Immunization in the Face of Collective Amnesia

Robert H. Hopkins, Jr, MD, MACP

Professor of Internal Medicine and Pediatrics, UAMS

Medical Director, National Foundation for Infectious Diseases

Disclosures

- I have no financial conflicts

- My basis (bias) in presenting this material:

1. I love being healthy; and I want the same for my patients and all in society.

2. Vaccination helps support 'being healthy.'

3. Appropriate [*read: based on ACIP recommendations*] vaccination is FAR safer than acquiring illnesses the vaccines are designed to protect (us) from.

Agenda

- Current Context: The world we live in today
- Re-emerging (and Persistent) Vaccine preventable diseases
  - Measles
  - Pertussis
  - Influenza and COVID-19
- What can I –or We- Do?

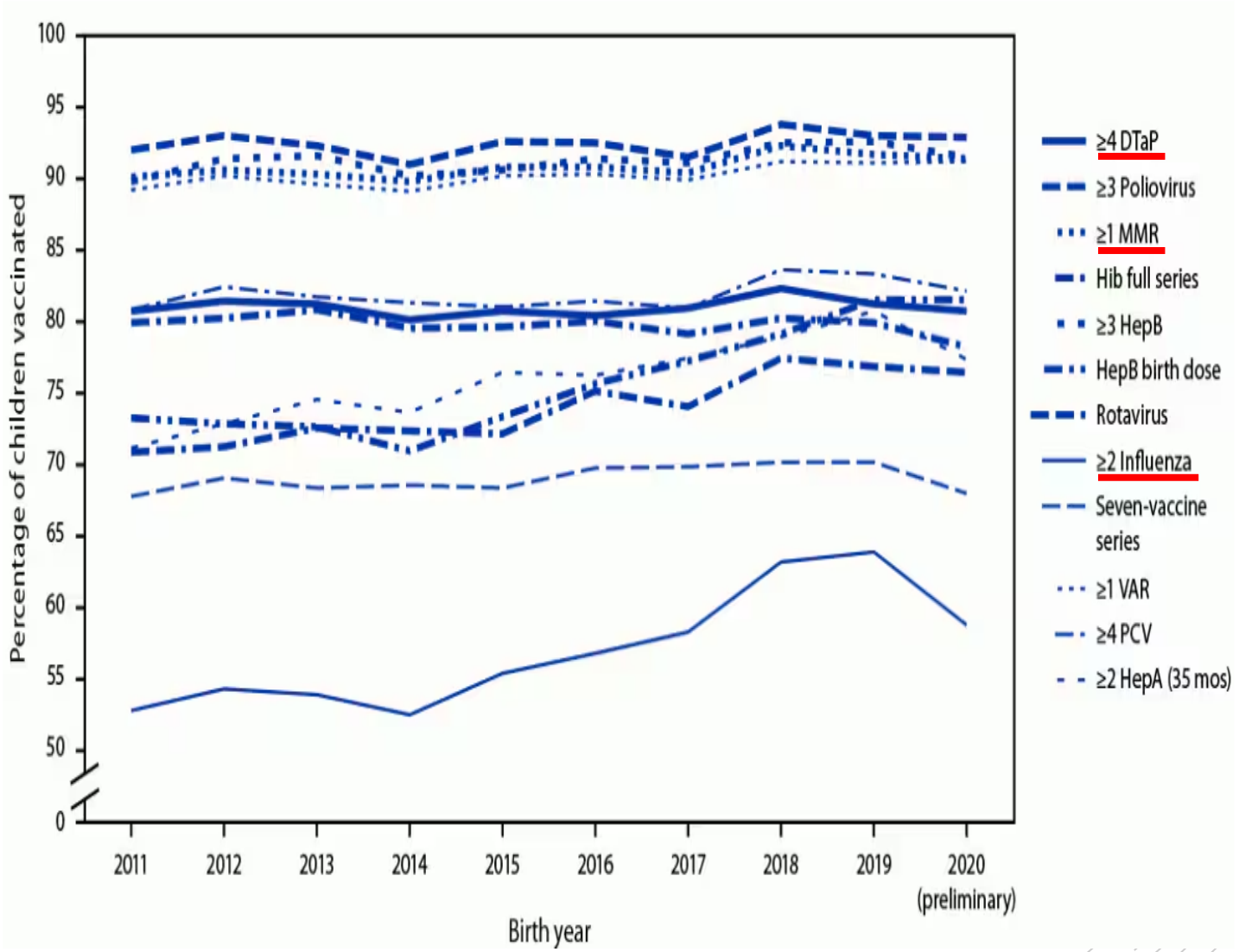
Context

Vaccination Coverage by Age 24 Months Among Children Born in 2019 and 2020 — National Immunization Survey-Child, United States, 2020–2022

Pediatric

https://www.cdc.gov/mmwr/volumes/72/wr/mm7244a3.htm#F1_down

FIGURE. Estimated coverage with selected individual vaccines*,†,§,¶,,††,§§ and a combined vaccine series¶¶ by age 24 months, by birth year*** – National Immunization Survey-Child, United States, 2012–2022**



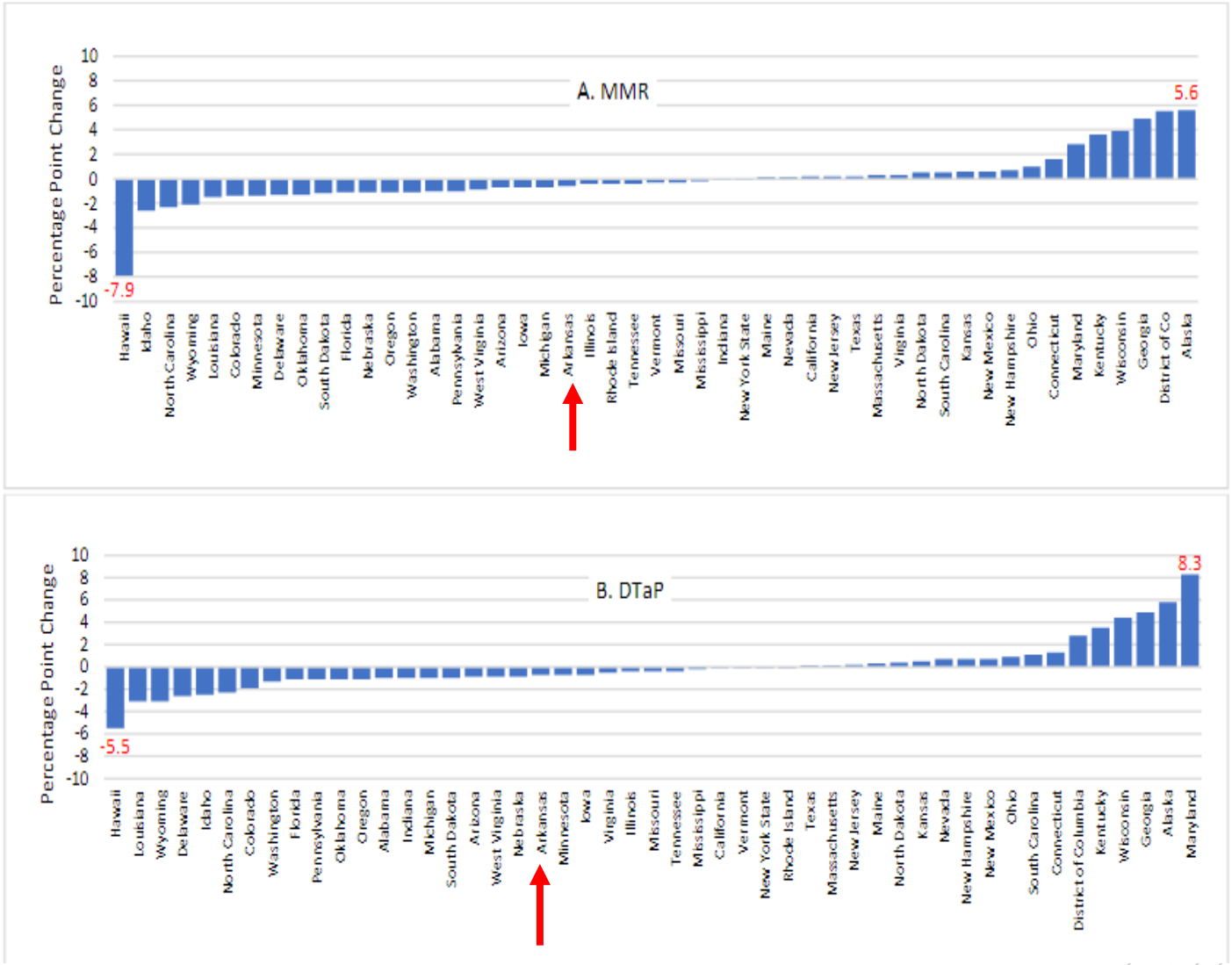
SUPPLEMENTARY TABLE 2. Estimated number and percentage* of children in a grace period/provisional enrollment† and with an exemption by type of exemption§ from vaccination among kindergartners, by immunization program¶ — United States,** 2022–23 school year

Immunization program	Grace Period/ Provisional Enrollment (%)	Medical exemption (%)	Nonmedical exemptions			Any exemption		
			Religious no.	Philosophic no.	(%)	2022–2023 %	2021–2022 %	Percentage point difference (2021–22 to 2022–23)
National Estimate††	2.5	0.2	—	—	2.8	3.0	2.6	0.4
Median††	2.0	0.2	—	—	3.2	3.3	2.7	0.6
U.S. jurisdictions								
Alabama	NP	0.1	1,101	§§	1.9	2.0	1.7	0.3
Alaska¶¶	NR	0.7	478	§§	5.0	5.7	4.6	1.1
Arizona	NR	0.1	***	5,944	7.4	7.4	6.8	0.6
Arkansas	9.2	<0.1	634	525	3.0	3.1	2.5	0.6
California	1.5	0.2	***	§§	§§, ***	0.2	0.3	-0.1
Colorado	≥0.6	≥0.3	***	†††	≥4.0	≥4.3	≥3.2	1.1

Coverage with Selected Vaccines and Exemption from School Vaccine Requirements Among Children in Kindergarten — United States, 2022–23 School Year

Pediatric

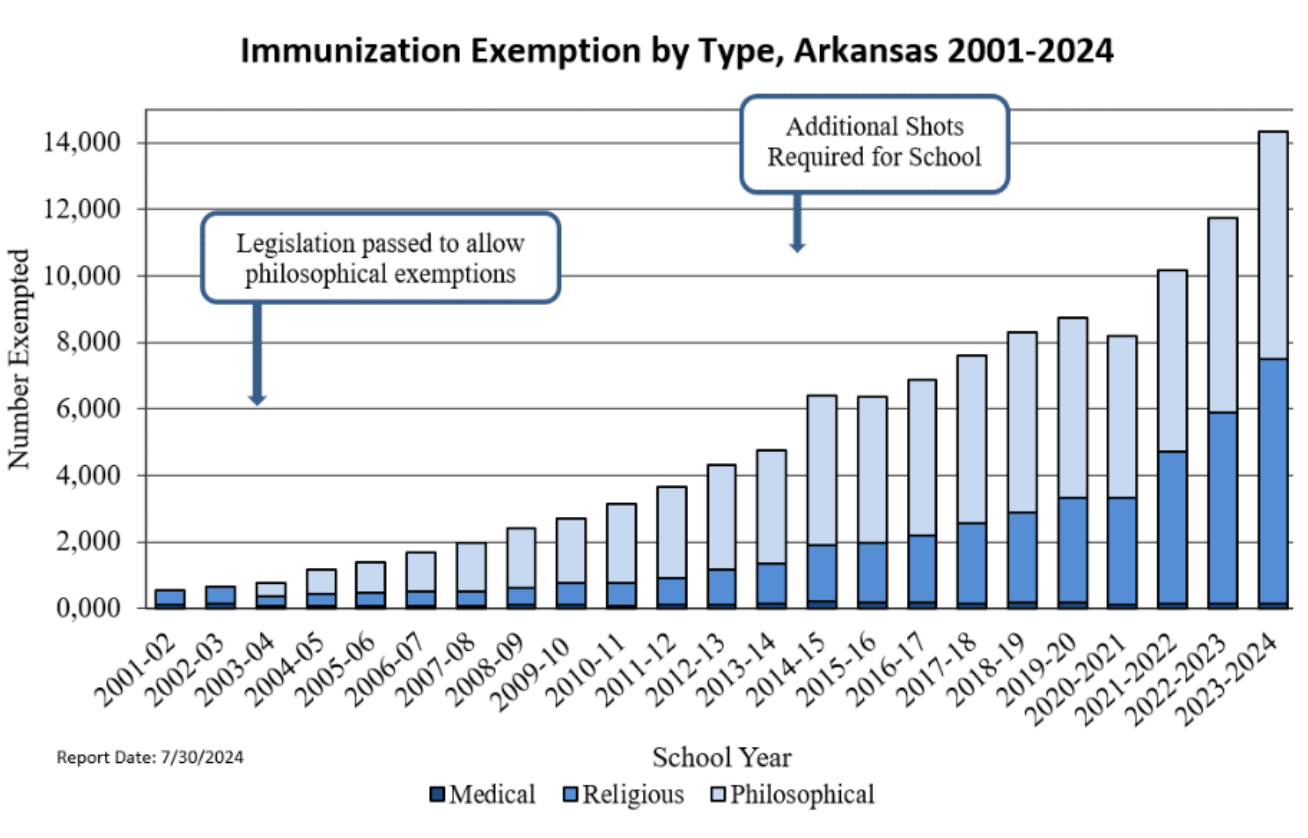
SUPPLEMENTARY FIGURE. Change in percentage of kindergartners who are fully vaccinated with measles, mumps, and rubella vaccine (A), diphtheria, tetanus, and acellular pertussis vaccine (B), ~~poliovirus vaccine (C), and varicella vaccine (D)~~ by state — United States*, 2021-22 to 2022-23 school years



https://www.cdc.gov/mmwr/volumes/72/wr/mm7245a2.htm
https://stacks.cdc.gov/view/cdc/134740

