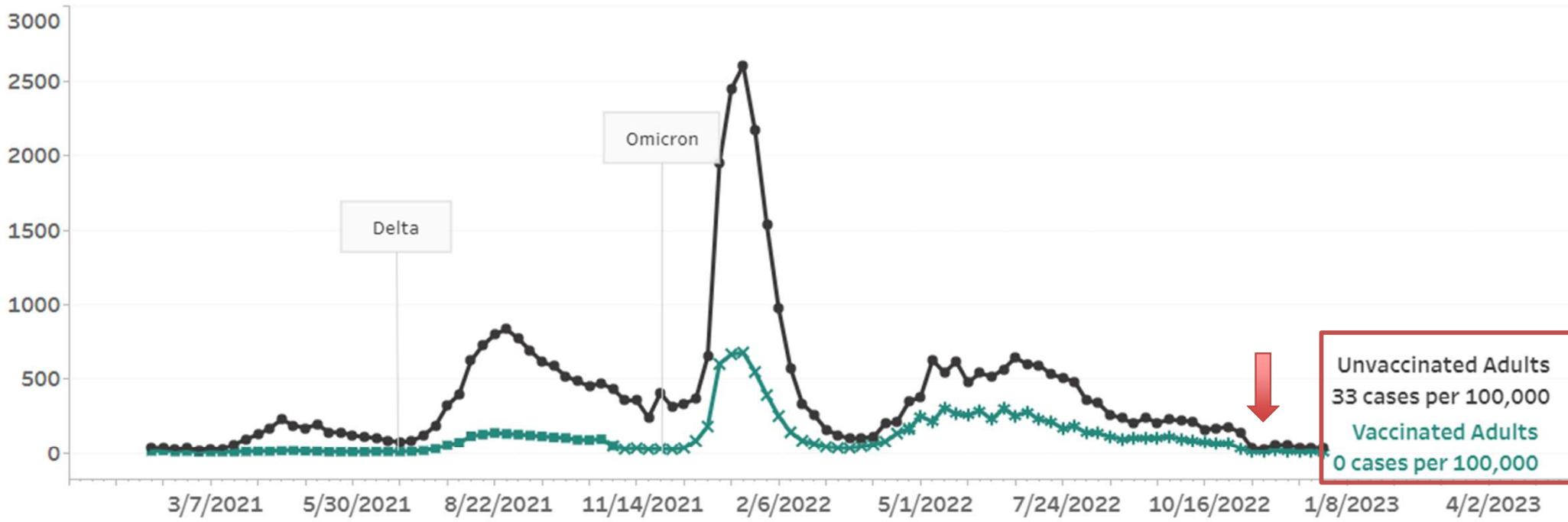


# COVID vaccine prevents hospitalizations

Select a county to change the graphs:

Oregon

COVID-19 Cases per 100,000 per Week by Vaccination Status  
Oregon



### Legend

- Unvaccinated Adults
- Vaccinated Adults: Primary series only
- × Vaccinated Adults: Primary series + valid booster
- \* Vaccinated Adults: Primary series + valid booster for 18 to 49 year olds, primary series + 2 valid boosters for 50+ year olds



## Are we on the other side?

- Most predictions say stable rates, can't rule out more
- RSV plateaued, but can fluctuate
- Rates of influenza A down; ? second influenza B peak, but always unpredictable
- COVID: new variants? May increase following flu peak

