BALTIMORE COUNTY
DEPARTMENT OF HEALTH

Measles, Pertussis and TB, Oh My!
Infectious Disease Update for Schools

Alexander Chen, MD, FACP
Chief, Division of Communicable Diseases

Isha Jain, MD, MPH
Chief, Division of School Based Services

Disclosures

- No conflicts of interest

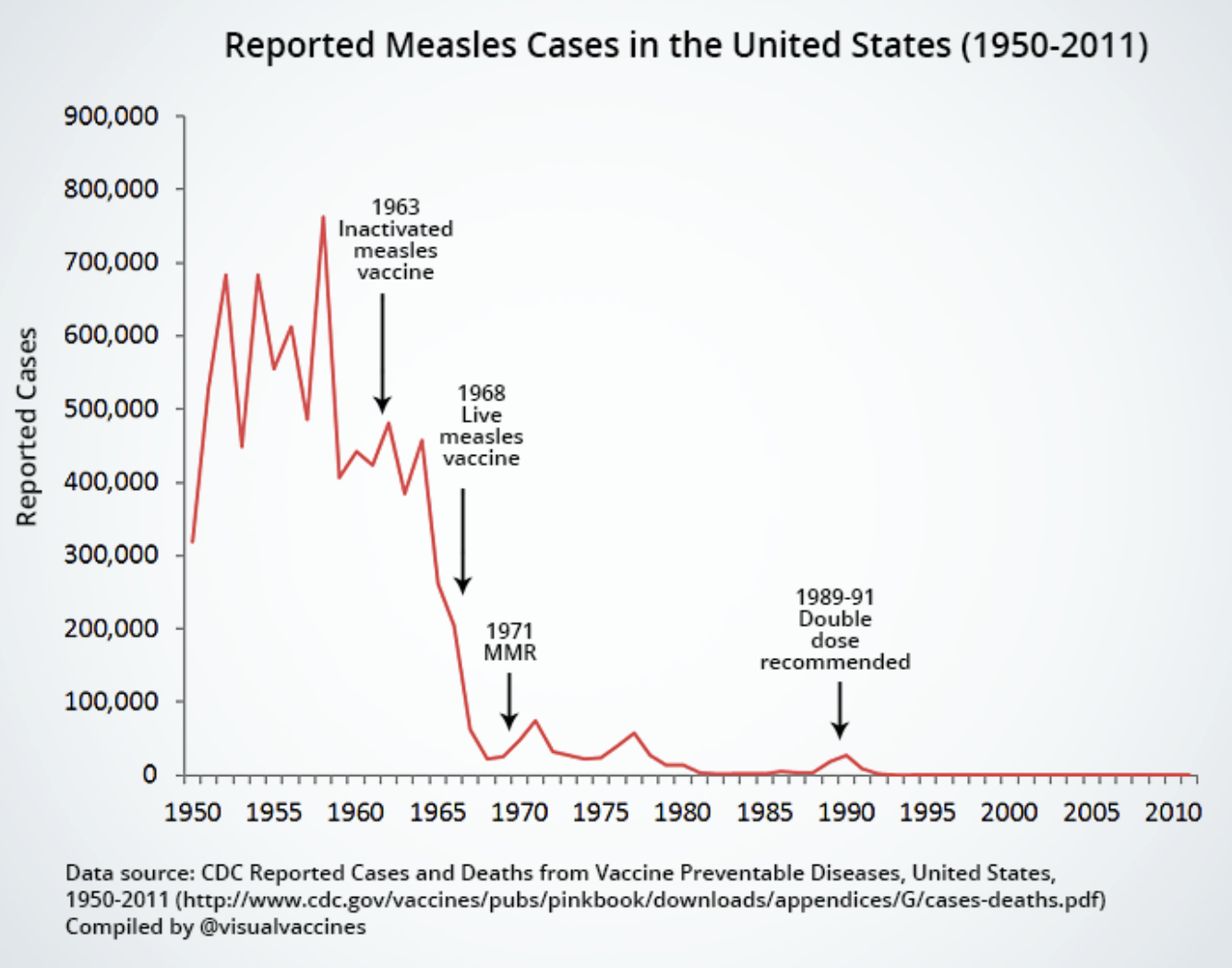
Agenda

- Measles
  - Current status
  - Clinical syndrome and recognition
  - Proof of immunity
  - Reporting and sample collection
  - Postexposure prophylaxis
  - Other information- Vit A
- Pertussis
  - Current status
  - Clinical syndrome and recognition
  - Prevention
  - Postexposure prophylaxis
- Tuberculosis
  - Current status
  - Screening
  - Latent case treatment
  - Active case-public health response

Measles

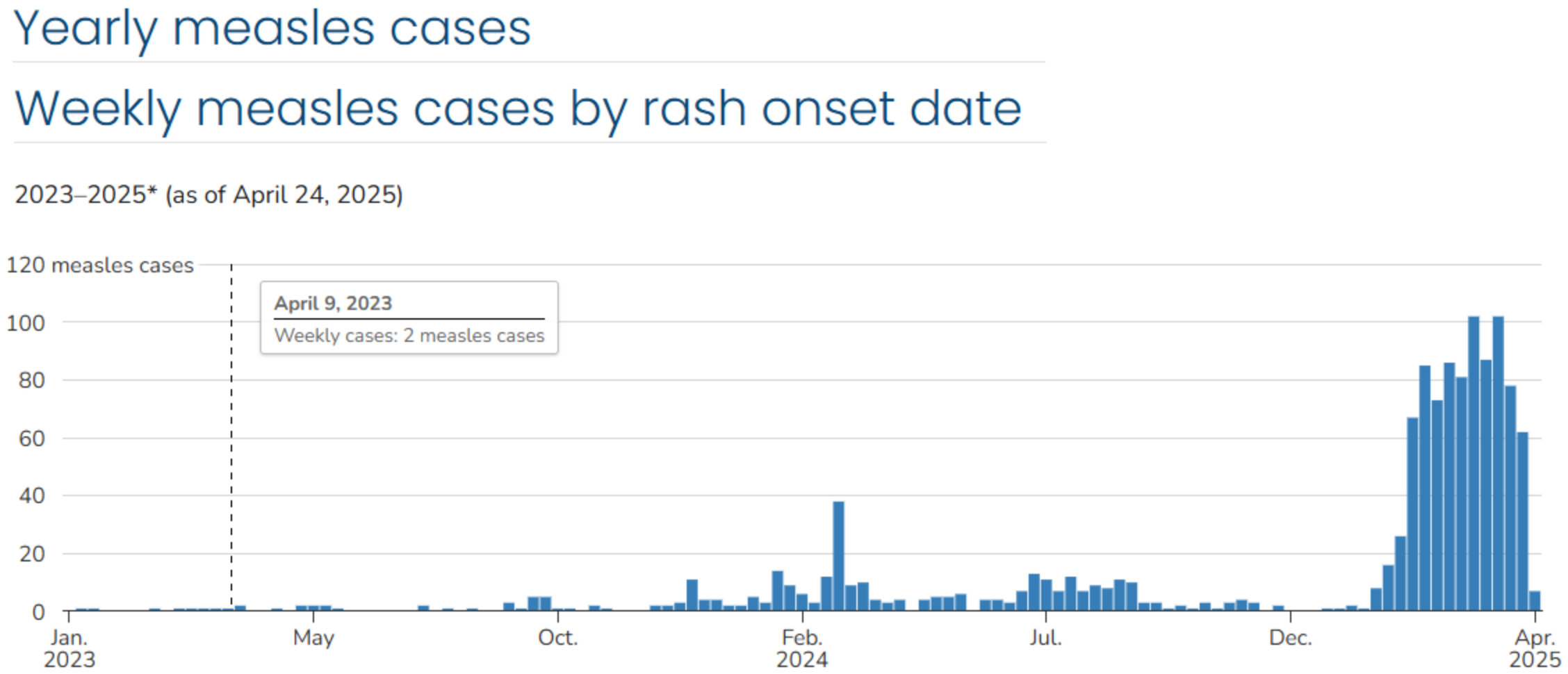
Image: https://www.cdc.gov/measles/hcp/clinical-overview/index.html

History of Measles - USA



- Attack rate over 90%
- Prior to vaccines: several hundred thousand cases/yr
- 1990: 27K cases, led to addition of 2nd dose
- After addition of 2nd dose, long lull between 1996-2014 with very few cases