Arkansas School Vaccine Exemptions

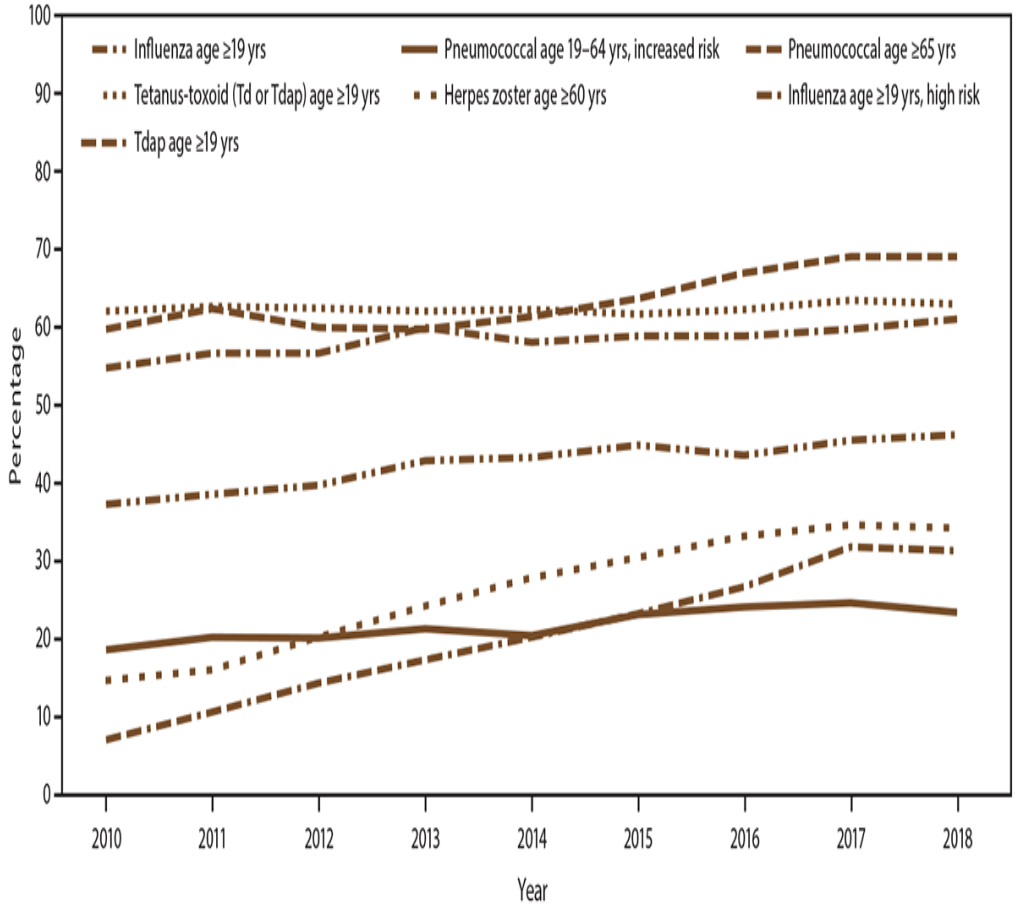
Pediatric



Exemption data courtesy of Dr. Haytham Safi, ADH 7/31/2024

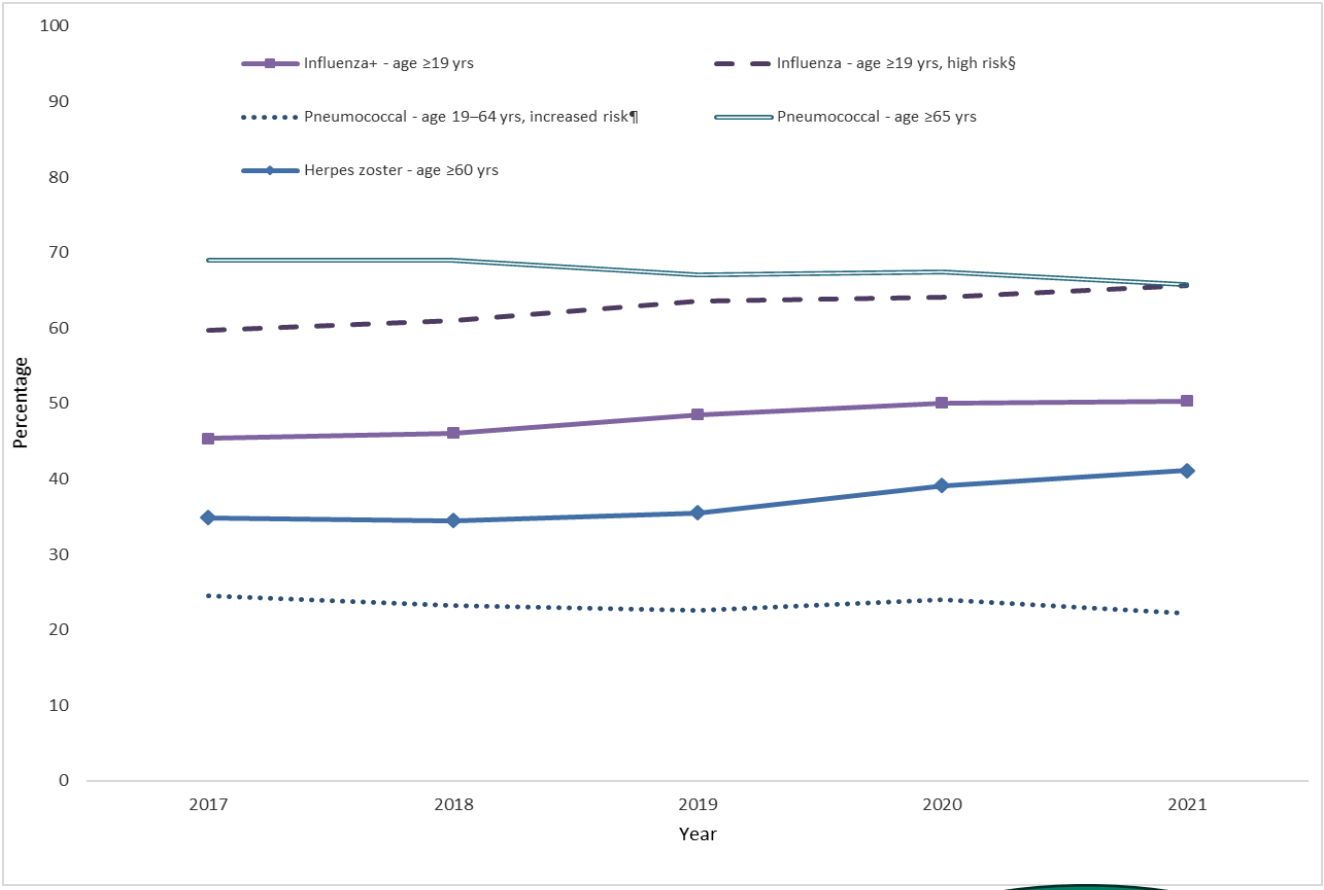
Adult Immunization Rates Offer an… Opportunity for Improvement

FIGURE. Estimated proportion of adults aged ≥19 years who received selected vaccines, by age group and risk status — National Health Interview Survey, United States, 2010–2018



NOTE: An additional table for this figure is available at http://stacks.cdc.gov/view/cdc/105534.

FIGURE. Estimated proportion of adults aged ≥19 years who received selected vaccines,* by age group and risk status — National Health Interview Survey, United States, 2017–2021

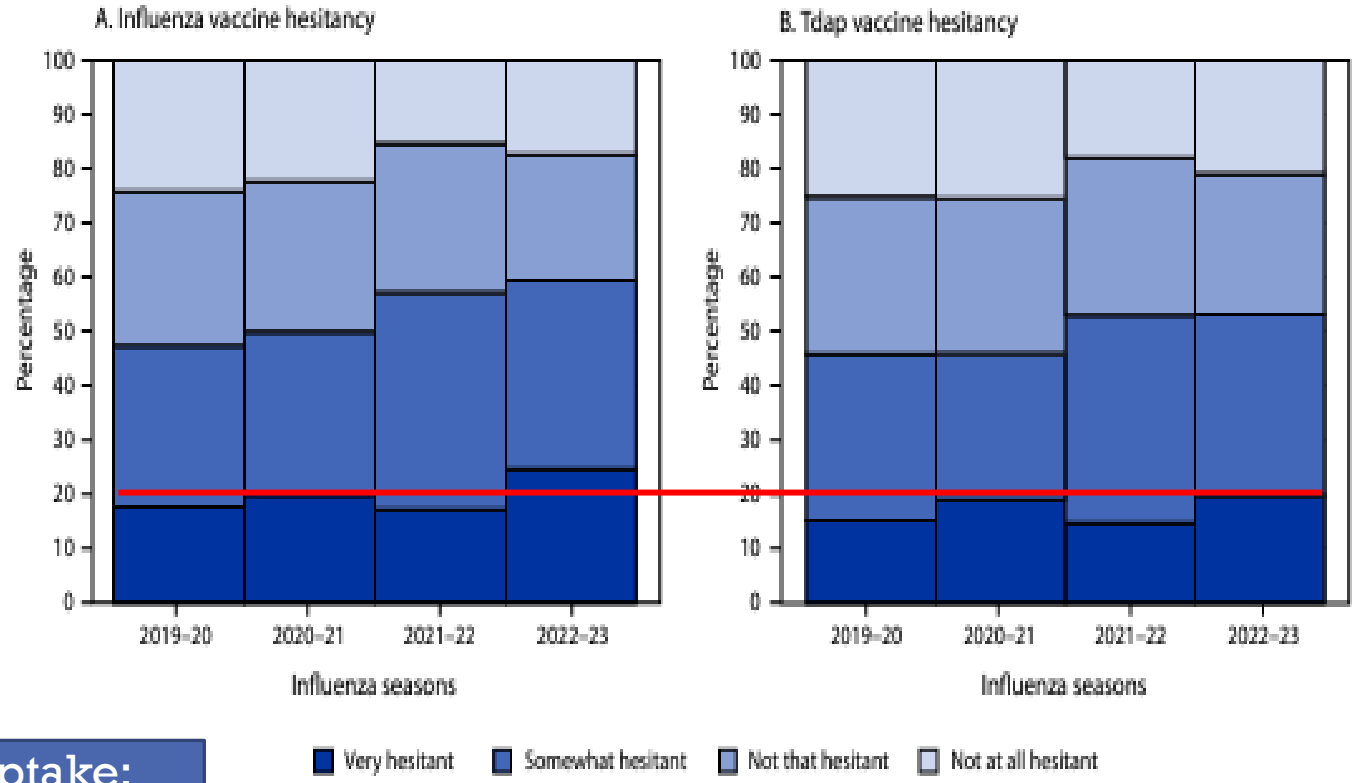


Adult

https://www.cdc.gov/mmwr/volumes/70/ss/ss7003a1.htm
https://www.cdc.gov/vaccines/imz-managers/coverage/adultvaxview/pubs-resources/vaccination-coverage-adults-2021.html