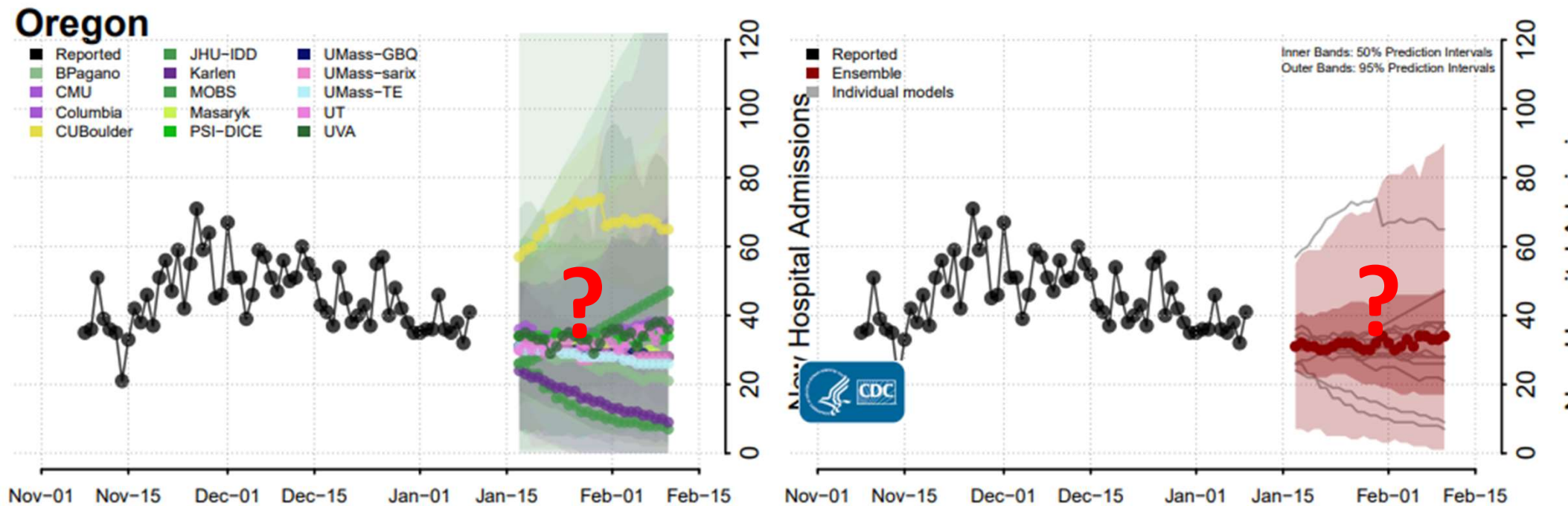


Embarrassing moments at gene parties



# BUT...

- New Omicron variant since mid-December: XBB.1.5
- Range of symptoms

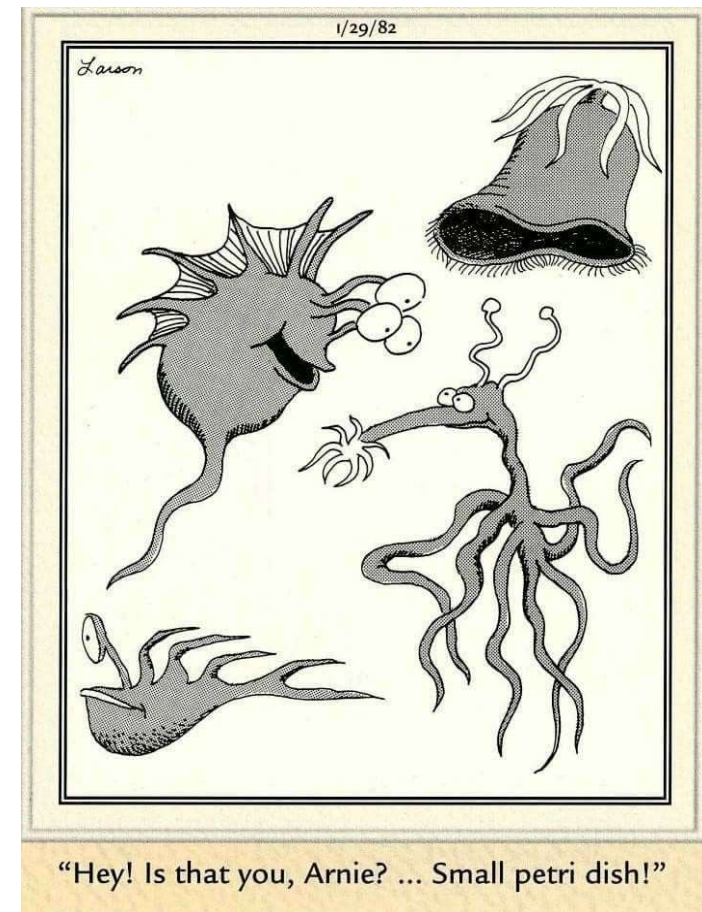






## Collateral damage

- Return of other secondary bacterial infections
  - Necrotizing pneumonias
  - Invasive bacterial infections
  - Meningitis, parameningeal infections
- Asthma, reactive airway disease...
- Invasive bacterial disease after *new* colonization (*Neisseria*, *Haemophilus*, *Streptococcus*, *Staphylococcus*)





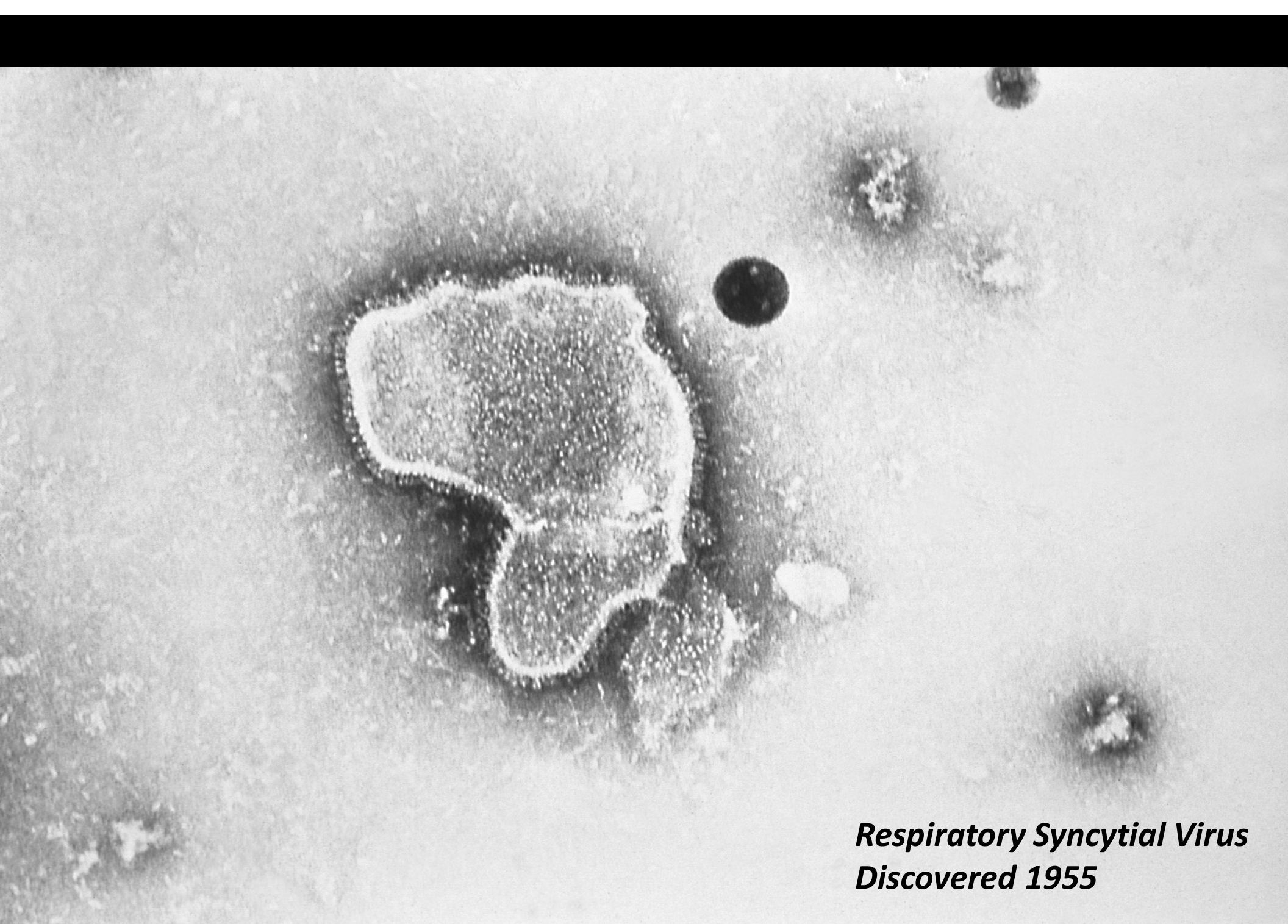
## What's next?

- Usual viral illness prevention
- RSV prophylaxis, when indicated
- Encourage influenza vaccination
- COVID vaccination
  - mRNA vaccines
  - Non-mRNA vaccine available  $\geq 12$  years
  - 2-dose series: Novavax
- Access to oral anti-virals for moderate/severe disease in at-risk populations
- Often increases after holidays (spring break, etc)

*Every Infection Preventionist's dream...*







***Respiratory Syncytial Virus  
Discovered 1955***



## Risk factors

- < 6 mo
- Cardiopulmonary disease
- < 35 weeks GA
- Trisomy 21
- Immunocompromise
- Siblings
- Secondhand smoke



# PEDIATRICS®

## Family and Child Risk Factors for Early-Life RSV Illness

Tiffany Fitzpatrick, MPH,<sup>abc</sup> J. Dayre McNally, MD, PhD,<sup>d</sup> Thérèse A. Stukel, PhD,<sup>abde</sup> Hong Lu, PhD,<sup>a</sup> David Fisman, MD, MPH,<sup>b</sup> Jeffrey C. Kwong, MD, MSc,<sup>ab,efghik</sup> Astrid Guttman, MDCM, MSc<sup>ab,ce,jk\*</sup>

Risk factor	Odds ratio for hospitalization
Maternal age < 25	1.23 (<20) - 1.50 (20-24)
Maternal criminal justice system involvement	1.31
Maternal mental health/addiction concerns	1.14
On welfare/disability/prescription support	1.22/1.25/1.22
Lowest 2 quartiles of income	1.12