Measles U.S.A since 2000

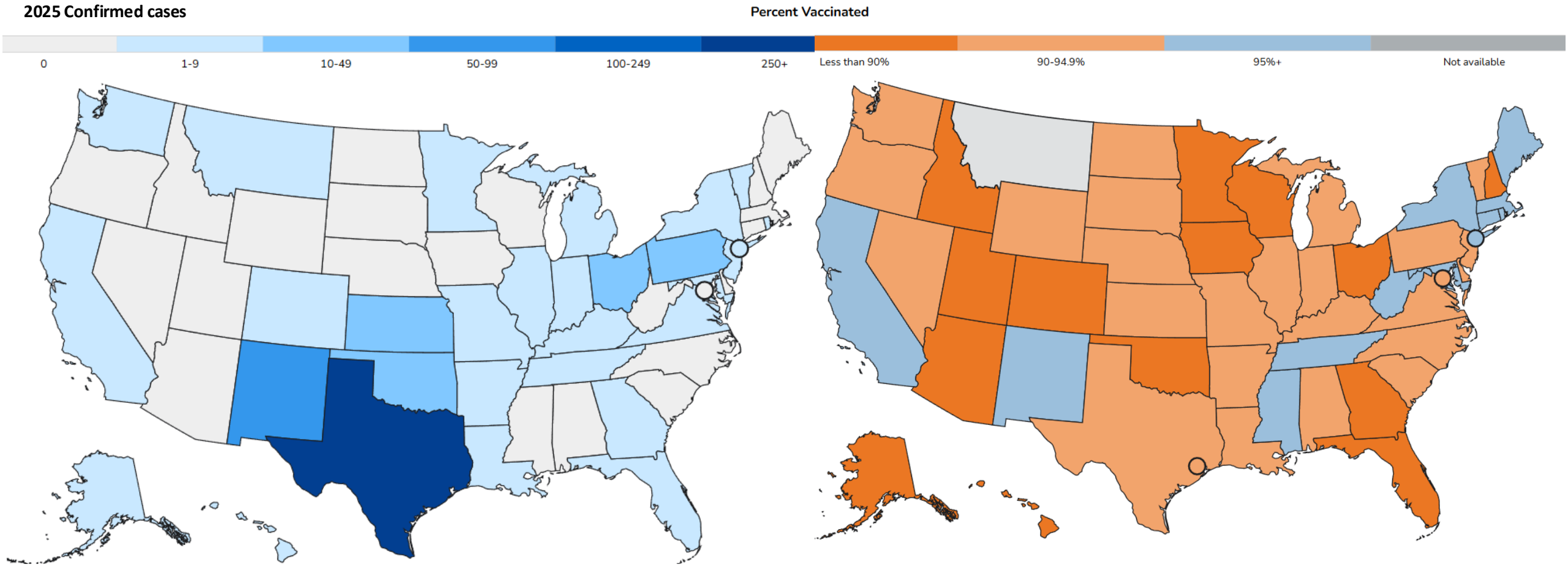


We have already surpassed 2024's count, and on pace to exceed 2019!

2025 U.S. cases

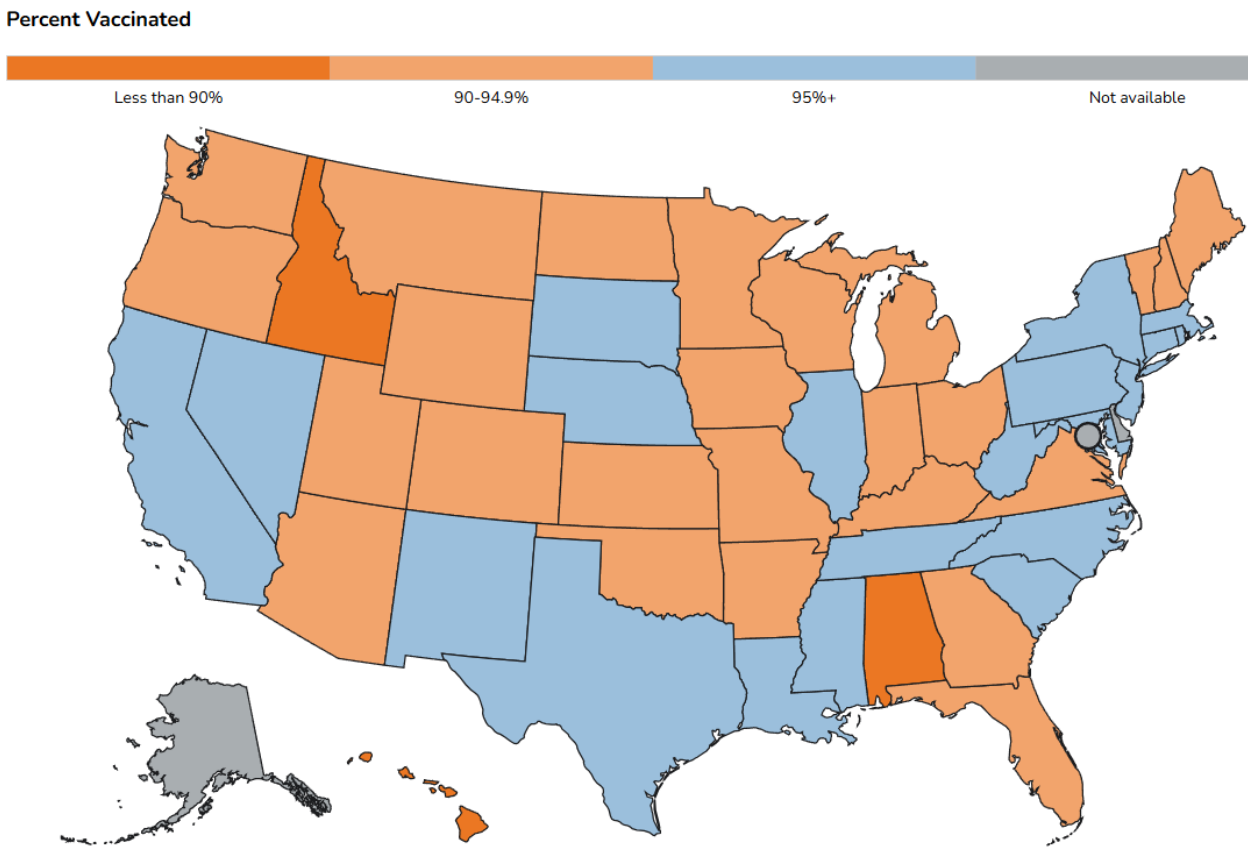
- As of 4/25/2025, nearly 900 confirmed cases (already more than all of 2024), and potentially many more that have not been brought to medical care
  - 97% unvaccinated
- At least 94 hospitalized (~11%)
- 2 child and 1 adult deaths, all unvaccinated
  - First child death since 2003
- At least 646 cases in Texas and 66 cases in NM alone
- Immunization rate in Gaines County, TX public kindergarten 82%, but many are homeschooled or in private school and therefore, unreported