Maternal Immunization Uptake and Hesitancy

FIGURE. Percentage of pregnant women* who were hesitant† about receiving influenza vaccine (A) and tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine (B) — Internet panel survey, United States, 2019–20 through 2022–23 influenza seasons



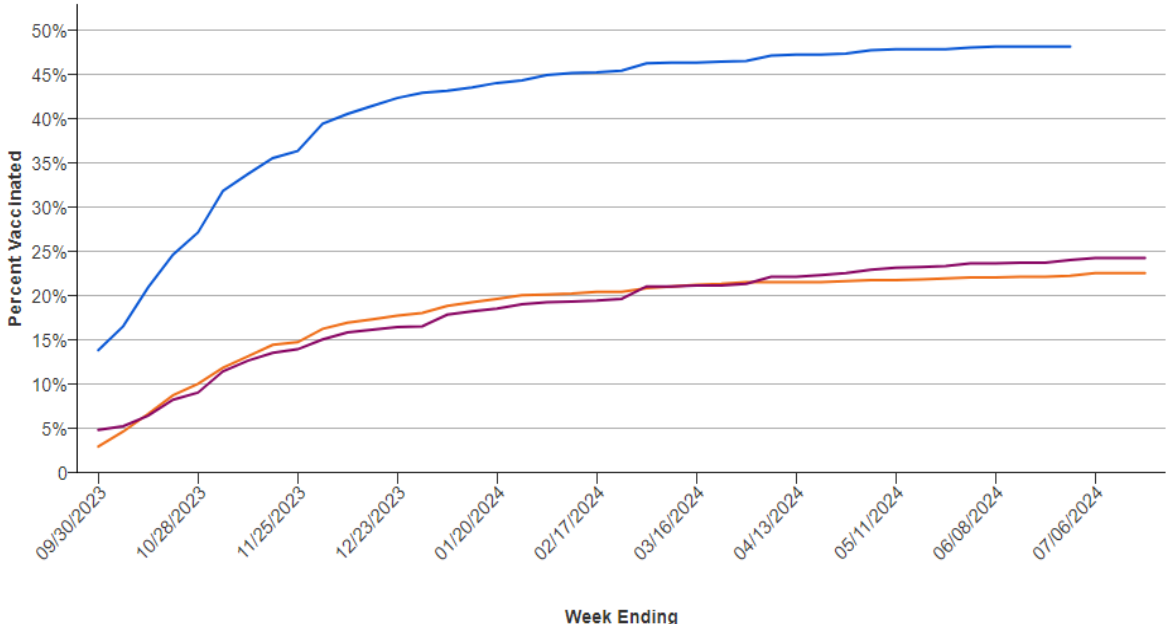
2022-23 Maternal Intrapartum Vaccine Uptake:	
Tdap	55.4%
Influenza	47.2%
COVID-19	27.3%

Adult

https://www.cdc.gov/mmwr/volumes/72/wr/mm7239a4.htm

Weekly Cumulative Percent Vaccinated in the United States

Cumulative percent of adults vaccinated with COVID-19 (18+ years), influenza (18+ years), or RSV (60+ years) vaccine.

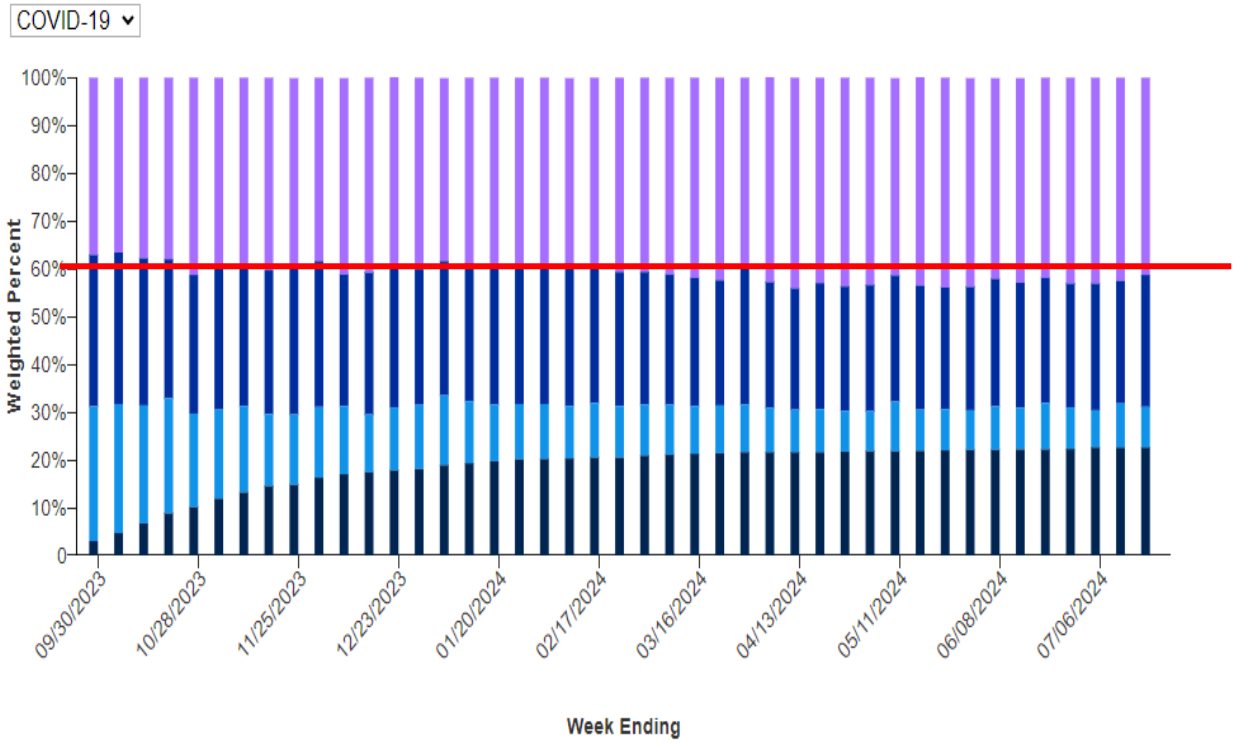


Select a virus to add or remove it from the graphic

COVID-19 (18+ years) Influenza (18+ years) RSV (60+ years)

Vaccination Status and Intent in the United States

Weekly intent for vaccination and cumulative percent of adults vaccinated with COVID-19 (18+ years), influenza (18+ years), or RSV (60+ years) vaccine.



Select a category to add or remove it from the graphic

Received vaccine Definitely will get a vaccine Probably will get a vaccine or are unsure

Probably or definitely will not get a vaccine

https://www.cdc.gov/respiratory-viruses/data-research/dashboard/vaccination-trends-adults.html

Measles

Global increase in the most infectious Vaccine Preventable Disease (VPD)…

and for which we have a highly effective vaccine.

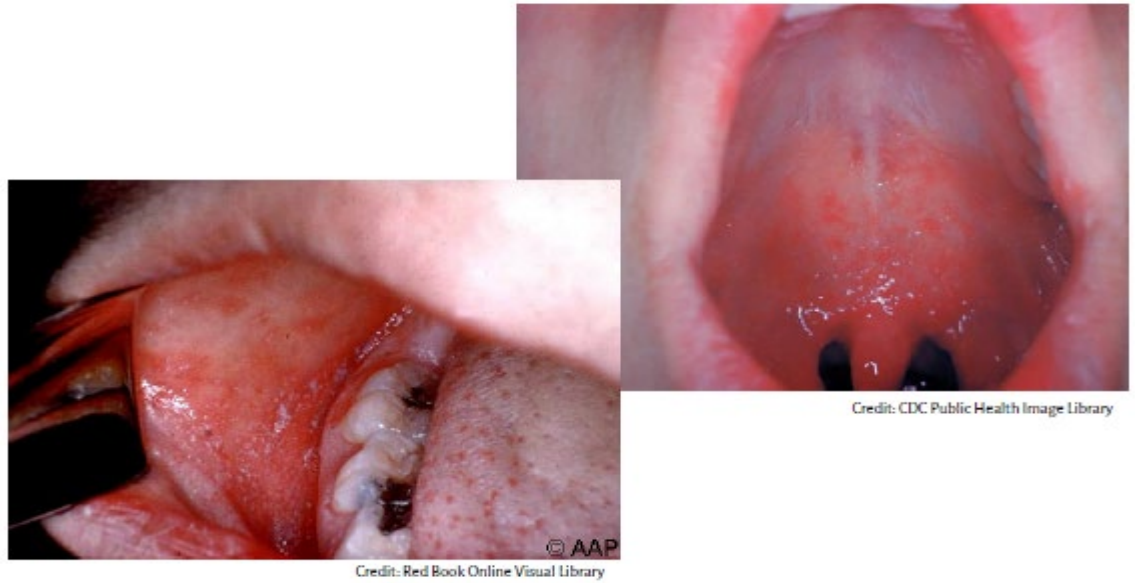
https://www.nfid.org/resource/contagious-chronicles-measles-alert/

Measles

- Measles is considered by many to be the most contagious viral disease known
  - HIGHLY Contagious [Unvaccinated R_0 ~12-16]
  - >90% secondary attack rate among susceptible contacts
- Measles is a reportable disease
- Measles was declared eliminated in US by the World Health Organization in 2000
  - Based on no continuous spread for >12 months…

https://www.cdc.gov/mmwr/volumes/73/wr/mm7314a1.htm

Measles



Credit: CDC Public Health Image Library

Credit: Red Book Online Visual Library

- Incubation period: 8-12 days [post-viral exposure]
- Initial [Prodrome] symptoms: FEVER [High-grade]
  COUGH
  CORYZA
  CONJUNCTIVITIS
- Koplik Spots: May appear on oral mucosa during prodrome
  - Small, irregularly shaped patches with bluish-white center on oral mucosa

Credit: CDC Public Health Image Library

Credit: Red Book Online Visual Library

Credit: CDC Public Health Image Library

https://www.cdc.gov/measles/hcp/index.html

Measles: Maculopapular Rash

- Rash
  - Begins 2-4 days after onset of symptoms at hairline
  - Spreads down body to face > neck > trunk > extrem.
  - Appears red on light skin - may be more difficult to appreciate on darker skin, may be 'purplish' or darker than surrounding skin
- Patients are infectious to others from 4 days prior to onset of rash to 4 days after onset of rash

Measles Complications

- Common: Otitis media, pneumonia, bronchitis, diarrhea
- 1 in 1000: Acute encephalitis- often results in permanent neurologic injury [Brain damage]
- 1-3 in 1000: Children die from respiratory and/or neurologic complications
- Rare individuals will develop Subacute Sclerosing Panencephalitis (SSPE): a fatal neurodegenerative disease characterized by deterioration of intellectual function, behavior and seizures which develops 7-10 years after measles infection.
- Complex immune interaction leads to immune amnesia with increase in infection after recovery from measles