The Journal of Infectious Diseases

MAJOR ARTICLE



## Mortality Associated With Acute Respiratory Infections Among Children at Home

Mauricio T. Caballero,<sup>1,2</sup> Alejandra M. Bianchi,<sup>1</sup> Alejandra Nuño,<sup>2</sup> Adrian J. P. Ferretti,<sup>1</sup> Leandro M. Polack,<sup>1</sup> Ines Remondino,<sup>3</sup> Mario G. Rodriguez,<sup>3</sup> Liliana Orizzonte,<sup>2</sup> Fernando Vallone,<sup>4</sup> Eduardo Bergel,<sup>5</sup> and Fernando P. Polack<sup>1</sup>

<sup>1</sup>Fundacion INFANT, <sup>2</sup>Secretaria de Salud de Lomas de Zamora, <sup>3</sup>Secretaria de Salud de Florencio Varela, <sup>4</sup>Region Sanitaria VI, and <sup>5</sup>Instituto de Efectividad Clinica y Sanitaria, Buenos Aires, Argentina

Risk factor	Odds ratio for death
No running water	4.39
Crowding (> 3 people per bedroom)	3.73
Adolescent mother (< 19 years)	4.89
Incomplete vaccination	3.39



# SIGNS AND SYMPTOMS OF RSV



Fever



Cough



Poor appetite



Fast, shallow breathing



A rapid heartbeat



Flaring of the nostrils



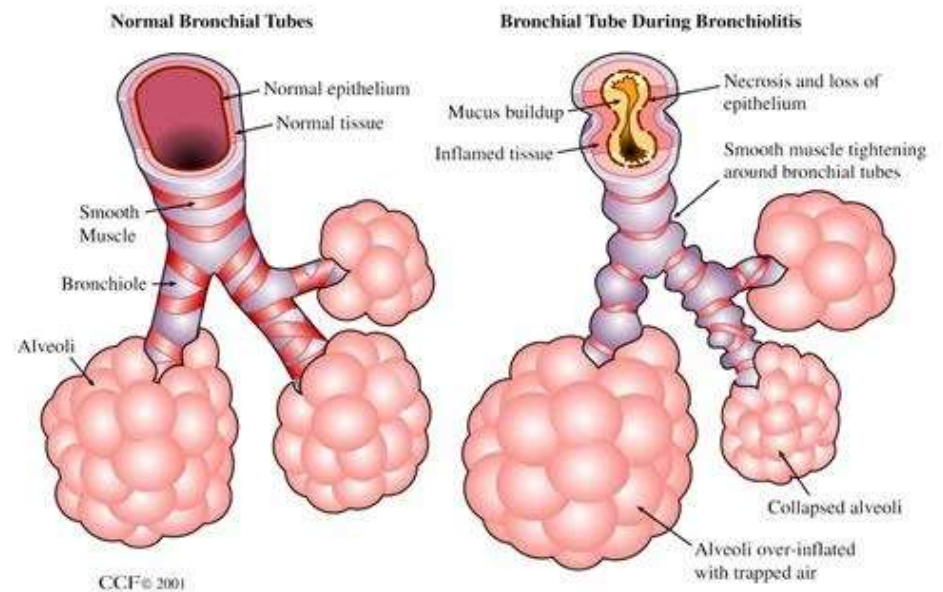
Vomiting after coughing



Stuffy nose and congestion



## Bronchiolitis Pathophysiology



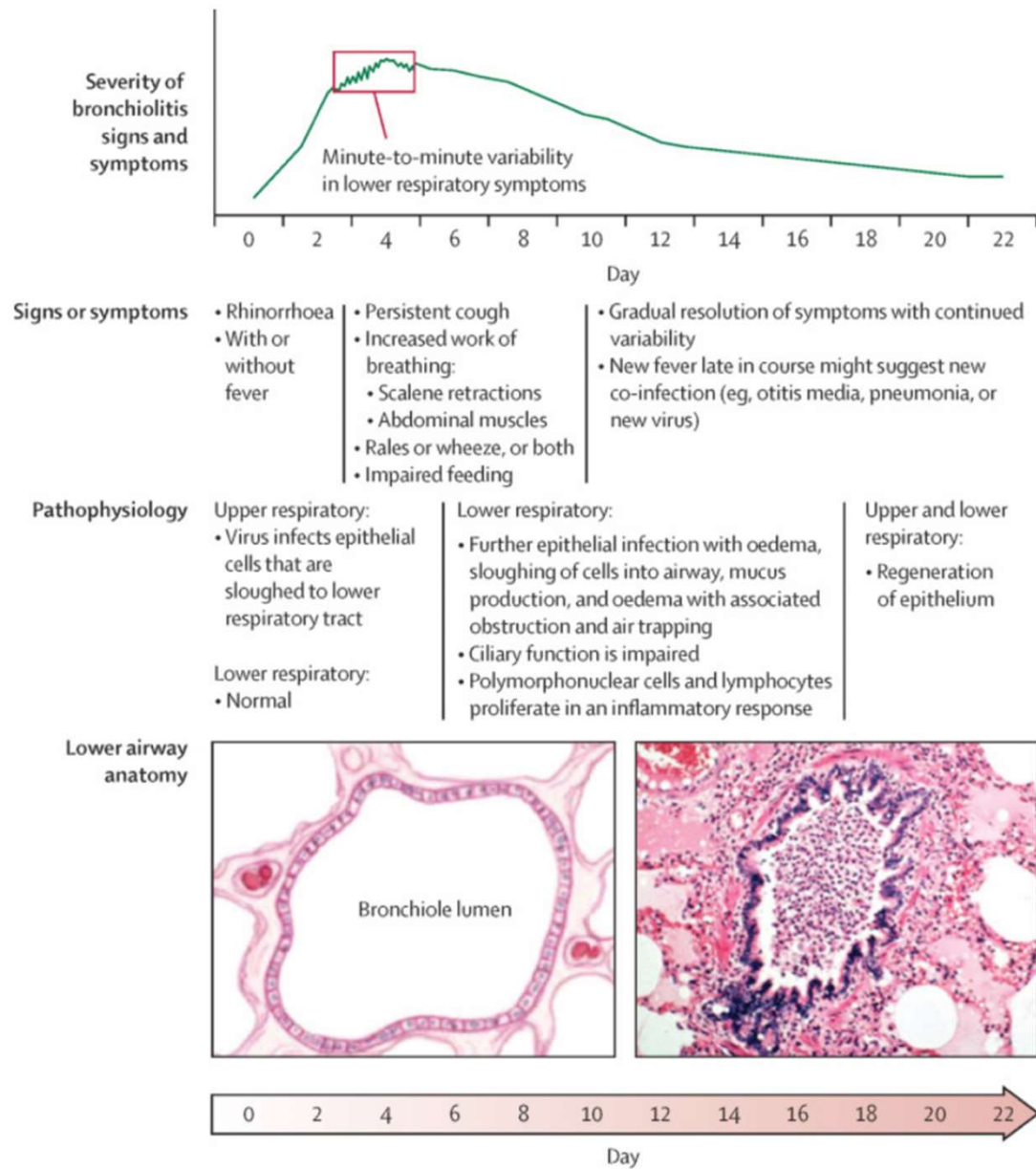
my.clevelandclinic.org

Sources:

<https://kidshealth.org/en/parents/bronchiolitis.html>  
<https://medlineplus.gov/ency/article/001564.htm>

Presented by:





**Figure 1.** Typical clinical course and pathophysiology of viral bronchiolitis  
 Lancet. 2017 14-20 January; 389(10065): 211–224. Published online 2016 Aug 20



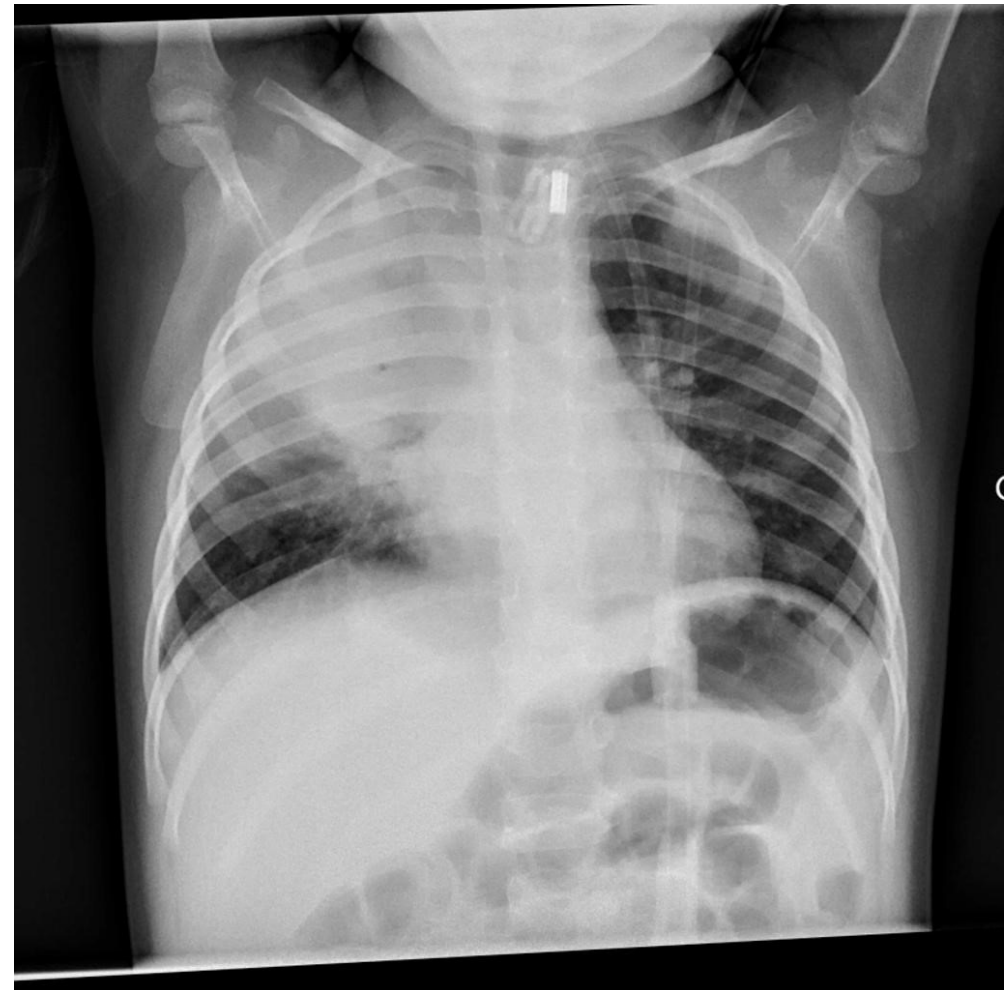
Most kids recover without complications.





## Complications

- Dehydration
- Aspiration
- Secondary bacterial pneumonia
- Apnea
- Respiratory failure





The diagnosis is made clinically.



Viral testing is  
generally not needed.



# Management

- Encourage fluids
- Nasal suctioning
- PRN antipyretics
- Cuddles





## Indications for ED visit or hospitalization

- Dehydration and/or poor feeding
- Moderate to severe respiratory distress
- Apnea
- Hypoxia
- Unable to care for at home





## Inpatient management

- Fluids: po vs IV vs NG
- Nasal suctioning
- Supplemental oxygen
- HHFNC
- Monitor for complications  
(and treat if needed)
- ICU





## Don't...

- Order CXR in children with uncomplicated bronchiolitis
- Routinely use bronchodilators in children with bronchiolitis
- Use systemic steroids in children with an uncomplicated LRTI.
- Use antibiotics for viral respiratory illnesses
- Routinely use airway clearance therapy in bronchiolitis
- Obtain comprehensive RVP for patients with suspected respiratory viral illnesses