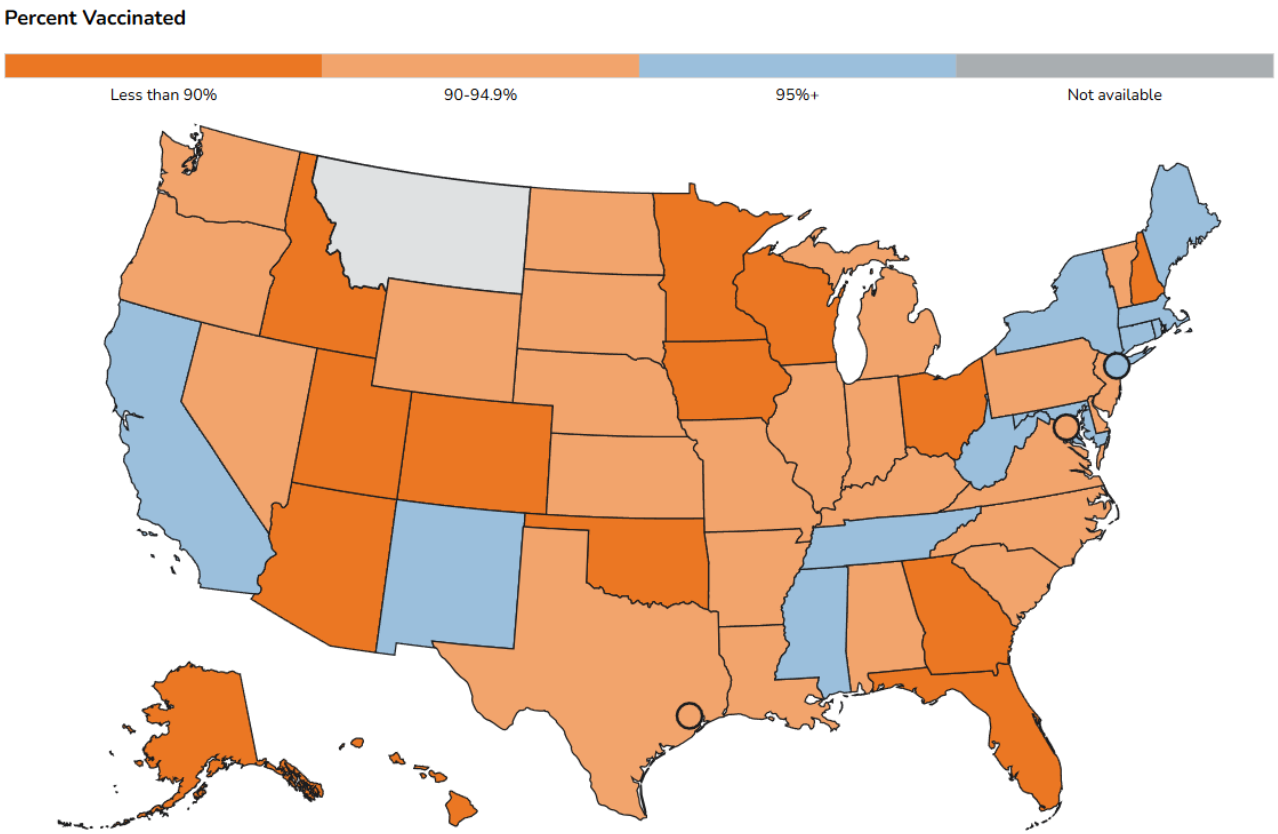
2025 cases and vaccination rates – U.S.



Source: CDC as of 4/25/2025

MMR Vaccination trends U.S.A.





Left: 2019-2020

Right: 2023-2024

Source: CDC

Measles essentials

- Maybe the most contagious disease in existence; can linger in air for 2 hours
- Main symptoms: fever (sometimes over 104°), runny nose, cough, red eyes. Sometimes diarrhea, ear infection
- Serious complications: pneumonia (1 in 20), brain swelling (1 in 1000), death (about 1 in 500)
- 2 dose MMR vaccine is 97% effective (93% after 1 dose)

Measles Infection Timeline:

DAY 0: Rash Onset

↓

	EXPOSURE WINDOW		INFECTIOUS PERIOD	RESOLUTION
Day	-21 -7		-4 0 4	5+
Illness	The average incubation period for measles is 11-12 days (from exposure to onset of prodrome). The rash typically appears ~14 days after exposure, with a range of 7-21 days.		The prodrome typically begins 3-5 days before the appearance of the rash. The infectious period starts 4 days prior to rash onset and ends 4 days after.	Symptoms typically start resolving 5-6 days after the rash onset. The rash fades in order of appearance.

Case Definition

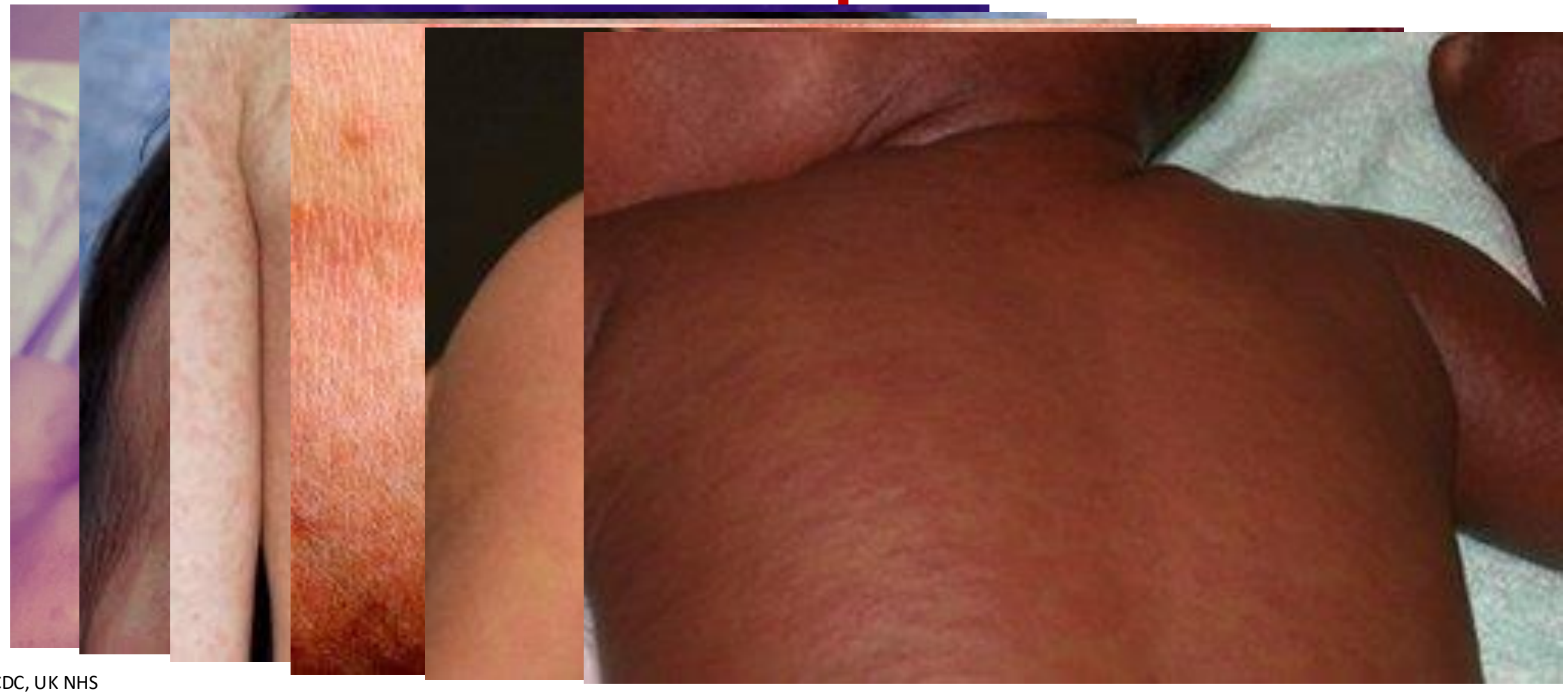
CLINICAL CRITERIA

An acute illness characterized by:

- Generalized, maculopapular rash lasting ≥3 days; AND
- Temperature ≥101°F or 38.3°C; AND
- Cough, coryza (runny nose), or conjunctivitis (red, watery eyes).

MDH: Local Health Department Guidelines for the Epidemiological Investigation and Control of Measles 2025

Measles - photos



CDC, UK NHS

What to do if you suspect measles

- Immediately place in private room with door closed and keep patient mask on, OR in Airborne Isolation Room
- Only staff who have evidence of immunity should enter
  - Staff should wear fit-tested N95 or equivalent respirator, also gloves, gown and eye protection
- Call your local Health Dept **immediately** to arrange testing
- Consider other diseases: Kawasaki dz, drug rash, scarlet fever, rubella, parvovirus, adenovirus, EBV, tick borne infxn

Am I immune to measles?*

TABLE 3. Acceptable presumptive evidence of immunity to measles, rubella, and mumps*

	Routine	Students at post-high school educational institutions	Health-care personnel†	International travelers
Measles	(1) Documentation of age-appropriate vaccination with a live measles virus-containing vaccine§: –preschool-aged children: 1 dose –school-aged children (grades K-12): 2 doses –adults not at high risk¶¶: 1 dose, or (2) Laboratory evidence of immunity,¶ or (3) Laboratory confirmation of disease, or (4) Born before 1957	(1) Documentation of vaccination with 2 doses of live measles virus-containing vaccine,§ or (2) Laboratory evidence of immunity,¶ or (3) Laboratory confirmation of disease, or (4) Born before 1957	(1) Documentation of vaccination with 2 doses of live measles virus-containing vaccine,§ or (2) Laboratory evidence of immunity,¶ or (3) Laboratory confirmation of disease, or (4) Born before 1957††	(1) Documentation of age-appropriate vaccination with a live measles virus-containing vaccine: –infants aged 6–11 months**: 1 dose –persons aged ≥12 months§: 2 doses, or (2) Laboratory evidence of immunity,¶ or (3) Laboratory confirmation of disease, or (4) Born before 1957