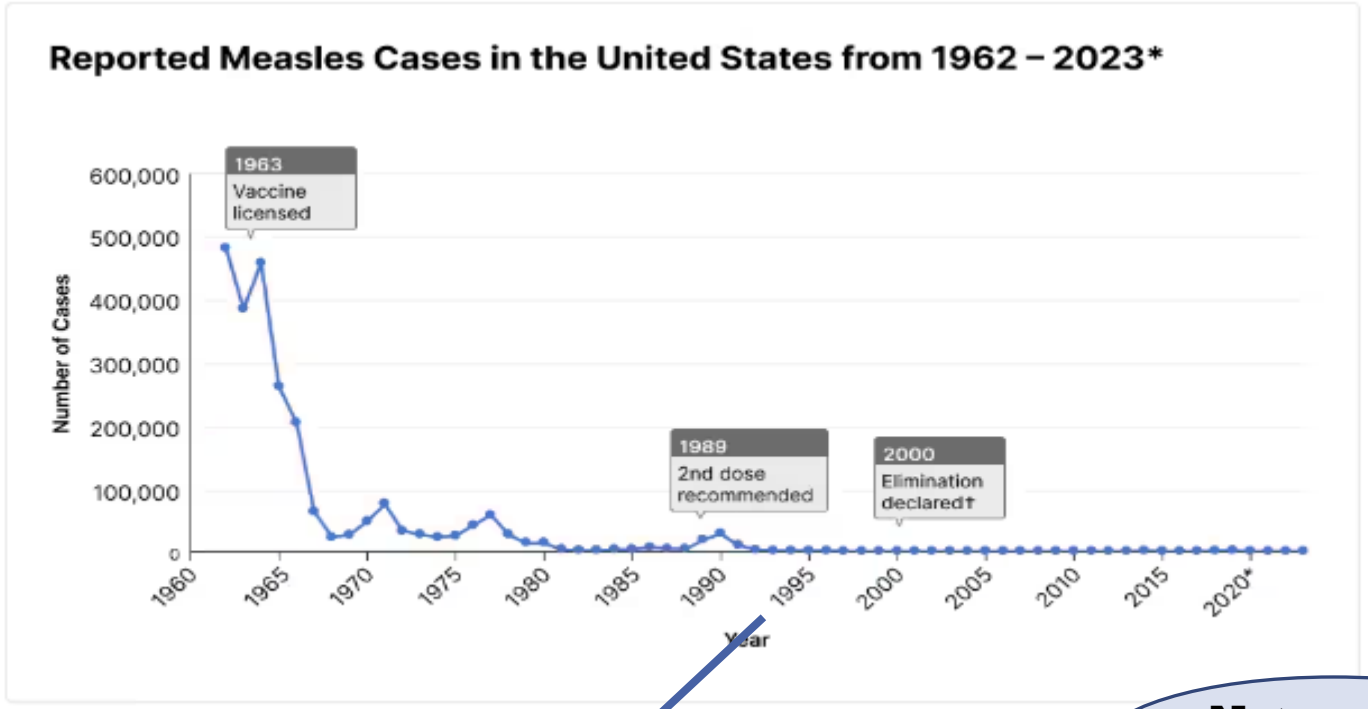
https://journals.lww.com/pidj/fulltext/2020/06000/The_Susceptibility_to_Other_Infectious_Diseases.2.aspx?context=FeaturedArticles&collectionId=2
https://www.science.org/doi/full/10.1126/science.aay6485

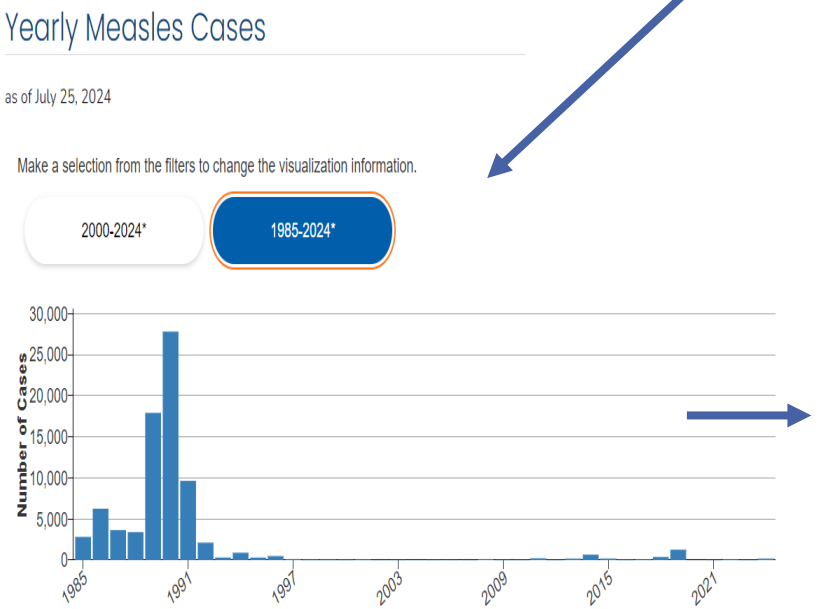
Risk factors for severe Measles, Complications

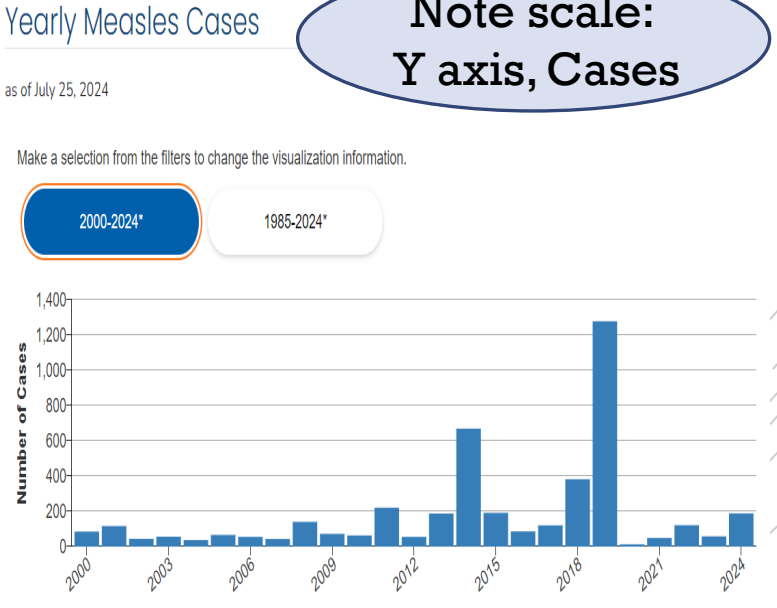
- Infants and children < 5 years
- Adults > 20 years
- Pregnant women
- Immune compromised persons

2001-2023
Median 79 cases/year
[range 13-1,274]

US Measles Cases since 1960



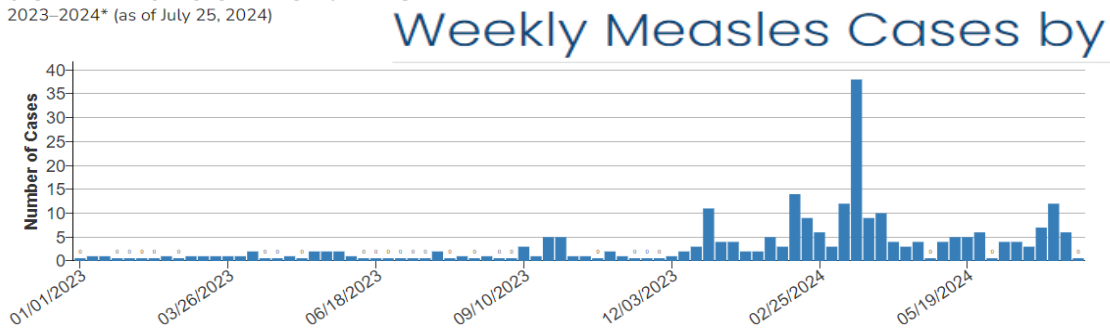




Note scale:
Y axis, Cases

https://www.cdc.gov/measles/data-research/?CDC_AAref_Val=https://www.cdc.gov/measles/cases-outbreaks.html

Measles in US, 2024



2001-2023
Median 79 cases/year
[range 13-1,274]

U.S. Cases in 2024

Total cases

188

Age

Under 5 years: **80 (43%)**

5-19 years: **47 (25%)**

20+ years: **61 (32%)**

Vaccination Status

Unvaccinated or Unknown: **85%**

One MMR dose: **10%**

Two MMR doses: **5%**

U.S. Hospitalizations in 2024

49%

49% of cases hospitalized (93 of 188) for isolation or for management of measles complications.

Percent of Age Group Hospitalized

Under 5 years: **61% (49 of 80)**

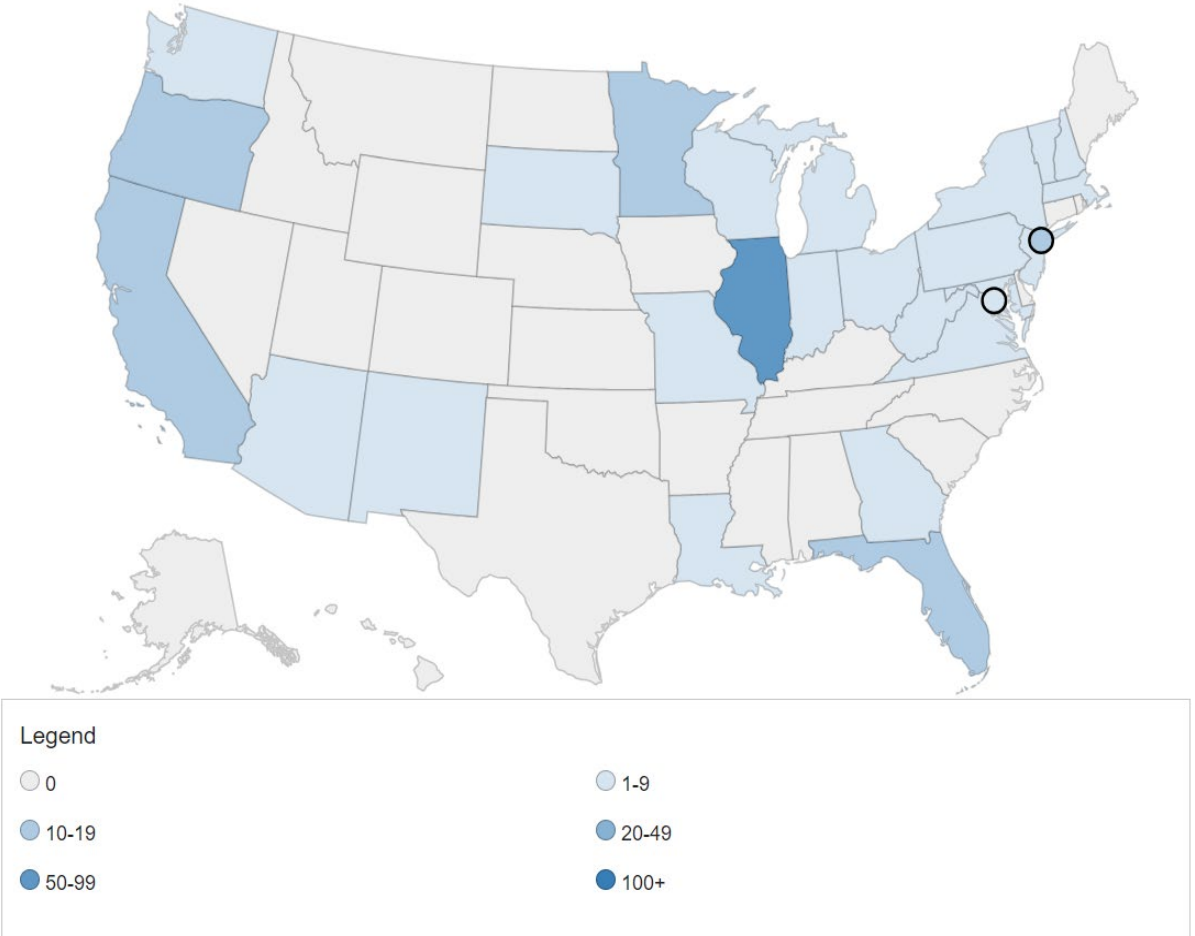
5-19 years: **34% (16 of 47)**

20+ years: **46% (28 of 61)**

https://www.cdc.gov/measles/data-research/?CDC_AAref_Val=https://www.cdc.gov/measles/cases-outbreaks.html