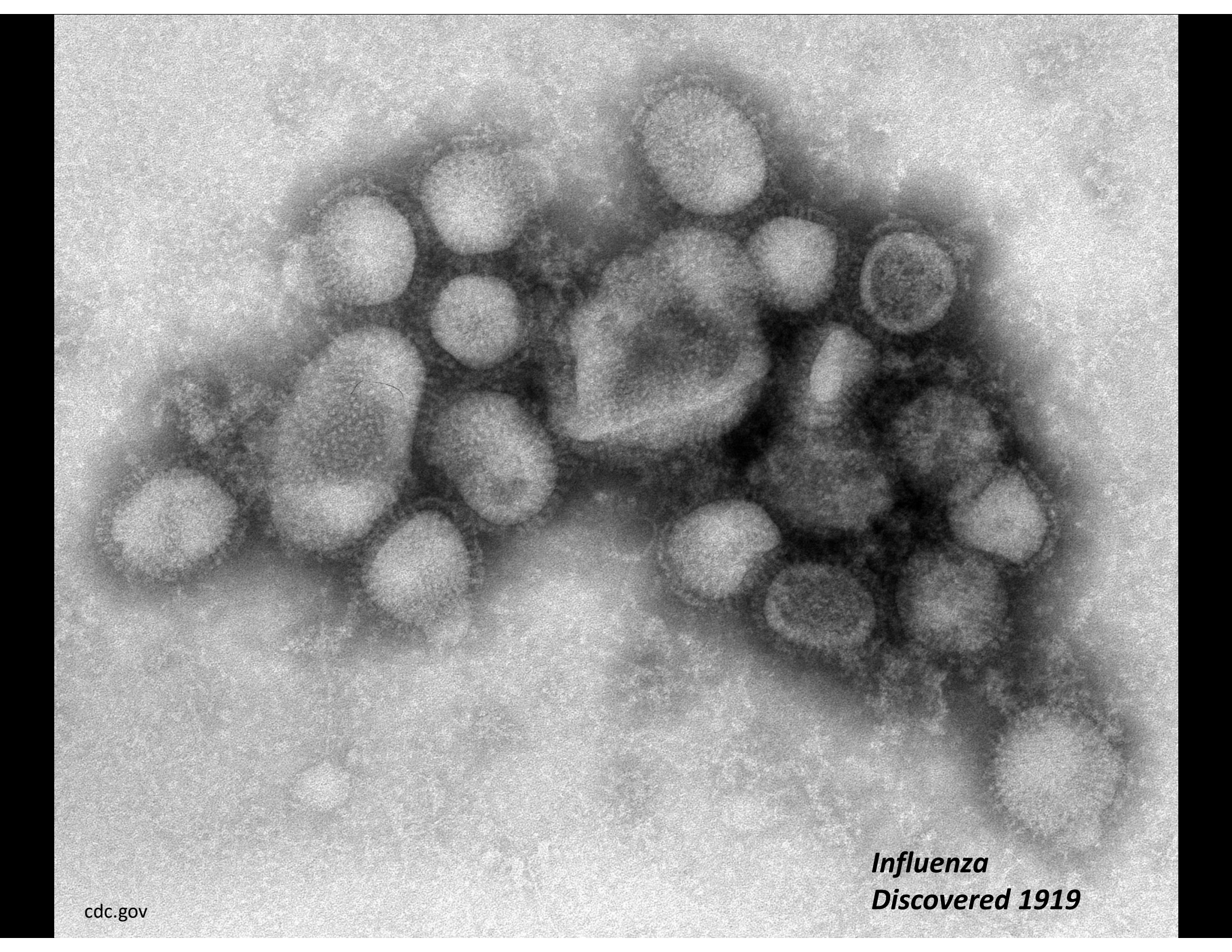


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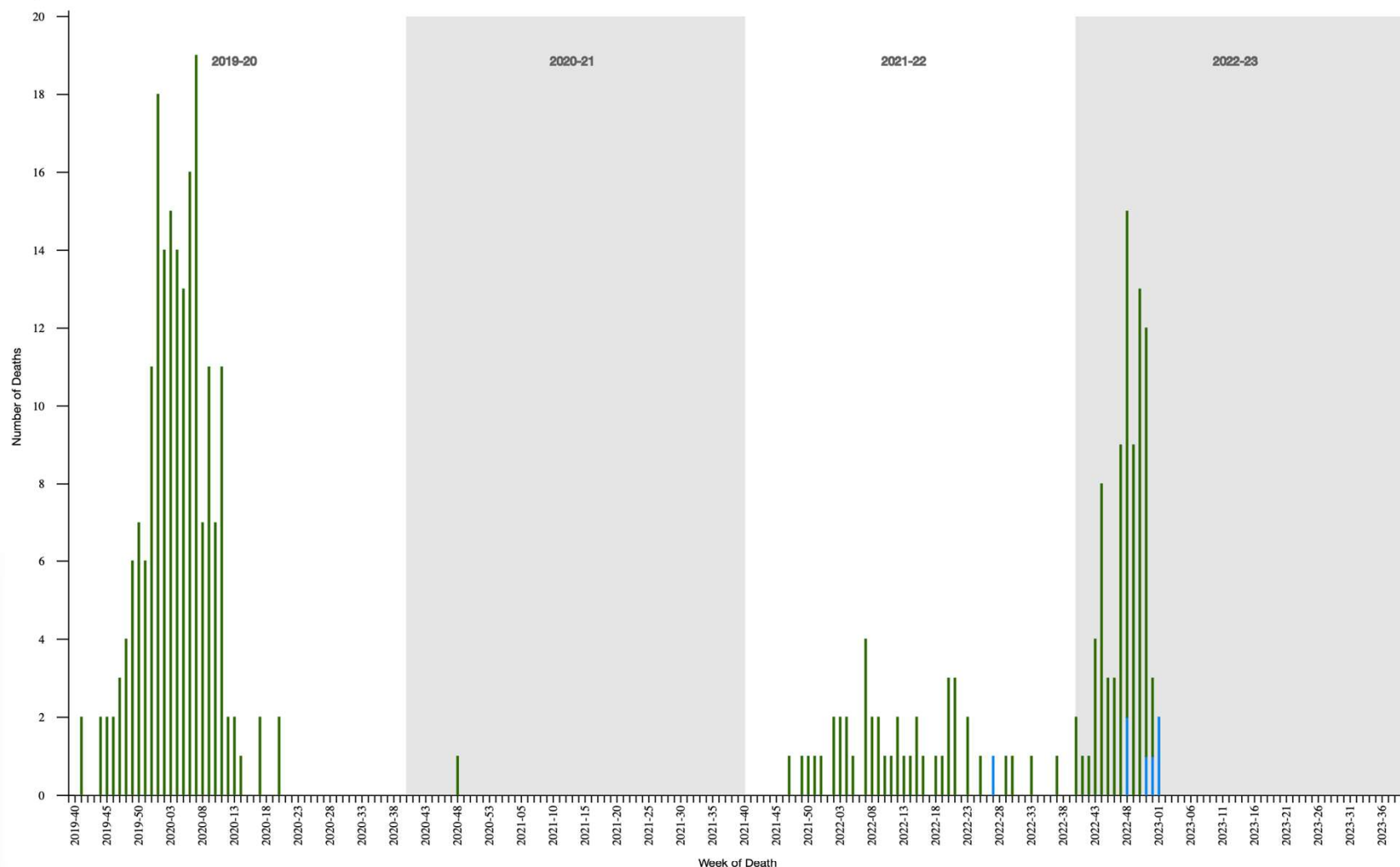


***Influenza***  
***Discovered 1919***

NUMBER OF INFLUENZA-ASSOCIATED PEDIATRIC DEATHS BY WEEK OF DEATH

Group By  Reported  Virus Type [Download Image](#) [Download Data](#) [?](#)

By Week  Current Week  Previous Weeks  All Deaths



Seasons	Total Deaths	Deaths reported During the Week Ending 14 Jan 2023
2019-20	199	0
2020-21	1	0
2021-22	45	1
2022-23	85	6



aap.org

## Risk factors

- < 5 years (esp < 2 years)
- Pregnancy
- Chronic medical conditions
- Black, Hispanic/Latinx, American Indian, Alaska Native



# FLU

## signs and symptoms



SORE THROAT



DRY COUGH



RHINITIS



FEVER



CHILLS



HEADACHE

**TABLE 2.** Signs and Symptoms and Clinical Diagnoses at the Initial Visit in Different Age Groups of Children With Influenza