*Talk to your provider if you have specific questions about weakened immunity

https://www.cdc.gov/mmwr/preview/mmwrhtml/rr6204a1.htm

Basic Information Needed

a. Demographics
b. Symptoms; each symptoms' onset date; past medical history
c. Measles vaccination history (collect dates when possible)
d. Any other diagnosis considered; Any related lab results
e. Treatment (what medication, when started)
f. Sick contacts/source of illness
g. Travel history and work site (esp. healthcare, school/daycare)
h. Photos of rash (avoid sending identifying features)

Post-exposure prophylaxis

If not fully immunized:

- MMR most effective within 72 hrs. of first exposure if 6 months or older
  - Can be given later, but not with IG
- Immune globulin: within 6 days
  - IM dose: 0.5 mL/kg (max 15 mL)
  - IV dose: 400 mg/kg for pregnant, severely immunocompromised regardless of immunity hx, or >30 kg

Vaccination for Outbreak Areas

- Infants 6 through 11 months receive an early dose of MMR vaccine (i.e., infant dose). Subsequent doses should follow CDC's recommended childhood schedule:
  - Another dose at 12 through 15 months of age
  - A final dose at 4 through 6 years of age
- Children > 12 months age w/o prior MMR: 1 dose immediately and follow with a 2nd dose at least 28 days after the first
- Children > 12 months with one prior dose should receive an early 2nd dose of MMR vaccine separated by at least 28 days
- Teenagers and adults with one prior dose of MMR vaccine should receive a second dose
  - Those with no evidence of immunity should receive one dose of MMR vaccine immediately and follow with a second dose at least 28 days later
- Similar recommendations for international travel

Vitamin A toxicity

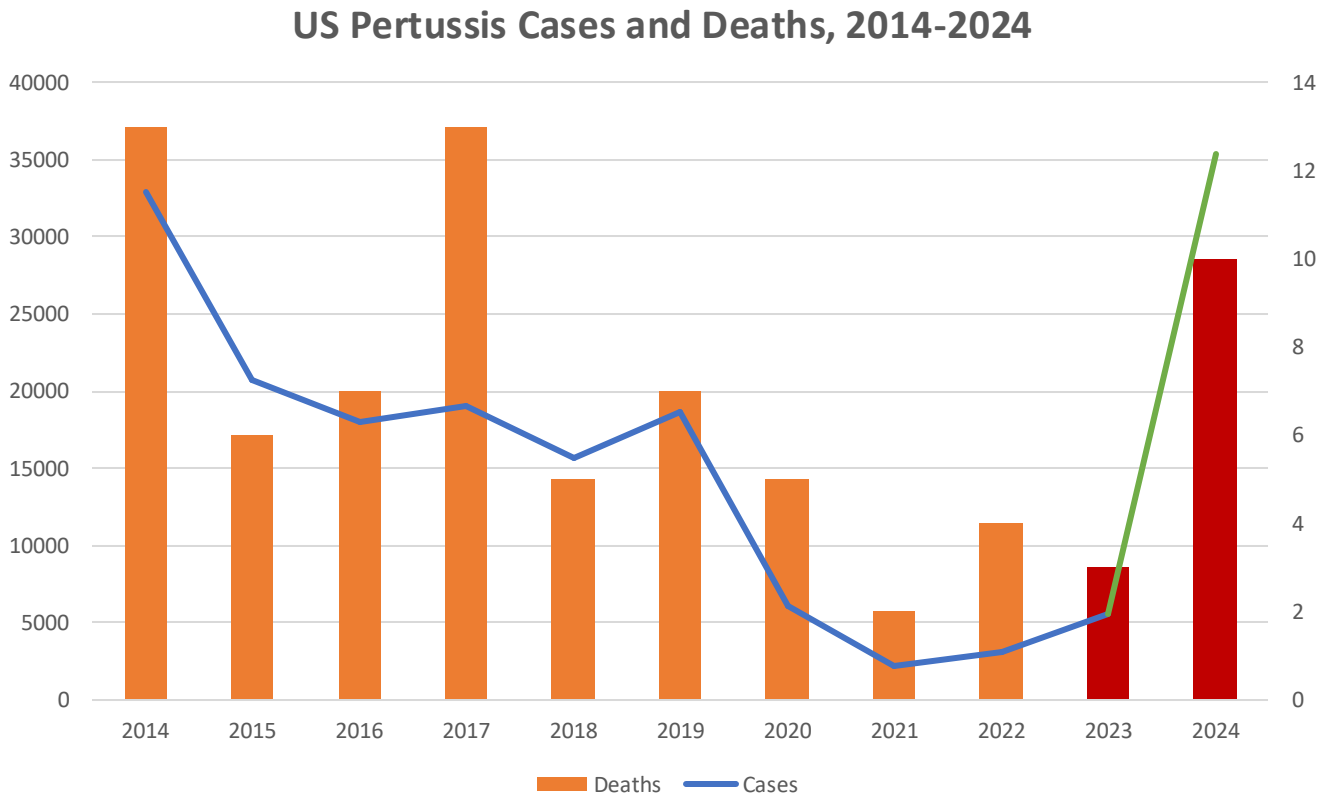
- Dosing is very confusing
- Several news reports of children in TX becoming ill
- Most adult OTC supplements have about 2,400-3,000 mcg RAE, about 6-10 times RDA for small children
- Some have much more (7500 mcg or more)
- 10,000 IU= 3,000 mcg RAE (Retinol Activity Equivalents)
- Only recommended for diagnosed cases for 2 days
- Not for prevention!