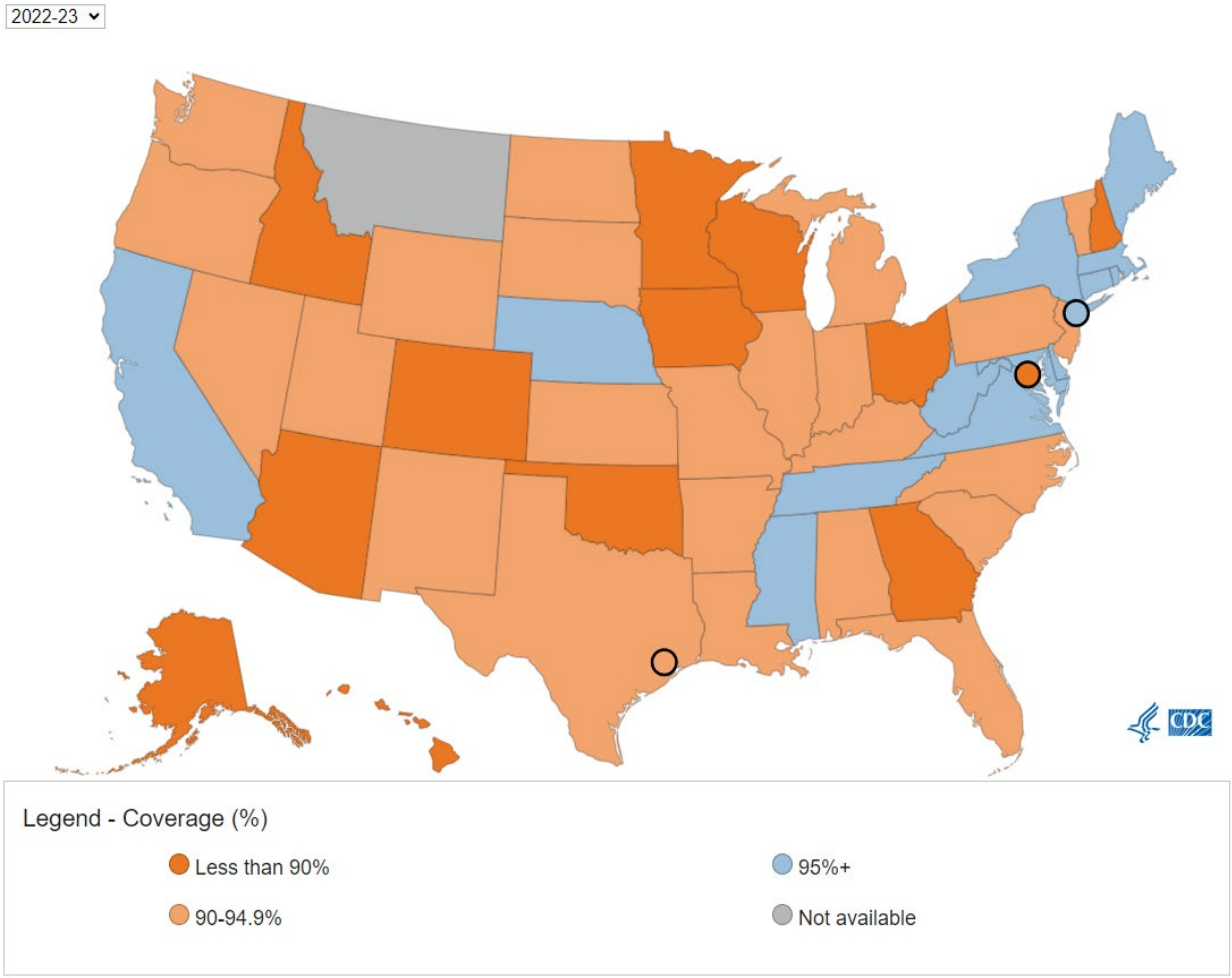
Measles Cases in 2024

as of July 25, 2024



188 cases in 2024 across 27 jurisdictions.
13 outbreaks (3+ cases)
65% cases are outbreak associated

MMR Vaccine Coverage for Kindergarteners by School Year (2009–2023)



2019-2020 School year: 95.2% [AR 94.3%]
2022-2023 School year: 93.1% [AR 91.9%]
[~250K more unvax. kids in age cohort/year]

Global Measles in 2024

Top 10 countries with measles outbreaks

Country	Number of Cases
Iraq	31,954
Azerbaijan	27,840
Kazakhstan	26,136
Ethiopia	16,555
India	15,880
Pakistan	15,428
Russian Federation	13,480
Kyrgyzstan	12,172
Yemen	9,431
Nigeria	7,059

Source: World Health Organization

This table is based on provisional monthly surveillance data reported to the World Health Organization (Geneva) as of June 2024. The data reflected covers November 2023 - April 2024.

Current US Measles (MMR) Vaccination Recommendations

- Routine immunization: Children 12-18 months + Second dose 4-6 years*

  [Catch-up Schedule: 2 doses separated 4 weeks]

- 2 doses recommended for (all) HCW, Int'l travelers (>1 yr), persons >4 years w/o severe immune suppression
- Adults presumed immune: Born before 1957, +IgG, Prior lab confirmed measles, Vaccination record
- Travel recommendation: MMR before departure if no e/o immunity and 6 months or older
- Live-Attenuated Vaccine. Contraindications: Pregnancy, Severe immune compromise, Severe allergy to MMR or component.
- Self-limited measles like rash in ~5%
  - PCR detection 14 days post vax., distinguish v. infection

* Can give MMRV for second dose only

https://www.cdc.gov/vaccines/schedules/hcp/imz/child-schedule-notes.html#note-mmr

Measles Summary

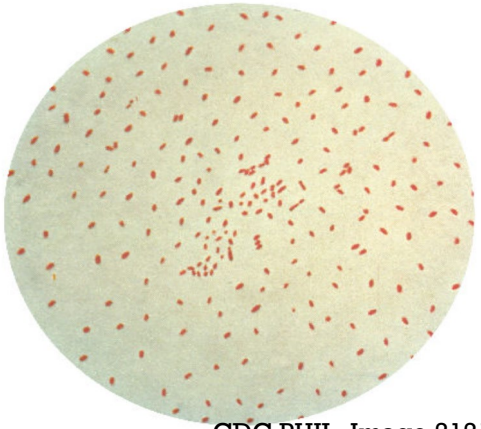
- HIGHLY CONTAGIOUS virus
- High rate of complications and death from infection
- Measles immunization is safe and highly effective- has potential to eliminate *and maybe eradicate* disease… but cannot do so without high level vaccination.
- Decrease in vaccination [vaccine uptake] with pandemic has led to global resurgence of disease
  - Decline in population vaccination rate does not reflect totality of risk in communities with even lower rates…
- Cases in US are primarily in unvaccinated individuals
  Most= voluntarily unvaccinated
- Majority of US cases/outbreaks linked to international travel and in populations with low vaccination rate

Pertussis

Increase in highly contagious bacterial VPD…

For which we have a safe and somewhat effective vaccine.

https://www.nfid.org/infectious-disease/whooping-cough/



CDC PHIL, Image 2121

Pertussis

- Highly contagious vaccine-preventable bacterial disease [aerobic gram-negative]
- Causes debilitating cough illness in people all ages
  - Highest morbidity and mortality in Infants
  - "The Hundred Days' Cough" in others
- Estimated annual worldwide burden
  - 16 million cases
  - 195,000 deaths
- Control of disease not great with vaccination pre-pandemic, worse with declines in vaccination since..
- Antibiotic treatment reduces transmission
  - Impact on symptoms varies by stage of illness

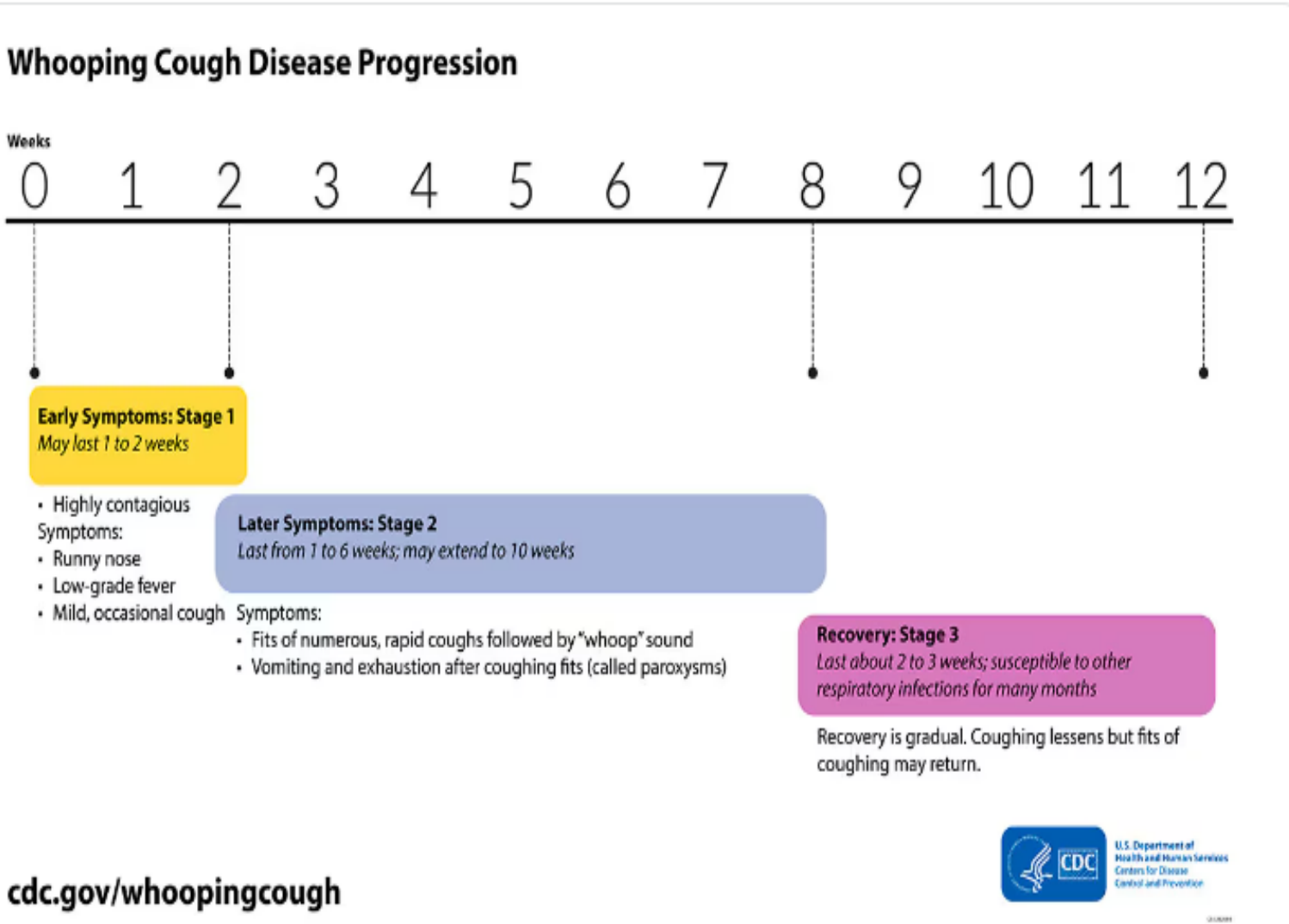
https://publications.aap.org/redbook/book/755/chapter/14080319/Pertussis-Whooping-Cough

1/3 Infants infected in 1st year will require hospital care:

2/3 have apnea (68%)
1/5 develop pneumonia (22%)
1/50 develop convulsions (2%)
1/150 develop encephalopathy (0.6%)
1/100 die (1%)

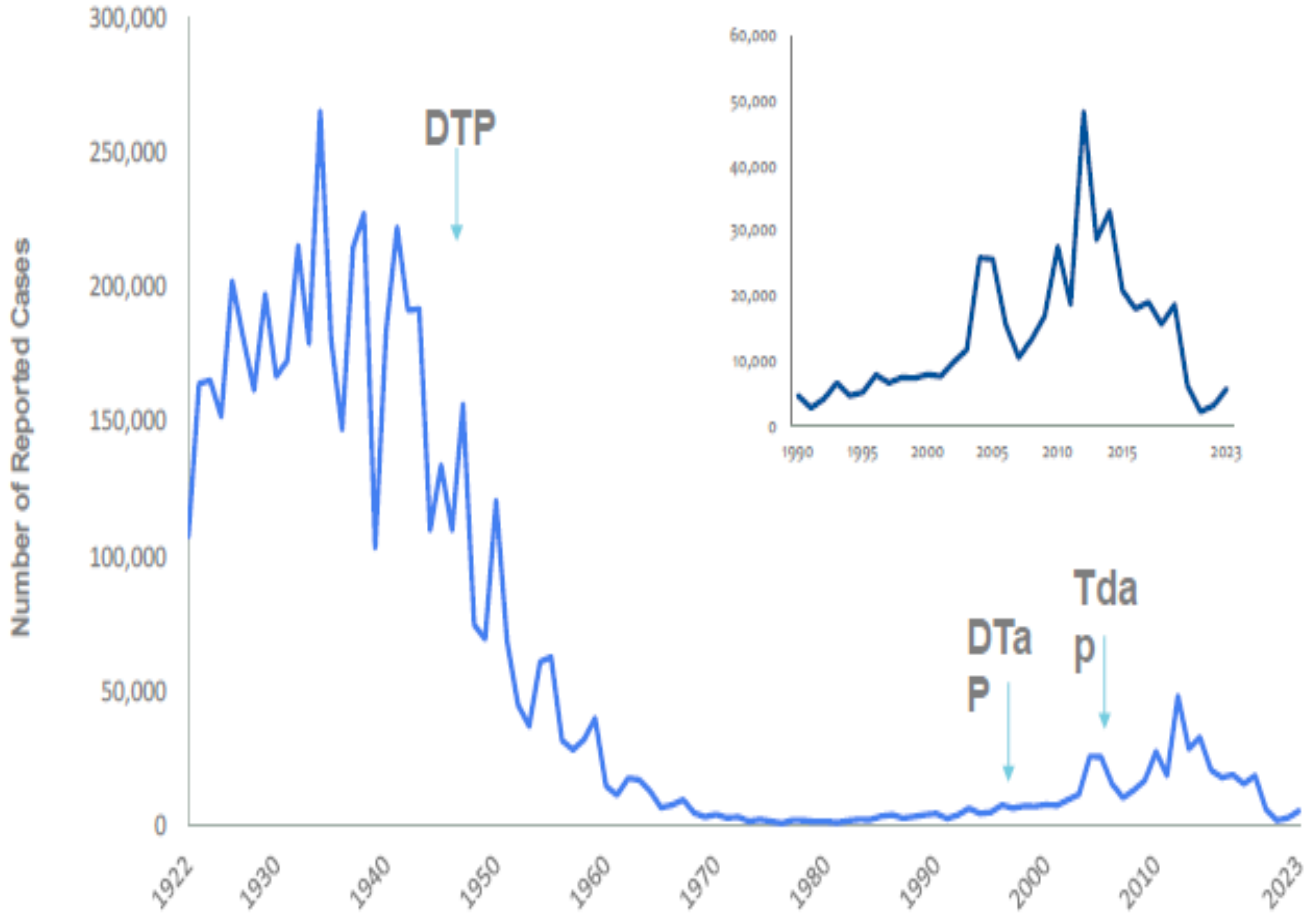
[Classic] Pertussis Illness

Adolescents, adults less likely to have severe disease or need hospital care, but pneumonia and other complications do occur