Sign or Symptom	Age Group			All (n = 353)	P*
	<3 yr (n = 101)	3–6 yr (n = 160)	7–13 yr (n = 92)		
Fever $\geq 37.5^{\circ}\text{C}$	99 (98)	148 (93)	87 (95)	334 (95)	0.157
Fever $\geq 38.0^{\circ}\text{C}$	95 (94)	145 (91)	77 (84)	317 (90)	0.053
Fever $\geq 39.0^{\circ}\text{C}$	60 (59)	82 (51)	36 (39)	178 (50)	0.018
Fever $\geq 40.0^{\circ}\text{C}$	20 (20)	19 (12)	4 (4)	43 (12)	0.005
Rhinitis	87 (86)	120 (75)	67 (73)	274 (78)	0.048
Cough	79 (78)	119 (74)	74 (80)	272 (77)	0.516
Sore throat	NA	39 (24)	51 (55)	90 (36)	<0.001
Headache	NA	29 (18)	36 (39)	65 (26)	<0.001
Myalgia	NA	5 (3)	12 (13)	17 (7)	0.006
Gastrointestinal symptoms	6 (6)	16 (10)	9 (10)	31 (9)	0.489
Tonsillar exudates	1 (1)	5 (3)	4 (4)	10 (3)	ND
Impaired general condition	10 (10)	14 (9)	12 (13)	36 (10)	0.552
Expiratory wheezing	2 (2)	6 (4)	1 (1)	9 (3)	ND
Laryngitis	6 (6)	10 (6)	7 (8)	23 (7)	0.881
Conjunctivitis	7 (7)	12 (8)	12 (13)	31 (9)	0.241
Acute otitis media	19 (19)	17 (11)	1 (1)	37 (10)	<0.001
Pneumonia	2 (2)	3 (2)	0 (0)	5 (1)	ND
Maxillary sinusitis	0 (0)	4 (3)	2 (2)	6 (2)	ND

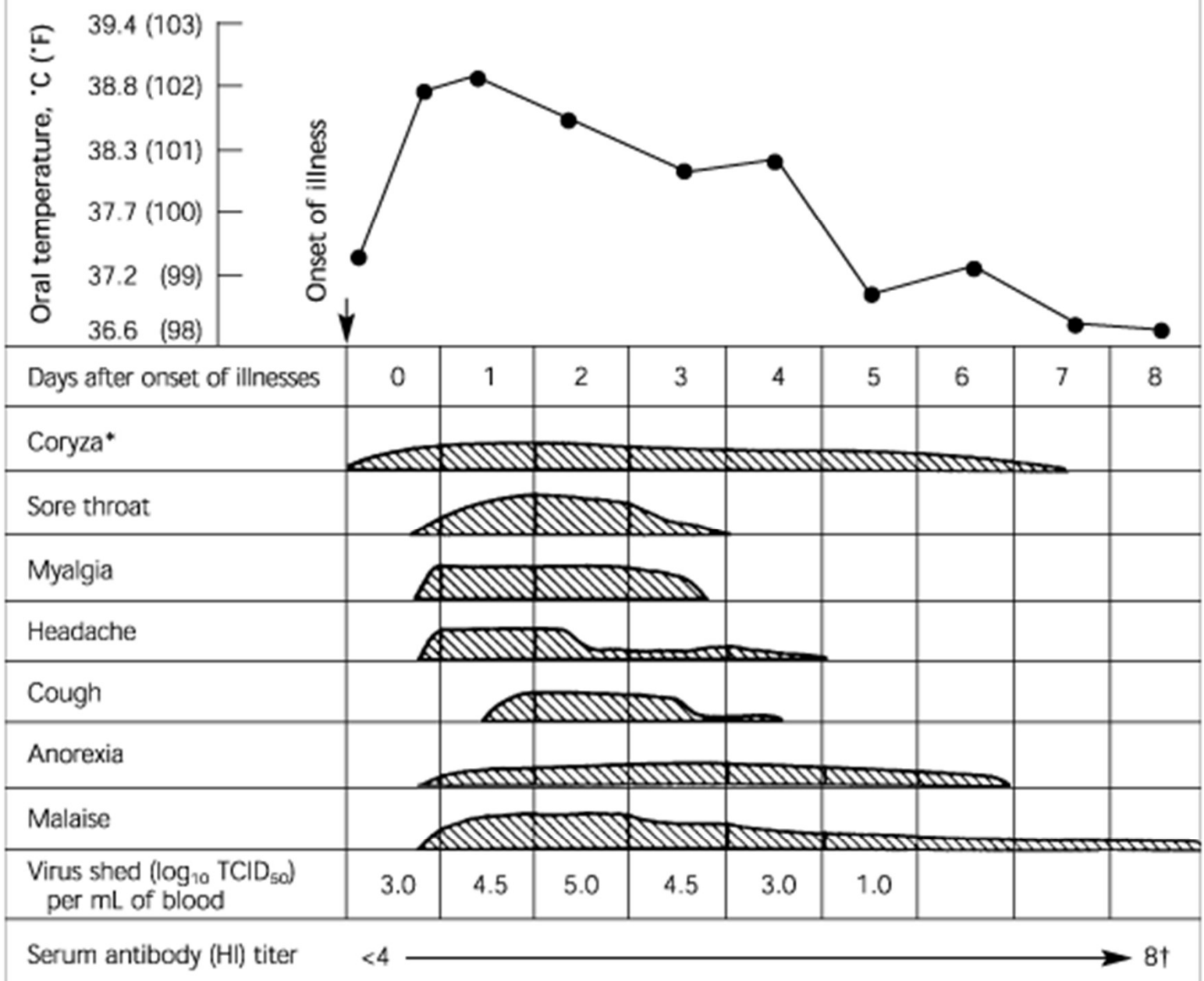
Data are number of (%) cases.

\*P:  $\chi^2$  test.

NA indicates not applicable; ND, not done because of low frequencies.



### Natural Course of Influenza



\*—Coryza is an acute inflammatory condition of the nasal mucous membranes with a profuse discharge from the nose.

†—Serum antibody titer was 64 at day 21.



Most kids recover without complications.

**TABLE 2****Complications of Influenza****Cardiovascular**<sup>26</sup>

Cerebrovascular accidents  
Ischemic heart disease  
Myocarditis

**Hematologic**<sup>26</sup>

Hemolytic uremic syndrome  
Hemophagocytic syndrome  
Thrombotic thrombocytopenic purpura

**Musculoskeletal**<sup>19,26</sup>

Myositis  
Rhabdomyolysis

**Neurologic**<sup>26</sup>

Acute disseminated encephalomyelitis  
Encephalitis  
Guillain-Barré syndrome  
Postinfluenza encephalopathy (neurologic symptoms occurring after resolution but within 3 weeks of primary infection)  
Reye syndrome  
Transverse myelitis

**Ocular**<sup>26</sup>

Conjunctivitis (most common)  
Optic neuritis  
Retinopathy  
Uveal effusion syndrome

**Pulmonary**<sup>8,25,27</sup>

Acute respiratory distress syndrome  
Diffuse alveolar hemorrhage  
Hypoxic respiratory failure  
Primary viral pneumonia  
Secondary bacterial pneumonia

**Renal**<sup>26</sup>

Acute kidney injury (e.g., acute tubulointerstitial nephritis, glomerulonephritis, minimal change disease)  
Multiorgan failure

*Information from references 8, 19, and 25-27.*



During influenza season, always consider influenza.