https://ods.od.nih.gov/factsheets/VitaminA-HealthProfessional/

Pertussis

https://www.kidshealth.org.nz/whooping-cough

Pertussis rates since 2014

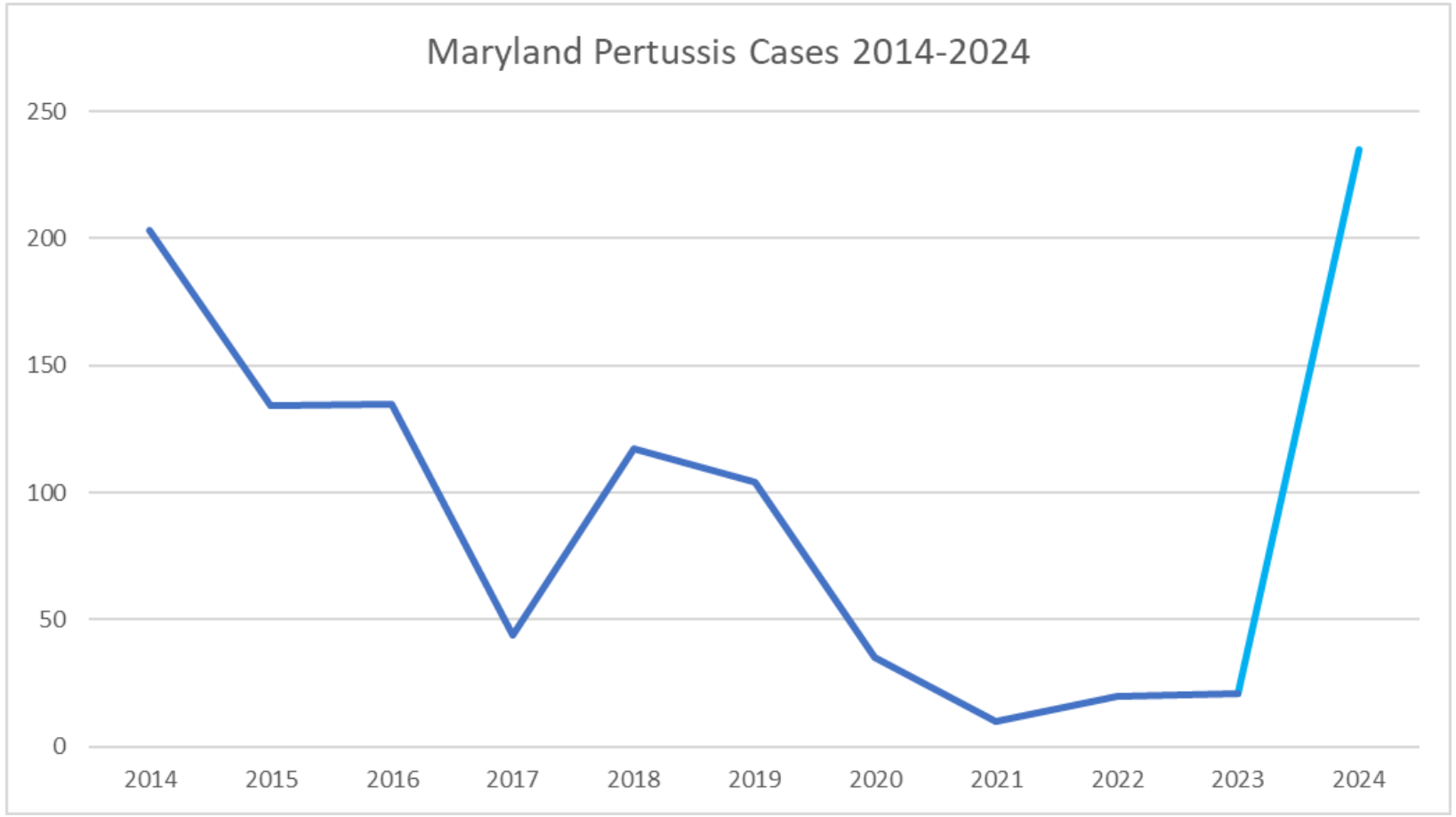


- Most deaths are among infants (< 1 year of age)
- Pertussis cases and death fell during the pandemic
- 6600+ cases in January-March 2025

Data: CDC, graphic by Dr. Chen

2025 Data: https://doi.org/10.1136/bmj.r704

Pertussis in Maryland



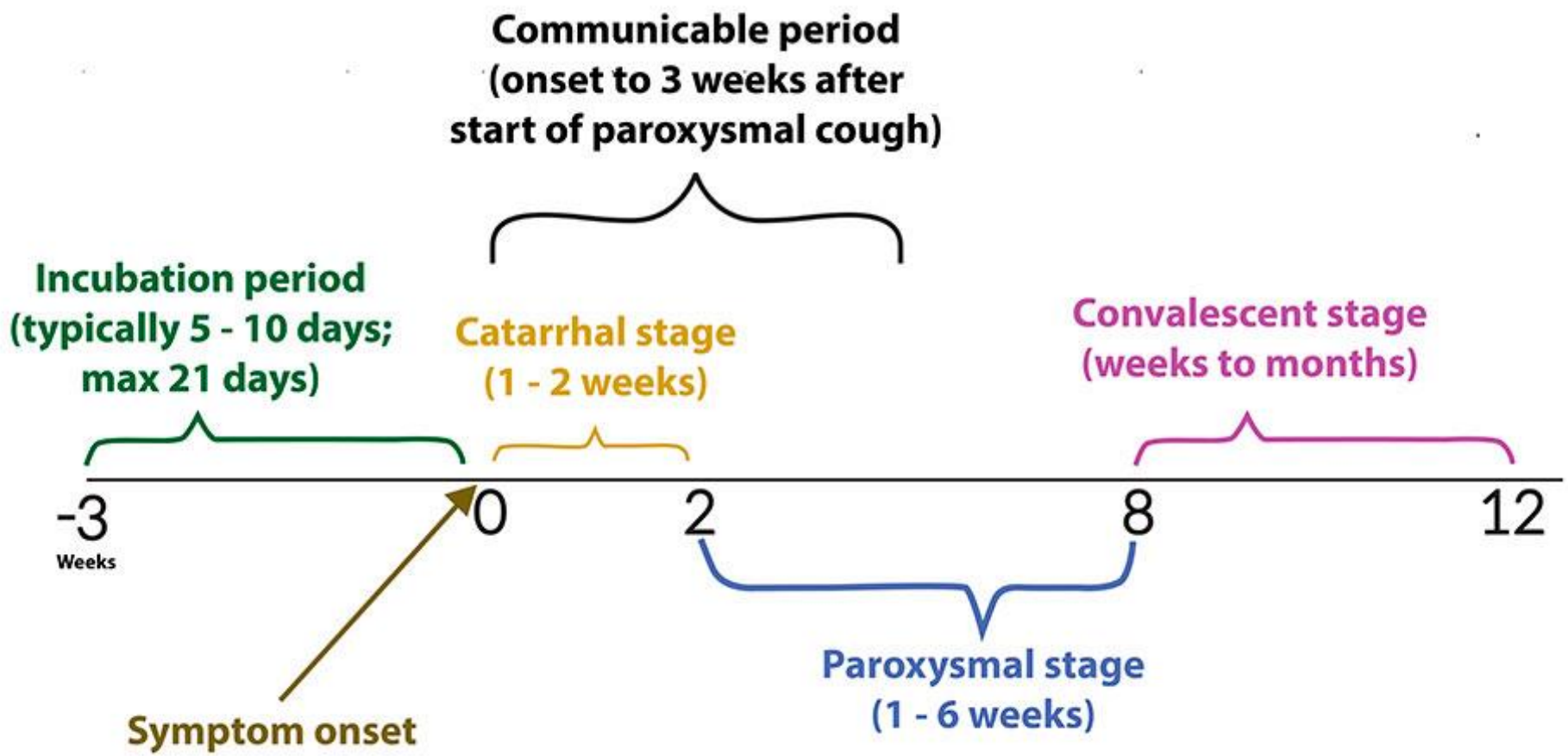
Data: CDC, graphic by Dr. Chen

Pertussis Essentials

- *Bordetella pertussis* is a gram-negative bacteria that produces many toxins
- Toxins cause the clinical symptoms
- Respiratory infection spread through respiratory droplets
- Highly infectious with 80% secondary attack rate in susceptible household contacts[1], asymptomatic persons can spread it too[2]

1 https://doi.org/10.1093/clinids/21.5.1211
2 https://bmcmedicine.biomedcentral.com/articles/10.1186/s12916-015-0382-8
AAP Red Book

Pertussis Disease Progression



cdc.gov/pertussis

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

Catarrhal Stage = Typical URI (rhinorrhea, low-grade fever, mild cough

Paroxysmal Stage = Coughing fits, +/- whoops, post-tussive emesis, exhaustion

Testing: NP swab, PCR within 3 weeks of cough onset

Pertussis Complications

- Adolescents and adults are unlikely to have complications if vaccinated
- Hospitalization is most common in infants <6 months old
- Un/under-vaccinated <12 months of age have the highest risk for severe complications (apnea 68%, pneumonia 22%) and death.

Image and information: https://www.cdc.gov/pertussis/hcp/clinical-signs/index.html

History of Pertussis Vaccines

- First vaccine: DTP in 1940s, "whole cell"
- Caused more side effects (high fever, febrile seizures, local swelling, persistent crying)
- Lawsuits --> National Childhood Vaccine Injury Act of 1986
  - Why we give and document VIS, Lot #s, enter reactions into VAERS
- New vaccines (DTaP) introduced in 1992 and replaced DTP entirely by 1996
  - "aP" is acellular pertussis = fewer vaccine side effects
  - Different products protect against 3 or 5 pertussis antigens
  - Decreases transmission, but primarily reduces morbidity and mortality

https://www.tandfonline.com/doi/full/10.4161/hv.29576
The National Childhood Vaccine Injury Act of 1986 | National Vaccine Information Center (NVIC)

Current Pertussis Vaccine Recommendations

- DTaP (<7 years old)
  - 5 doses: 2mo, 4mo, 6mo, 15-18mo, 4-6 yrs
  - Higher doses of antigens
- TDaP (≥7 years old)
  - 11-12 years old
  - >18 years old at least 1 dose as part of q10 yr Tetanus vaccination
  - Every pregnancy (ideally early 3rd trimester)
  - Cocooning (AAP, AAFP, ACOG) for close contacts of pregnant person/infant

Pertussis Vaccination

- European study in infants 2-11 months old showed reduction in hospitalization: 46% after 1 dose, 76% after 2 doses[1]
- Immunity lasts about 4-12 yrs after DTaP vaccine, TDaP <4 years, and about 4-20 yrs after infection[2,3]
- Research into better vaccines ongoing