Less severe disease in vaccinated individuals

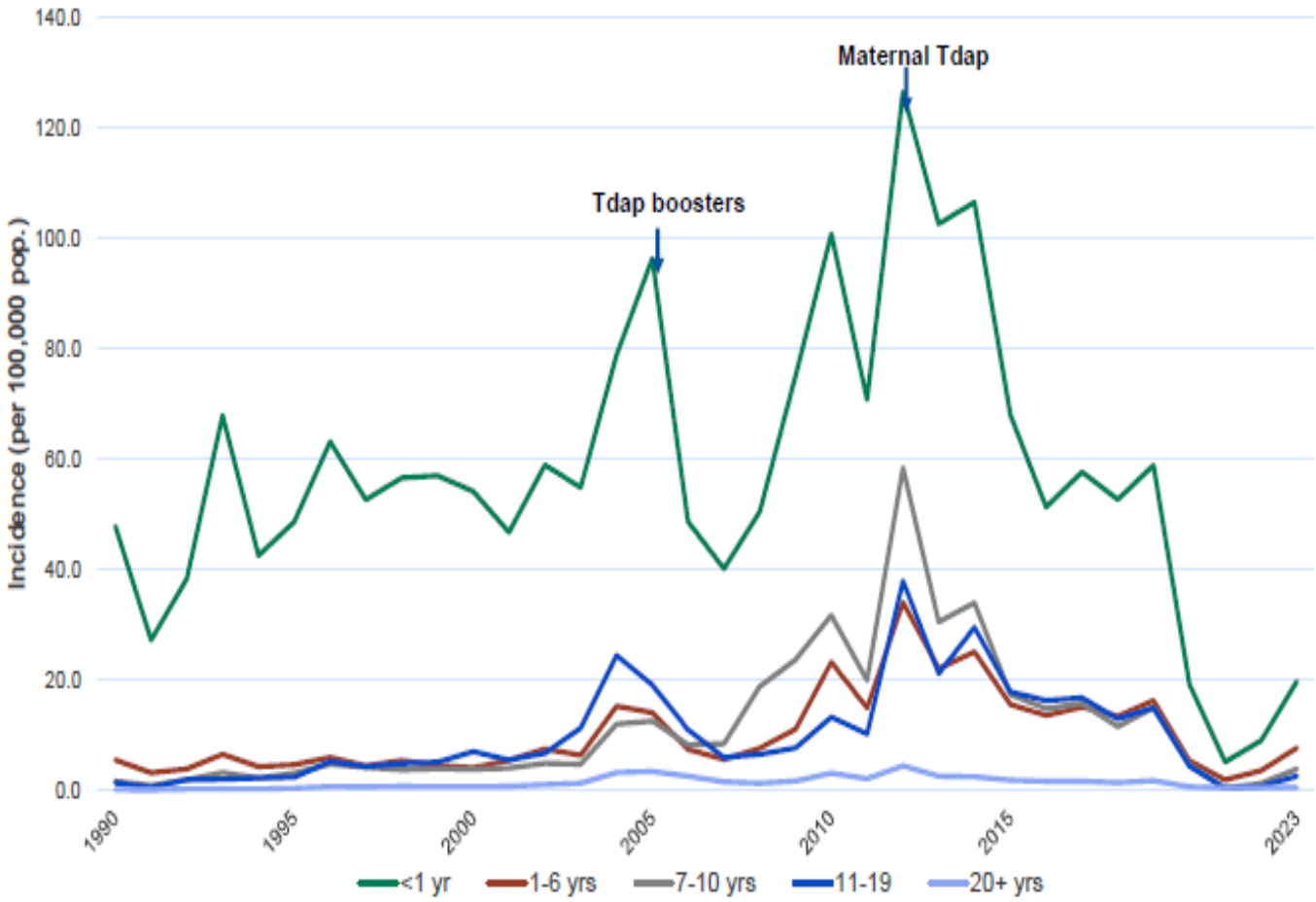
Pertussis Disease [Cases Reported 1922-2023*]



*2022 and 2023 data are provisional

SOURCE: CDC, National Notifiable Diseases Surveillance System

US Pertussis Incidence by Age, 1990-2023*



*2022 and 2023 data are provisional
SOURCE: CDC, National Notifiable Diseases Surveillance System

Pertussis 2023-2024

- Pertussis reporting is PASSIVE

  [reported numbers likely underestimate burden]

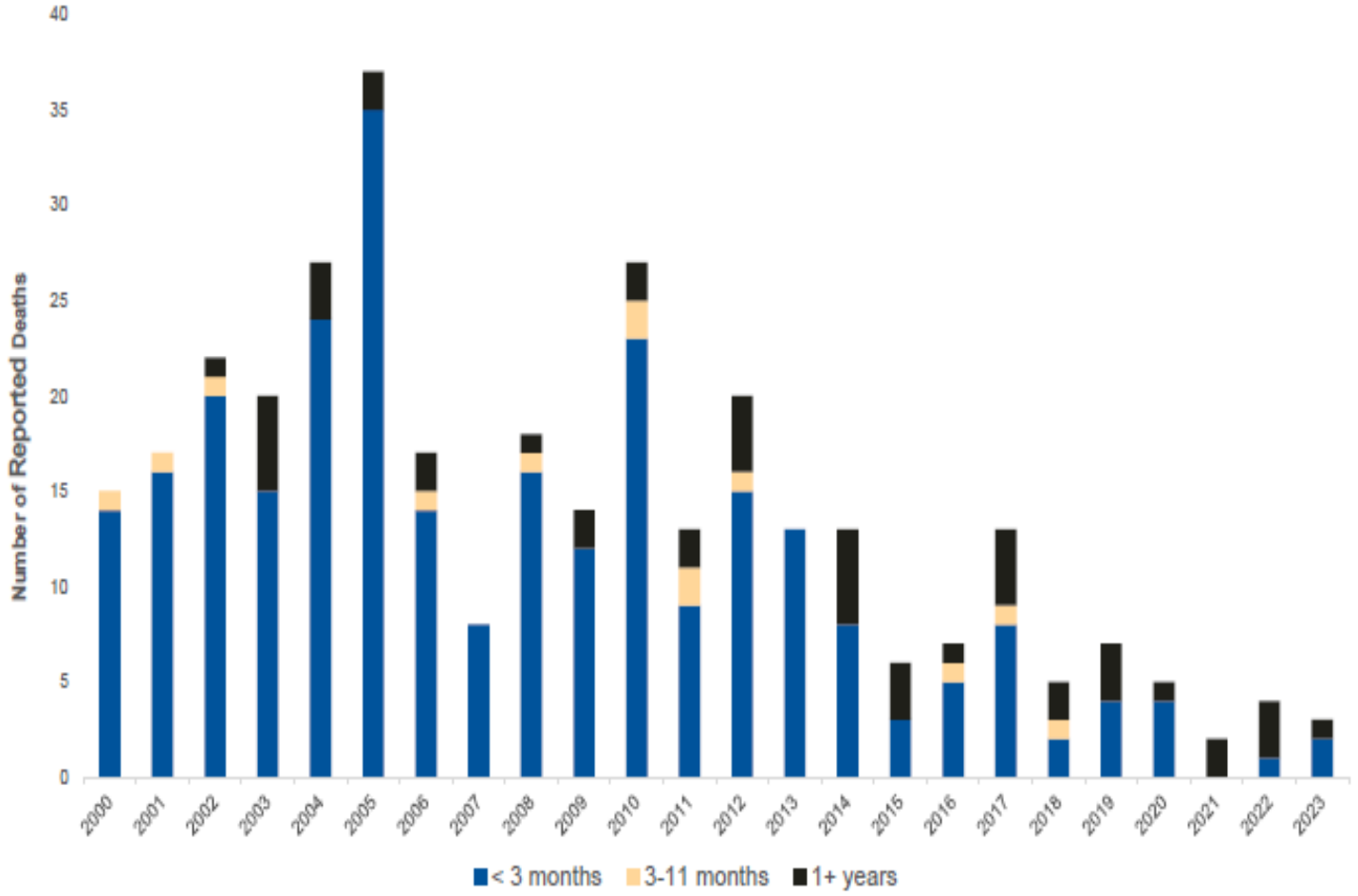
- Week ending July 20, 2024: 8861 cases, year to date

  Comparison, 2023: 2626 midyear, 5611 total

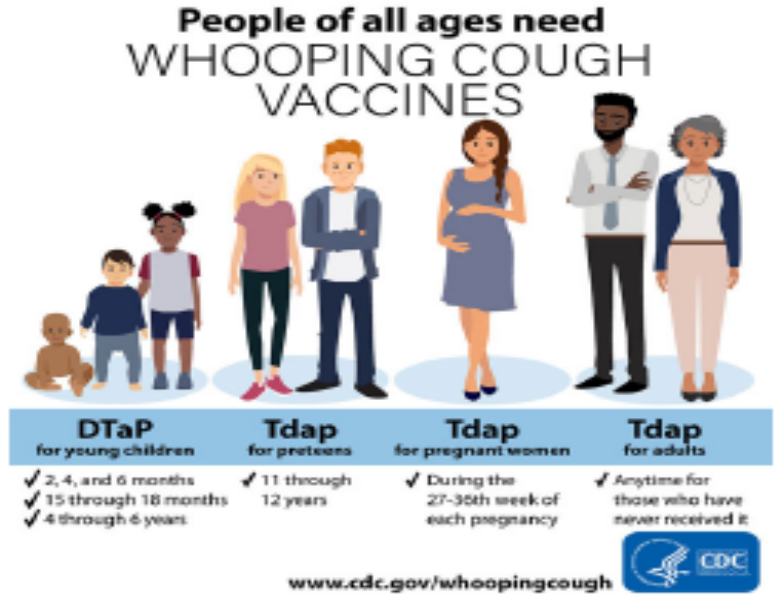
  Comparison, 2022: 2388 cases

https://wonder.cdc.gov/nndss/static/2024/29/2024-29-table990.html

Pertussis Deaths by Age Group 2000-2023*



*2022 and 2023 data are provisional
SOURCE: CDC, National Notifiable Diseases Surveillance System