**Does the patient have signs and symptoms suggestive of influenza, including atypical clinical presentation, or findings suggestive of complications associated with influenza?<sup>2,3</sup>**

**Yes**

**No**

**Is the patient being admitted to the hospital?**

**Yes**

**No**

**Will influenza testing results influence clinical management?<sup>4</sup>**

**Influenza testing probably not indicated; consider other etiologies**

**Yes**

**No**

**Test for influenza; start empiric antiviral treatment for hospitalized patients while results are pending (molecular assays should be used for influenza testing of hospitalized patients.)<sup>4,5,6,7,8</sup> Proper interpretation of testing results is important.**

**Influenza clinically diagnosed; start empiric antiviral treatment if the patient is in a high-risk group for influenza complications<sup>7,8</sup>, or has progressive disease, advise close follow-up if worsening**



# Management

- Encourage fluids
- PRN acetaminophen and/or NSAIDs
- Cuddles
- Antivirals





# Neuraminidase inhibitors

- Reduce duration of symptoms by 1 day
- Best if started within 48 hours
- Can reduce respiratory complications, hospital LOS, and mortality in high risk patients





## Indications for treatment

- At risk for severe complications
- Younger children (esp < 2 years)
- High risk contacts
- Hospitalization







Antivirals should be given ASAP after symptom onset.



## Indications for ED visit or hospitalization

- Dehydration and/or poor feeding
- Moderate to severe respiratory distress
- Hypoxia
- Worsening of chronic illnesses
- Serious complications

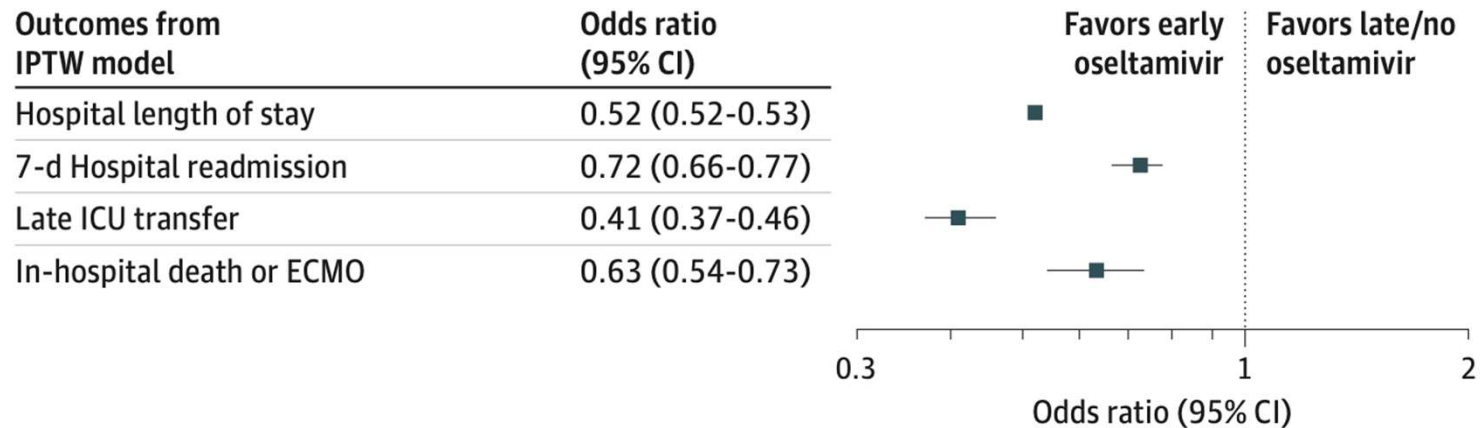
# Association of Early Oseltamivir With Improved Outcomes in Hospitalized Children With Influenza, 2007-2020

Patrick S. Walsh, MD, MS; David Schnadower, MD, MPH; Yin Zhang, MS; Sriram Ramgopal, MD; Samir S. Shah, MD, MSCE; Paria M. Wilson, MD, MEd

Figure 2. Results of Weighted Analysis of Oseltamivir Use and Outcomes

**A** Primary analysis

Early oseltamivir vs late/no oseltamivir



# How to Help your Family Fight Flu

Flu shots! Everyone 6 months and up should get a flu shot each year.

## Here are other ways to #FightFlu:

- Wash hands frequently
- Sanitize toys
- Teach kids to cough in their elbow (like a vampire!)
- Keep kids home from school & child care if they have any flu symptoms



**Keep your family and community healthy by getting vaccinated today!**



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# **Choosing Wisely**<sup>®</sup> CELEBRATING 10 YEARS

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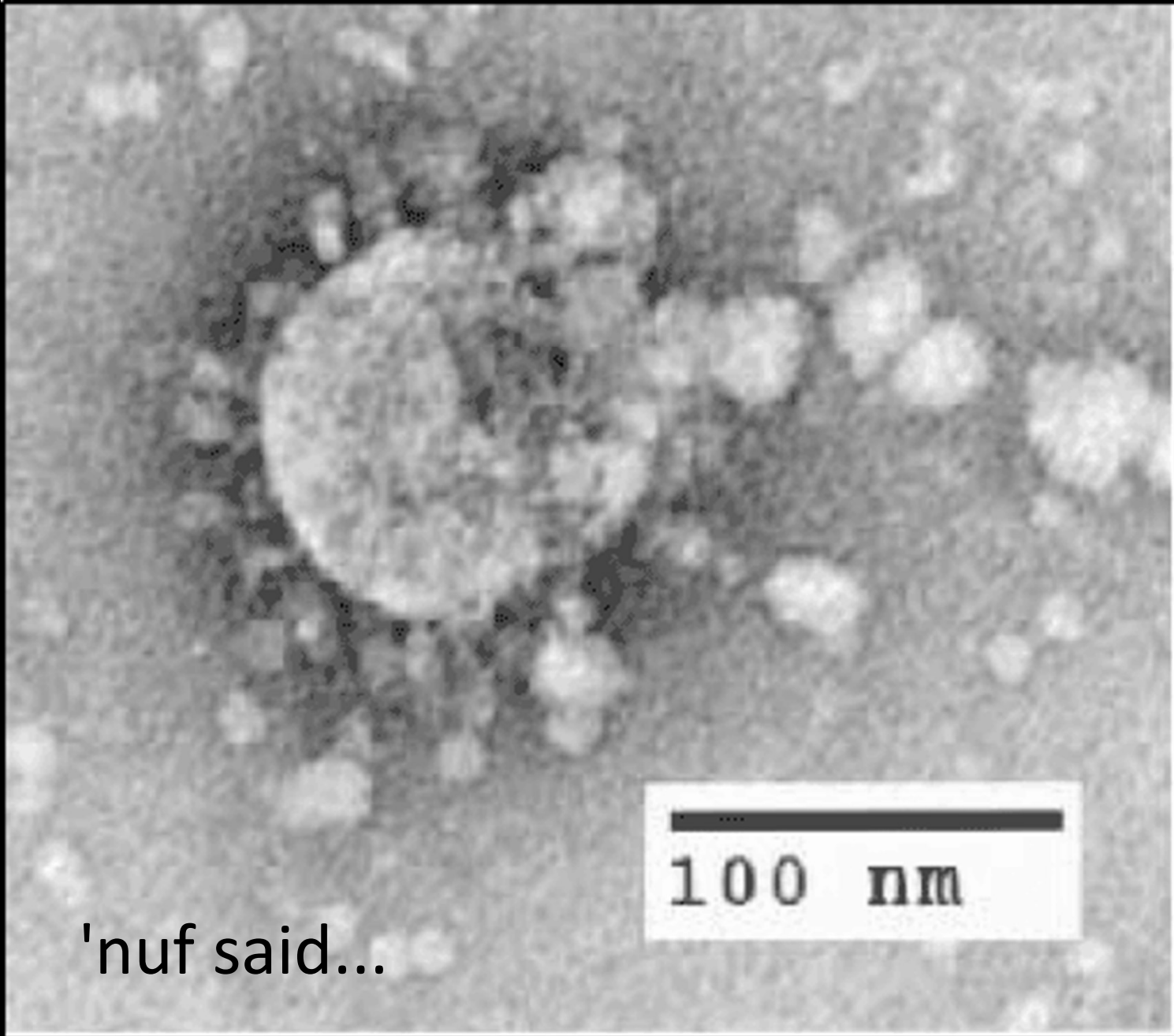
ASCLS  
The American Society for Clinical Laboratory Science