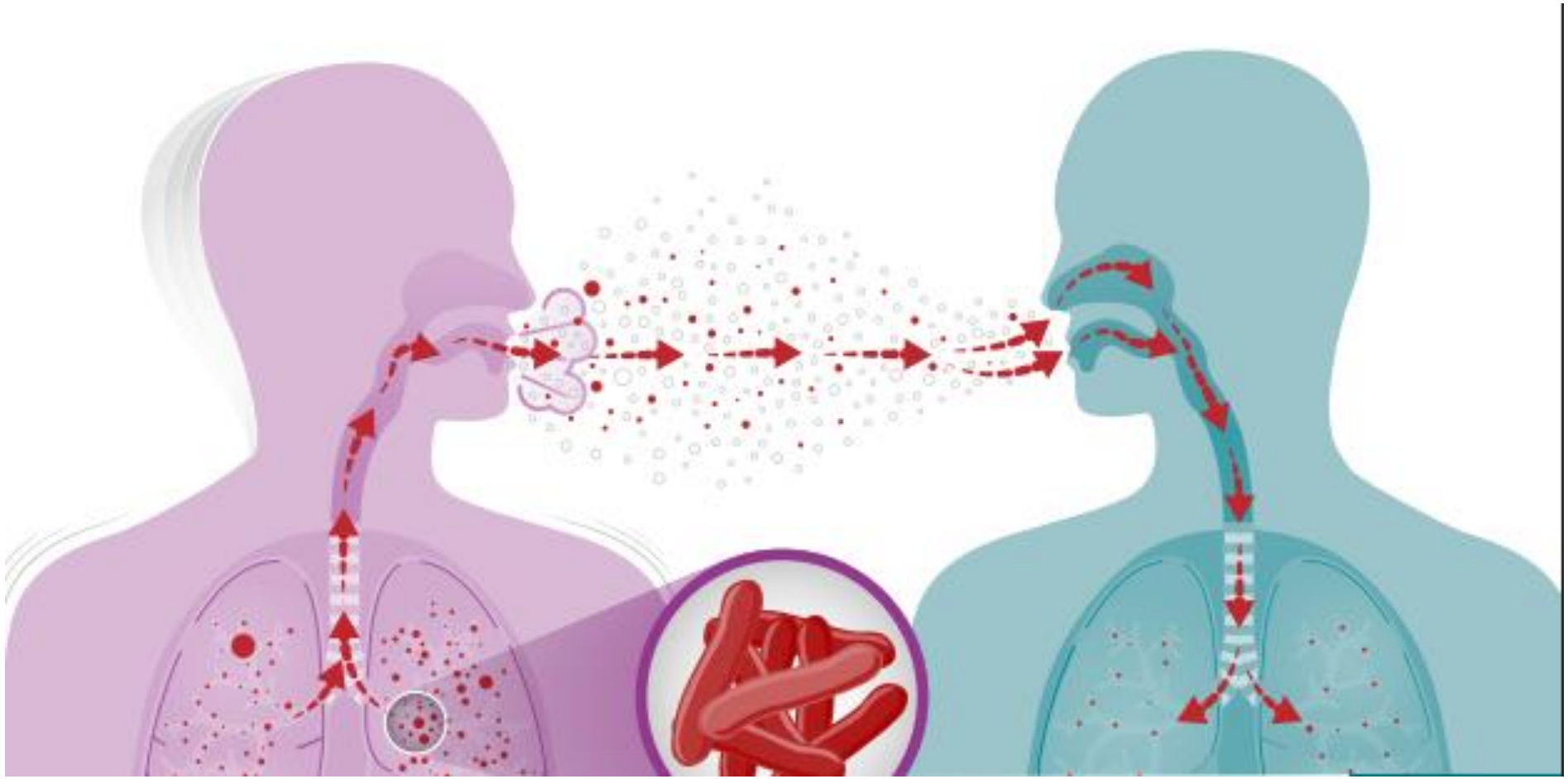
1 https://doi.org/10.1016/j.vaccine.2024.02.090
2 https://doi.org/10.1097/01.inf.0000160914.59160.41
3 UpToDate

Pertussis Postexposure Prophylaxis

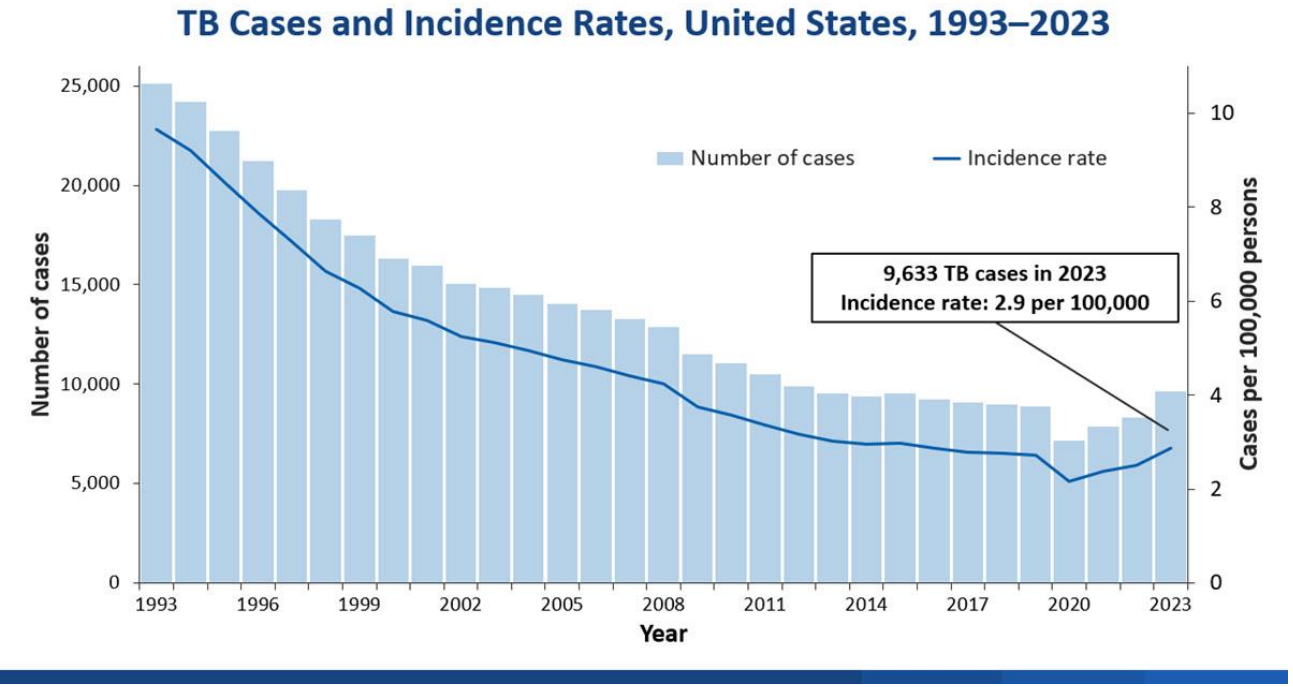
- Needs to be given within 21 days of exposure, *regardless of immunization status*
- Main targets: household contacts, childcare, high risk individuals (infants, pregnant women), those who have contact with high-risk persons
- Post-exposure work restrictions unnecessary for HCPs who get PEP, regardless of exposure to high-risk persons
- Antibiotics for 5-14 days depending on type (macrolides preferred, TMP/SMX is an alternative)
- Catch-up vaccination for any close contacts

AAP RedBook
https://www.cdc.gov/infection-control/hcp/healthcare-perso
epidemiology-control/pertussis.html