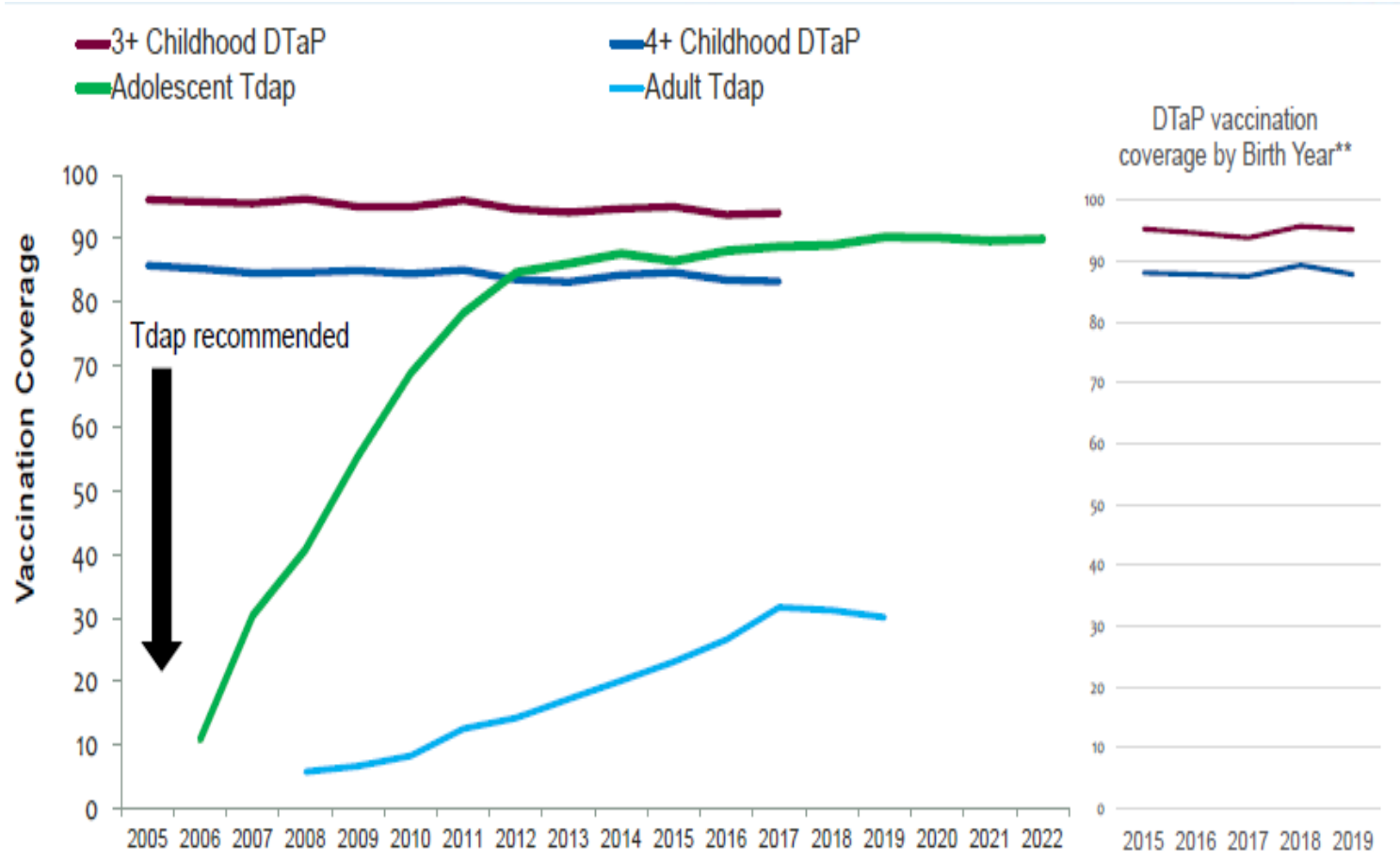


US Pertussis Vaccination

- Infants, Children
  - Widely used since 1940's
  - 1990's transition from DTP to DTaP vaccines
    - Due to reactogenicity of whole-cell pertussis component in vaccine
  - Schedule: DTaP at 2, 4, 6 months + 15-18 months + 4-6 years
- Adolescents, Adults (2005-)
  - Tdap at 11-12 years
  - Tdap *(or Td)* every 10 years
  - Pregnant women: Tdap every pregnancy between 27-36 weeks gestation

Sidebar: Whole cell pertussis and National Childhood Vaccine Injury Act of 1986…
https://www.cdc.gov/vaccinesafety/ensuringsafety/history/index.html

US DTaP and Tdap Vaccination Coverage 2004-2022



Sources: CDC National Immunization Survey: DTaP among children aged 19 through 35 months, Tdap coverage among adolescents aged 13 through 17 years; Coverage among adults aged 19 through 64 years from National Health Information Survey
**coverage estimates by birth cohort among 35 month olds

Pertussis Summary

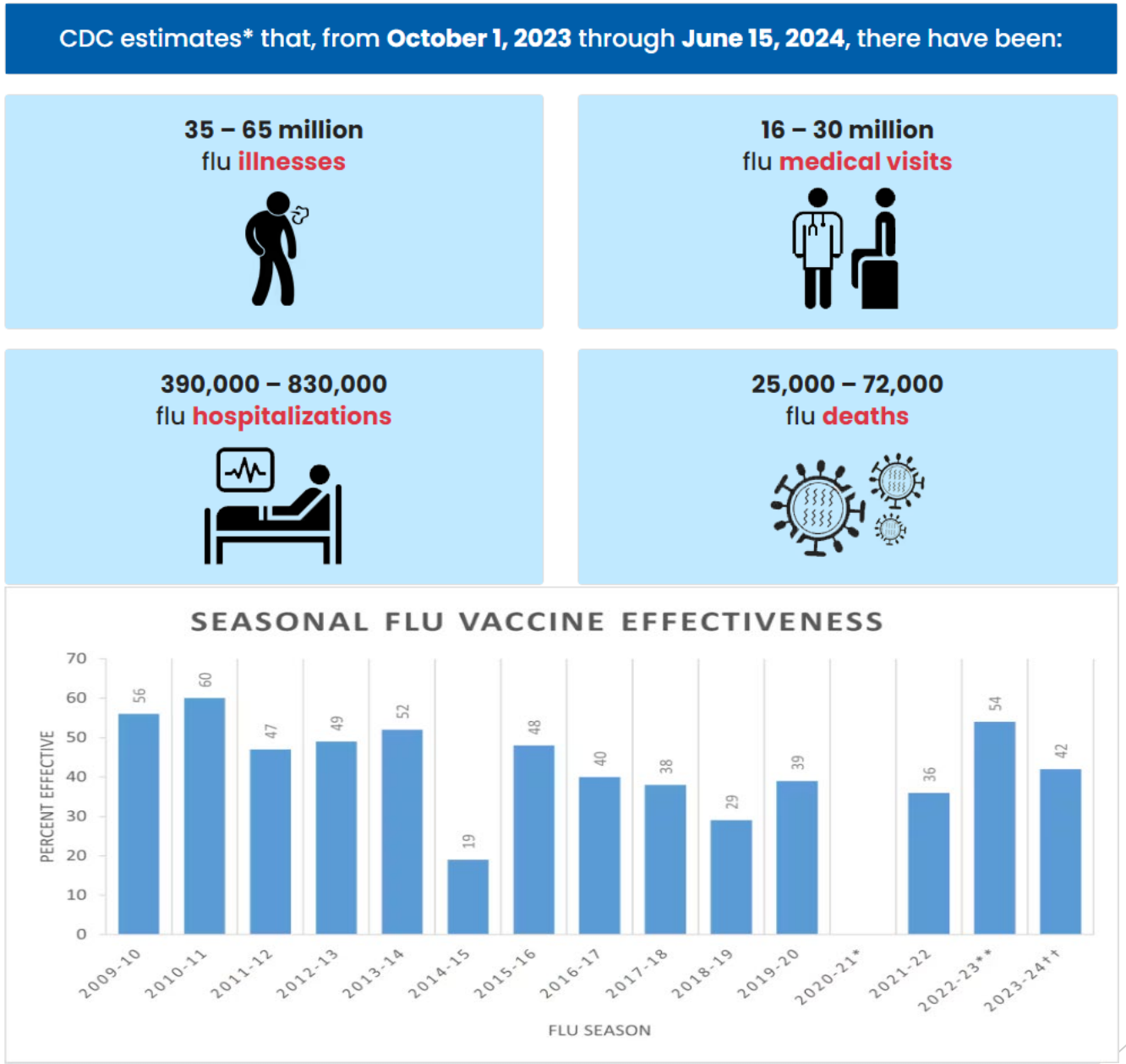
- Pertussis is highly contagious and best prevented by vaccination
- Vaccination recommended for all 2+ months of age and through the lifespan [adolescents, adults less likely UTD]
  - Vaccines work well but protection fades with time
  - Other than local reactogenicity (arm swelling, pain)- adverse effects are rare
- All children and insured adults should be able to receive without copay*
  - *Medicare part D- pharmacy only unless given for injury [tetanus prevention]

Influenza, COVID-19

Ongoing challenges by viruses

which ‘remain uncontrolled’…

Influenza Snapshot



https://www.cdc.gov/flu/about/burden/preliminary-in-season-estimates.htm

Despite vaccine uptake in <50% of our population and effectiveness ~40% we prevent millions of illnesses and medical visits and save thousands of lives each year… what's not to like???

Influenza Vaccine Benefits

Table 1: Estimated Number of Flu Illnesses, Medical Visits, Hospitalizations, and Deaths Prevented by Vaccination, by Age Group, 2010-2011 through 2022-2023 Flu Seasons

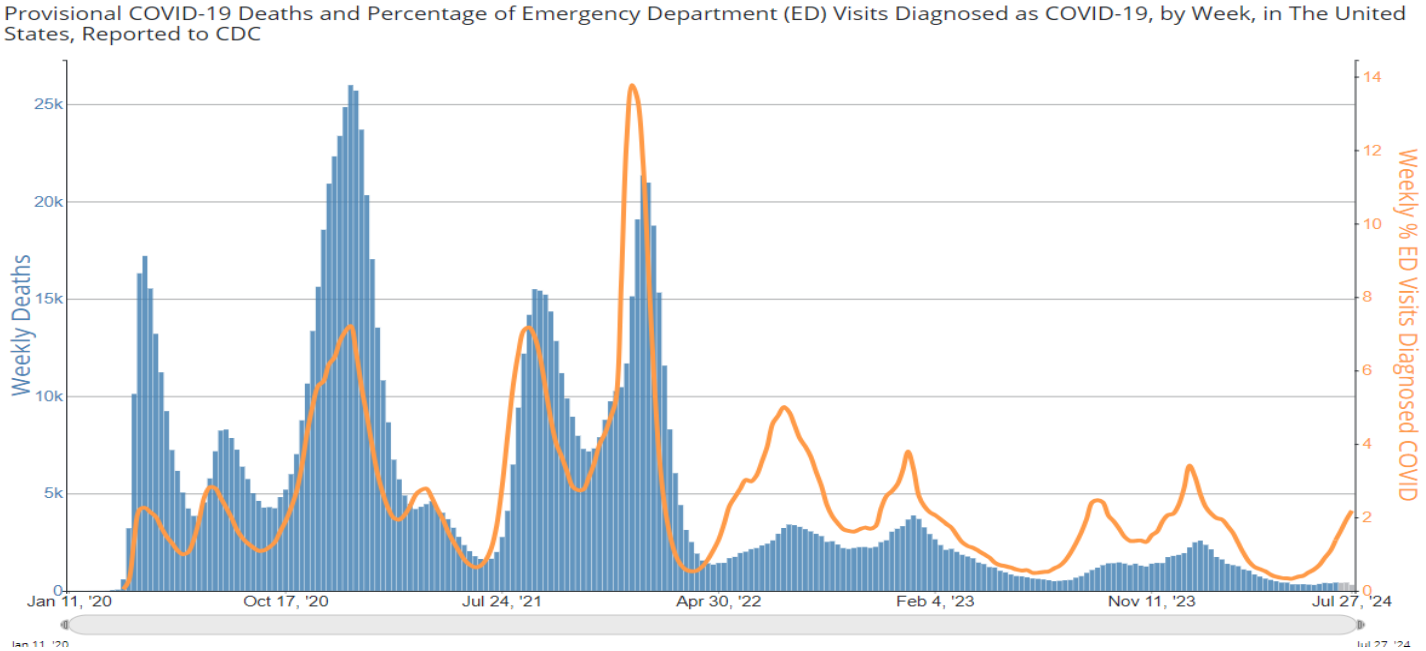
	Prevented Symptomatic Illnesses		Prevented Medical Visits		Prevented Hospitalizations		Prevented Deaths	
Season	Estimate	95% UI	Estimate	95% UI	Estimate	95% UI	Estimate	95% UI
2015-2016	5,300,000	(2,500,000, 9,200,000)	2,700,000	(1,300,000, 4,500,000)	70,000	(15,000, 170,000)	5,900	(510, 20,000)
2016-2017	5,300,000	(2,400,000, 11,000,000)	2,700,000	(1,300,000, 5,400,000)	72,000	(13,000, 190,000)	5,200	(360, 16,000)
2017-2018	5,900,000	(4,700,000, 7,400,000)	3,100,000	(2,400,000, 3,900,000)	82,000	(40,000, 100,000)	4,800	(1,000, 14,000)
2018-2019	3,100,000	(2,400,000, 4,700,000)	1,600,000	(1,200,000, 2,400,000))	43,000	(30,000, 160,000)	2,800	(700, 16,000))
2019-2020	7,000,000	(5,400,000, 8,900,000)	3,400,000	(2,600,000, 4,300,000)	100,000	(52,000, 153,000)	7,200	(2,000, 27,000)
2021-2022**	1,800,000	(1,000,000, 2,700,000)	900,000	(500,000, 1,400,000)	22,000	(6,000, 62,000)	1,100	(0, 7,000)
2022-2023**	5,900,000	(4,000,000, 7,700,000)	2,900,000	(1,900,000, 3,800,000)	64,000	(34,000, 96,000)	3,600	(0, 12,000)