American Academy of Allergy Asthma & Immunology

## Don't...

- Test for influenza unless the patient is symptomatic and the result will influence management and decision making
- Routinely avoid influenza vaccination in egg-allergic patients



'nuf said...

100 nm



# Is it RSV, influenza, or COVID?

• RARELY •• SOMETIMES ••• OFTEN

Symptoms ▾	Cold	Flu	Covid-19	R.S.V.
<input type="checkbox"/> Cough	•••	•••	•••	•••
<input type="checkbox"/> Difficulty breathing	•	•	•••	••
<input type="checkbox"/> Fatigue	••	•••	•••	•
<input type="checkbox"/> Fever	•	•••	••	••
<input type="checkbox"/> Headaches	••	•••	•••	••
<input type="checkbox"/> Muscle pain or body aches	••	•••	••	•
<input type="checkbox"/> New loss of taste or smell*	•	•	••	•
<input type="checkbox"/> Runny or stuffy nose	•••	••	••	•••
<input type="checkbox"/> Sneezing	•••	••	••	••
<input type="checkbox"/> Sore throat	•••	••	•••	•
<input type="checkbox"/> Vomiting or diarrhea	•	••	••	•
<input type="checkbox"/> Wheezing	•	•	•	•••

\*A stuffy nose may temporarily decrease the ability to taste or smell but it does not cause a sudden, complete loss of these senses. • Source: Centers for Disease Control and Prevention

“An ounce of prevention is worth a pound of cure.” – Benjamin Franklin





## Questions?

- Pediatric hospitalist via the Transfer Center: 503-216-7768
- Pediatric Specialty Clinic:
  - Phone: 503-216-6050
  - Fax: 971-282-0102





# References

- CDC. COVID-19 Science Briefs. [https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/vaccine-induced-immunity.html#anchor\\_1635540449320](https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/vaccine-induced-immunity.html#anchor_1635540449320). Accessed 18 Jan 2023.
- Domachowske JB, Rosenberg HF. RSV infection: Immune response, immunopathogenesis and treatment. Clin Microbiol Rev 1999;12(2):298-309 doi: [10.1128/cmr.12.2.298](https://doi.org/10.1128/cmr.12.2.298).
- Griffiths C, Drews SJ, Marchant DJ. 2017. Respiratory syncytial virus: infection, detection, and new options for prevention and treatment. Clin Microbiol Rev 30:277–319. <https://doi.org/10.1128/CMR.00010-16>.
- HYUN WHA KIM, JOSE G. CANCHOLA, CARL D. BRANDT, GLORIA PYLES, ROBERT M. CHANOCK, KEITH JENSEN, ROBERT H. PARROTT, RESPIRATORY SYNCYTIAL VIRUS DISEASE IN INFANTS DESPITE PRIOR ADMINISTRATION OF ANTIGENIC INACTIVATED VACCINE, American Journal of Epidemiology, Volume 89, Issue 4, April 1969, Pages 422–434, <https://doi.org/10.1093/oxfordjournals.aje.a120955>.
- Krammer, F. The human antibody response to influenza A virus infection and vaccination. Nat Rev Immunol 19, 383–397 (2019). <https://doi.org/10.1038/s41577-019-0143-6>. Accessed 18 Jan 2023.
- Markovskaya Y, et al. (2022). Coronavirus disease 2019 (COVID-19):
- Secondary bacterial infections and the impact on antimicrobial resistance during the COVID-19 pandemic. Antimicrobial Stewardship & Healthcare Epidemiology, <https://doi.org/10.1017/ash.2022.253>.
- OHA Weekly Updates. Slides from 18 Jan 2023.



# References

- [ChoosingWisely.org](https://www.choosingwisely.org/). Accessed 20 Jan 2023.
- Ralston SL, et al. "Clinical Practice Guideline: The Diagnosis, Management, and Prevention of Bronchiolitis." *Pediatrics* 2014; 134(5).
- Fitzpatrick T, et al. "Family and Child Risk Factors for Early-Life RSV Illness." *Pediatrics* 2021; 147(4).
- Caballero, MT, et al. "Mortality Associated With Acute Respiratory Infections Among Children at Home." *J Infect Dis* 2019; 219(3).
- Florin TA, et al. "Viral bronchiolitis." *Lancet* 2017; 389(10065).
- Frankl D, et al. "A Randomized Trial of High-Flow Oxygen Therapy in Infants with Bronchiolitis." *N Engl J Med* 2018; 378(12).
- FluView Interactive, [gis.cdc.gov](https://gis.cdc.gov/). Accessed 21 Jan 2023.
- Silvennoinen H, et al. "Clinical presentation of influenza in unselected children treated as outpatients." *Pediatr Infect Dis J*. 2009; 28(5).
- Gaitonde DY, et al. "Influenza: Diagnosis and Treatment." *Am Fam Physician* 2019; 100(12).
- Montalto, NJ. "An office-based approach to influenza: clinical diagnosis and laboratory testing." *Am Fam Physician* 2003; 67(1).
- Walsh, PS, et al. "Association of Early Oseltamivir With Improved Outcomes in Hospitalized Children With Influenza, 2007-2020." *JAMA Pediatr* 2022; 176(11).
- [CDC.gov](https://www.cdc.gov/). Accessed 20 Jan 2023.
- [UpToDate.com](https://www.upToDate.com/). Accessed 16 Jan 2023.
- Sheikh, K. "Do You Have Covid, Flu or R.S.V.?" *The New York Times*. 13 Dec 2022.