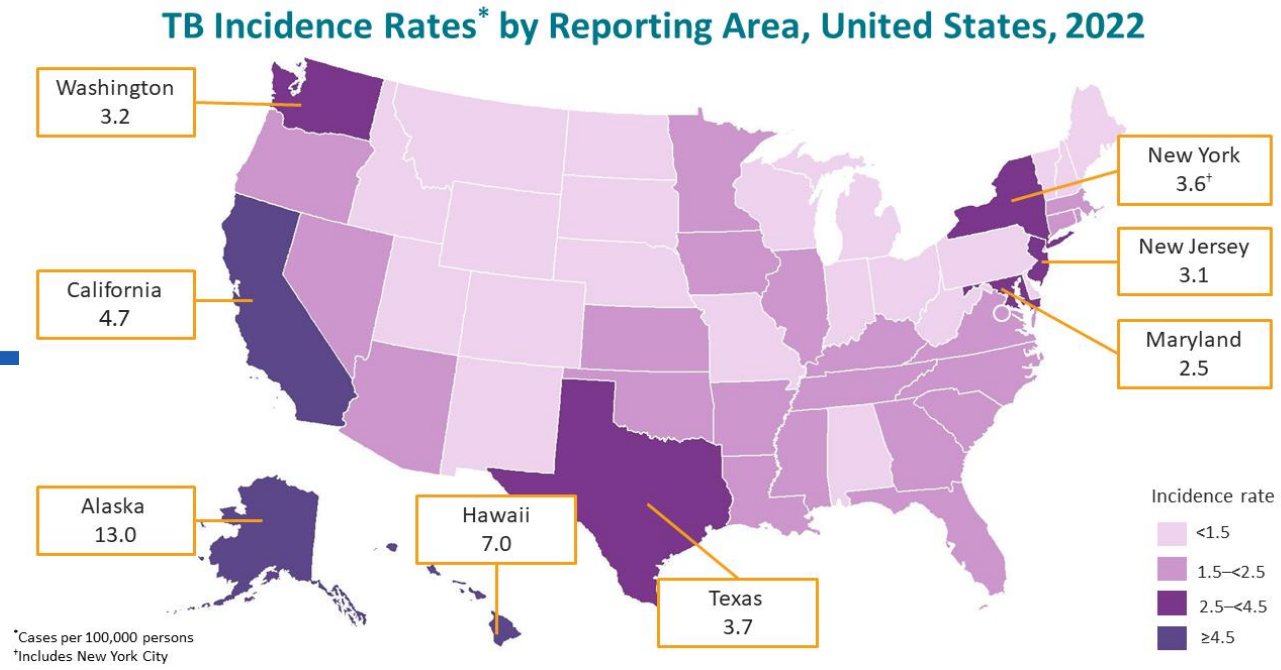
Tuberculosis



Tuberculosis cases USA



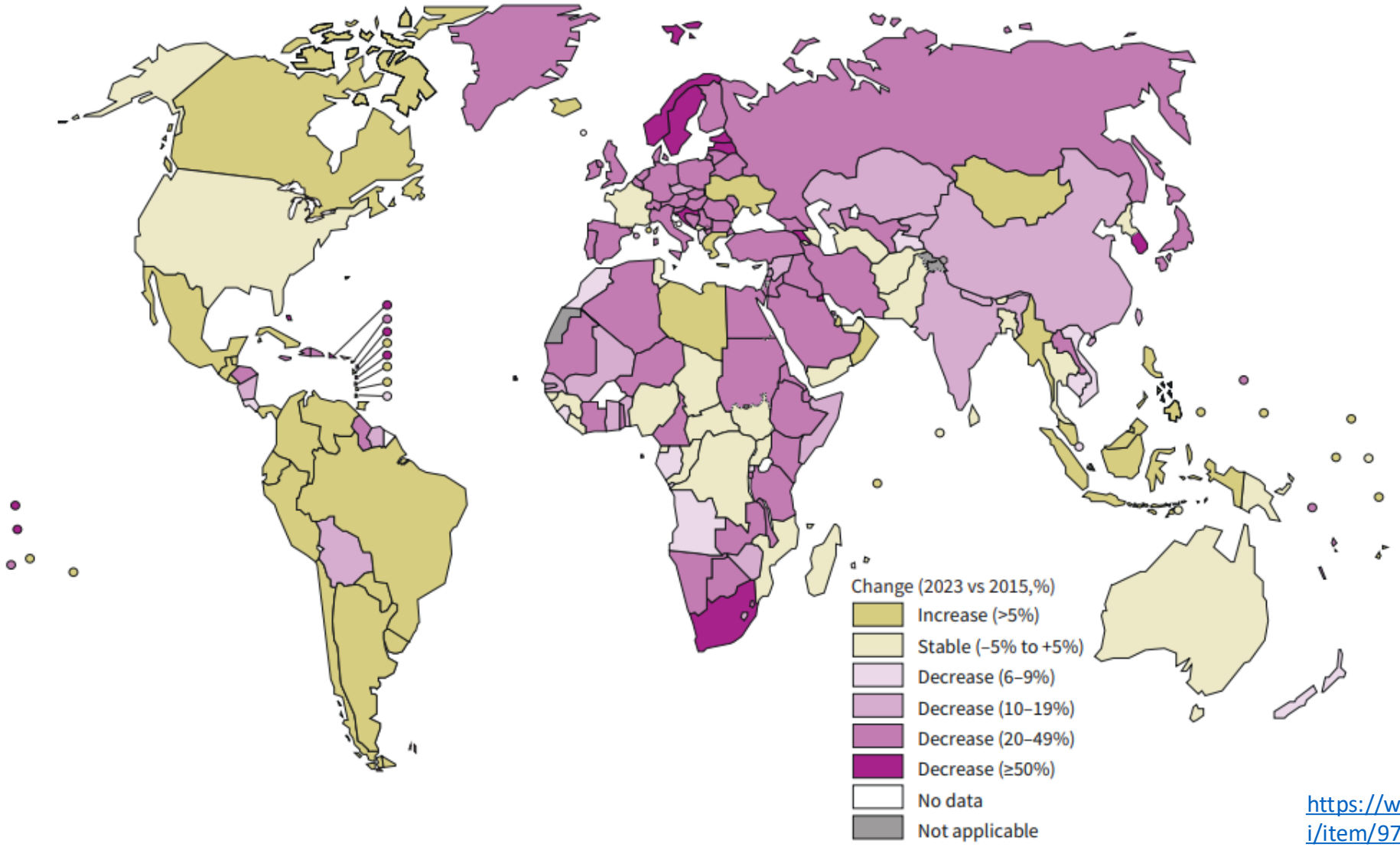
Maryland is one of the higher incidence states



Counts had been falling prior to the pandemic, but are now rising

Graphics: CDC

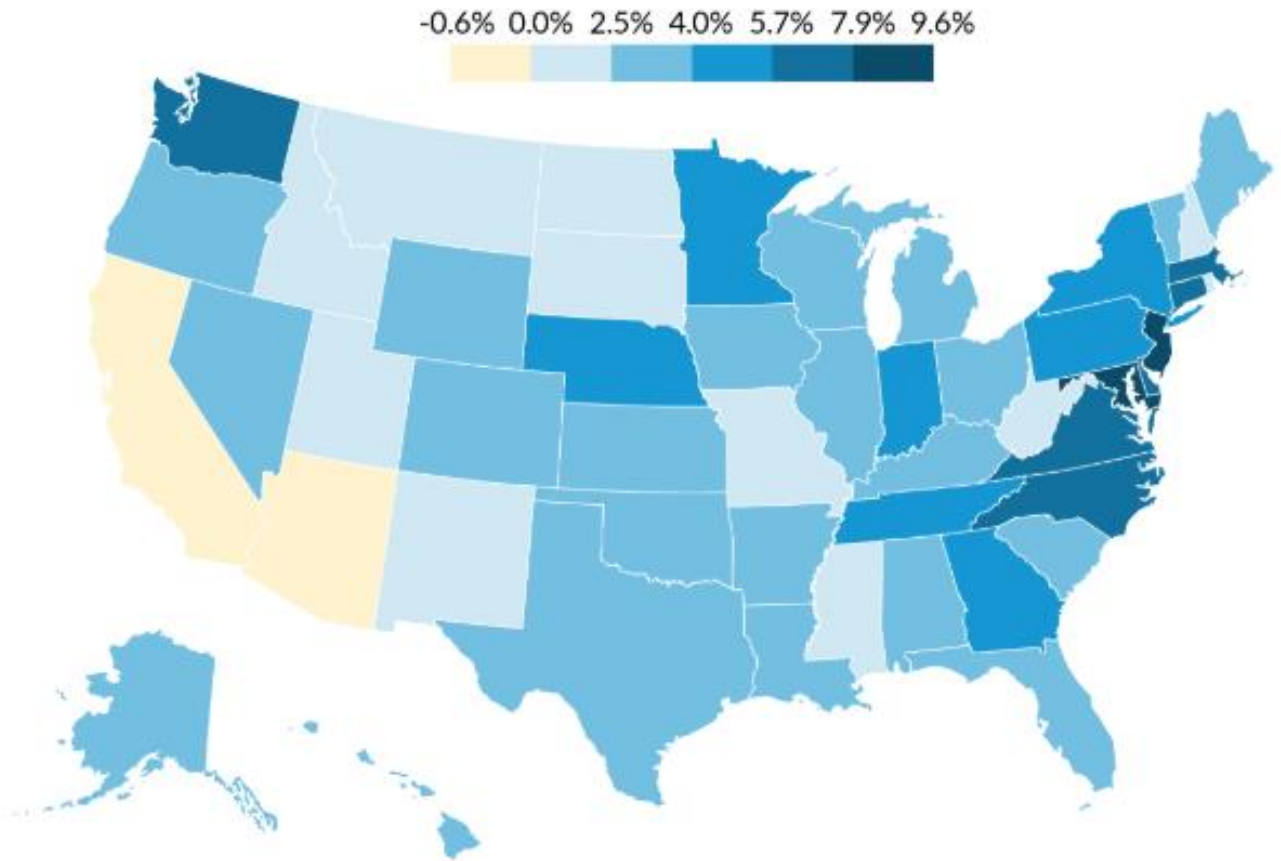
Change (%) in estimated TB incidence (new cases per 100 000 population), 2023 compared with 2015



https://www.who.int/publications/i/item/9789240101531

The Share of Children Who Are Children of Immigrants Increased Substantially in Some Nontraditional Immigrant Destination States from 2006 to 2017