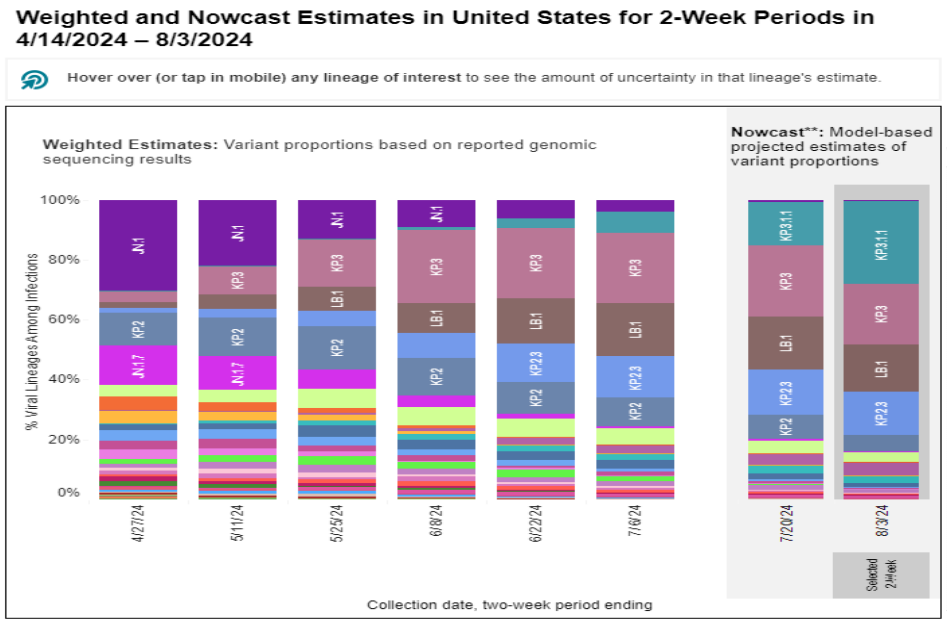
*Estimates are not available for the 2020-2021 flu season due to minimal influenza activity.

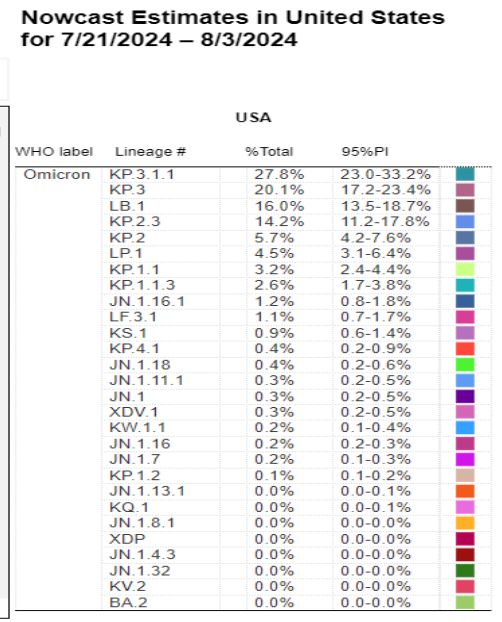
https://www.cdc.gov/flu/vaccines-work/past-burden-prevented-est.html

As long as we continue to have -essentially- unmitigated COVID-19 viral spread, we will see ongoing variant evolution -at our own peril…

COVID-19 Snapshot







WHO label	Lineage #	%Total	95%PI
Omicron	KP.3.1.1	27.8%	23.0-33.2%
	KP.3	20.1%	17.2-23.4%
	LB.1	16.0%	13.5-18.7%
	KP.2.3	14.2%	11.2-17.8%
	KP.2	5.7%	4.2-7.6%
	LP.1	4.5%	3.1-6.4%
	KP.1.1	3.2%	2.4-4.4%
	KP.1.1.3	2.6%	1.7-3.8%
	JN.1.16.1	1.2%	0.8-1.8%
	LF.3.1	1.1%	0.7-1.7%
	KS.1	0.9%	0.6-1.4%
	KP.4.1	0.4%	0.2-0.9%
	JN.1.18	0.4%	0.2-0.6%
	JN.1.11.1	0.3%	0.2-0.5%
	JN.1	0.3%	0.2-0.5%
	XDV.1	0.3%	0.2-0.5%
	KW.1.1	0.2%	0.1-0.4%
	JN.1.16	0.2%	0.2-0.3%
	JN.1.7	0.2%	0.1-0.3%
	KP.1.2	0.1%	0.1-0.2%
	JN.1.13.1	0.0%	0.0-0.1%
	KQ.1	0.0%	0.0-0.1%
	JN.1.8.1	0.0%	0.0-0.0%
	XDP	0.0%	0.0-0.0%
	JN.1.4.3	0.0%	0.0-0.0%
	JN.1.32	0.0%	0.0-0.0%
	KV.2	0.0%	0.0-0.0%
	BA.2	0.0%	0.0-0.0%

** These data include Nowcast estimates, which are modeled projections that may differ from weighted estimates generated at later dates
# Enumerated lineages are US VOC and lineages circulating above 1% nationally in at least one 2-week period. "Other" represents the aggregation of lineages which are circulating <1% nationally during all 2-week periods displayed. While all lineages are tracke
by CDC, those named lineages not enumerated in this graphic are aggregated with their parent lineages, based on Pango lineage definitions, described in more detail here:

https://covid.cdc.gov/covid-data-tracker/#emergency-visits-landing
https://covid.cdc.gov/covid-data-tracker/#variants-genomic-surveillance

COVID-19 Vaccine Benefits

- Short term reduction in infection
- Reduction in severe disease
- Reduction in hospitalization risk
- Reduction in risk of death from COVID-19
- Reduction in Long COVID risk

https://www.cdc.gov/covid/vaccines/how-they-work.html

What can I/We do?

Build knowledge

Walking the walk

Talking the Talk

Carrying the Torch

Build Knowledge and Skills

- Depth and breadth depend on your own motivation, background, time
  - Ongoing learning is critical. Science is ongoing – static information quickly outdated
  - Use trusted information sources [see resources at end]
- Develop your skills in critical analysis [see below]
  - Consider biases
  - Assess for mis- and disinformation
- Know and acknowledge our limits

https://guides.library.jhu.edu/evaluate/home
https://guides.lib.uw.edu/research/evaluate/socialmedia
https://library.csi.cuny.edu/misinformation
https://www.apa.org/topics/journalism-facts/misinformation-disinformation
https://crankyuncle.com/#content

Walking the Walk

- I am vaccinated implies [*if not stated directly*] that I trust my healthcare team and believe in the value of immunization.
- People relate through stories: Anecdotes are powerful
  - In other words- tell positive stories about your experiences with vaccines!

Communication Basics

- MICRO — Listen/Observe, Address motivation, questions and needs of the person in front of you. Stay within limits of your knowledge.
  - 'Man on the street'
  - Clinical setting
  - Small groups [<10]
- MACRO — Address motivation, questions and needs of a population, Prepare ahead of time.
  - Presentations to larger groups
  - Interview/News media
  - Social Media
  - Manuscript

MICRO

Nonclinical Communication

- Situational awareness — Audience, setting, comfort
- Neutral or positive interaction
- What is the question
  - Ask yourself: Do I have an answer or am I willing/able to find it?
- Brief message(s) or discussion
- Acknowledge gaps and uncertainty
- Repeat key point(s)
- Close with a positive

MICRO

Clinical Setting 1

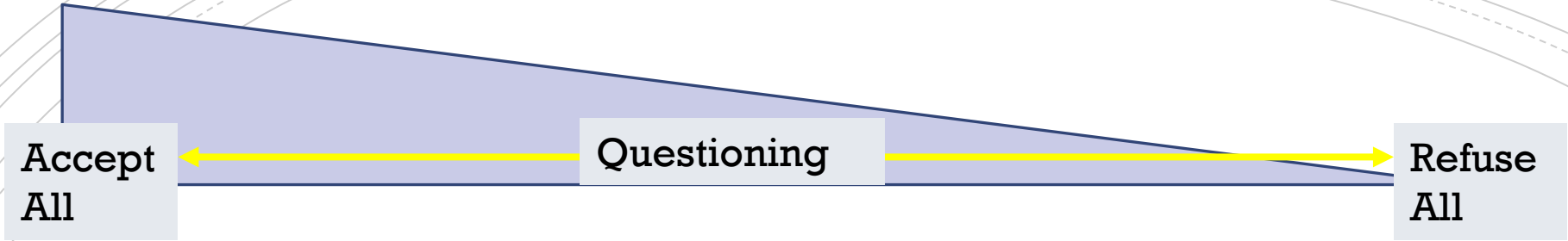
- Immunization is a TEAM SPORT
  - All healthcare team members can change patient/family behaviors
    - **Clinical leadership:** inform/resource, support team members' K S A*
    - **Management:** assure vaccines, processes, resources for vaccination
    - **Team Goal**: successful individual and community protection from VPD
    - **Tools**: standing orders, reminders, registry, collaboration across settings
- STRONG PRESUMPTIVE PROVIDER RECOMMENDATION = KEY
  - Emphasizes importance of immunization

    Simply 'OFFERING' implies low value.
  - BUT it does not happen as often as it should [EVERY opportunity]
  - Patients hear it FAR less often than we think they do…
  - Put simply:

DON'T ASK, RECOMMEND!

and give a reason WHY…

*KSA= Knowledge Skills and Attitudes



MICRO

Clinical Setting 2
Vaccine Hesitancy

- Vaccine hesitancy falls along a spectrum
  - MOST accept all vaccines
  - MANY have questions and/or concerns about 1+ vaccines
  - FEW are anti-science/anti-vaccine
- SO… IF recommendation is followed by a pause, you hear a question or see a furrowed brow… **Step onto the PATHe!!**
- **PATHe** to address vaccine hesitant patients/families:
  - **P**REPARE yourself
  - **A**PPROACH the patient
  - **T**ALK the talk
  - **H**UMANIZE your recommendation
  - **E**MBRACE the long game

MACRO

Communication

- Situational awareness
  - Target audience
  - Rules of the road (time limit, word count, format)
  - Save time for questions/discussion, if possible
  - Consider any 'Post' MACRO… (It will live forever in ether…)
- Tailor content to audience
  - Address Key Message/Messages
  - Audience engagement, if possible
  - Avoid argument, debates (unless that is your forte)
- How good is your filter? [e.g. Do you need an editor?]
- Stay positive and avoid pejoratives
- Revisit key points at conclusion

https://www.nfid.org/5-key-reasons-to-engage-with-media/

Carrying the Torch

- All of us have a role!
  - Clinical
  - Public Health
  - Industry
  - Public
- Immunize effectively
  - Fill ‘gaps’ left following pandemic
  - Increase vaccination to meet goals beyond ‘catch up’
  - Reach underserved individuals and communities
- Communicate/Educate
  - Value/Benefits
  - Safety
  - Individual/Family/Community
  - How do we do this more effectively?
- Innovate
  - Science: develop safer, better, more convenient vaccines

Resources

https://www.cdc.gov/vaccines/index.html

https://www.nfid.org/

https://www.immunize.org/

https://www.immunizear.org/

https://www.hhs.gov/vaccines/about/index.html

https://www.acponline.org/clinical-information/clinical-resources-products/adult-immunization

https://www.aap.org/