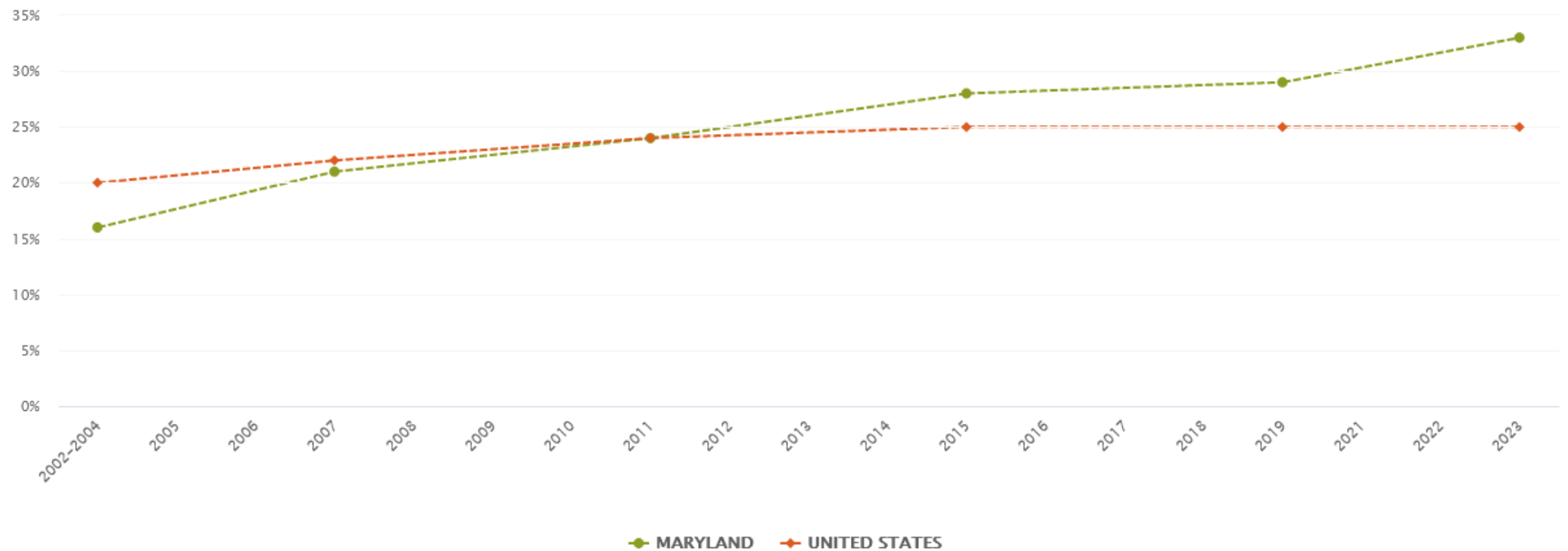
Percentage-point change in the share of children who are children of immigrants



Source: Urban Institute calculations using Census Bureau American Community Survey data.

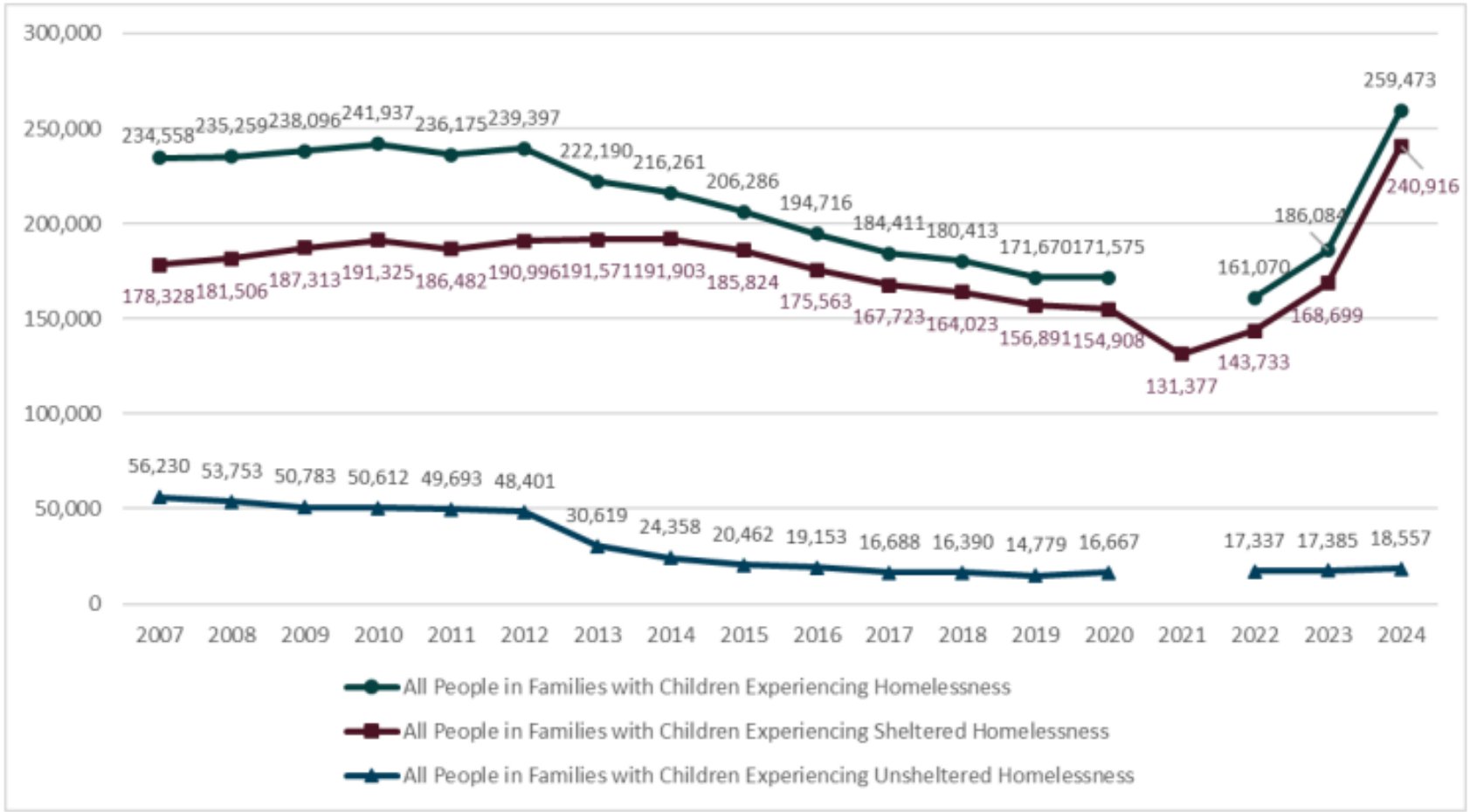
URBAN INSTITUTE

CHILDREN IN IMMIGRANT FAMILIES (PERCENT)



Data: Annie E Casey Foundation Kids Count Data Center https://www.aecf.org/blog/who-are-the-children-in-immigrant-families

Exhibit 3-1: PIT Estimates of People in Families with Children Experiencing Homelessness by Sheltered Status, 2007-2024



Tweedle - Own work, data taken from the Department of Homeland Security on Yearbook of Immigration Statistics 2021, Table 2. US Dept of Housing and Urban Development. 2024 Annual Homelessness Assessment Report (AHAR) to Congress

TB Risk Screening

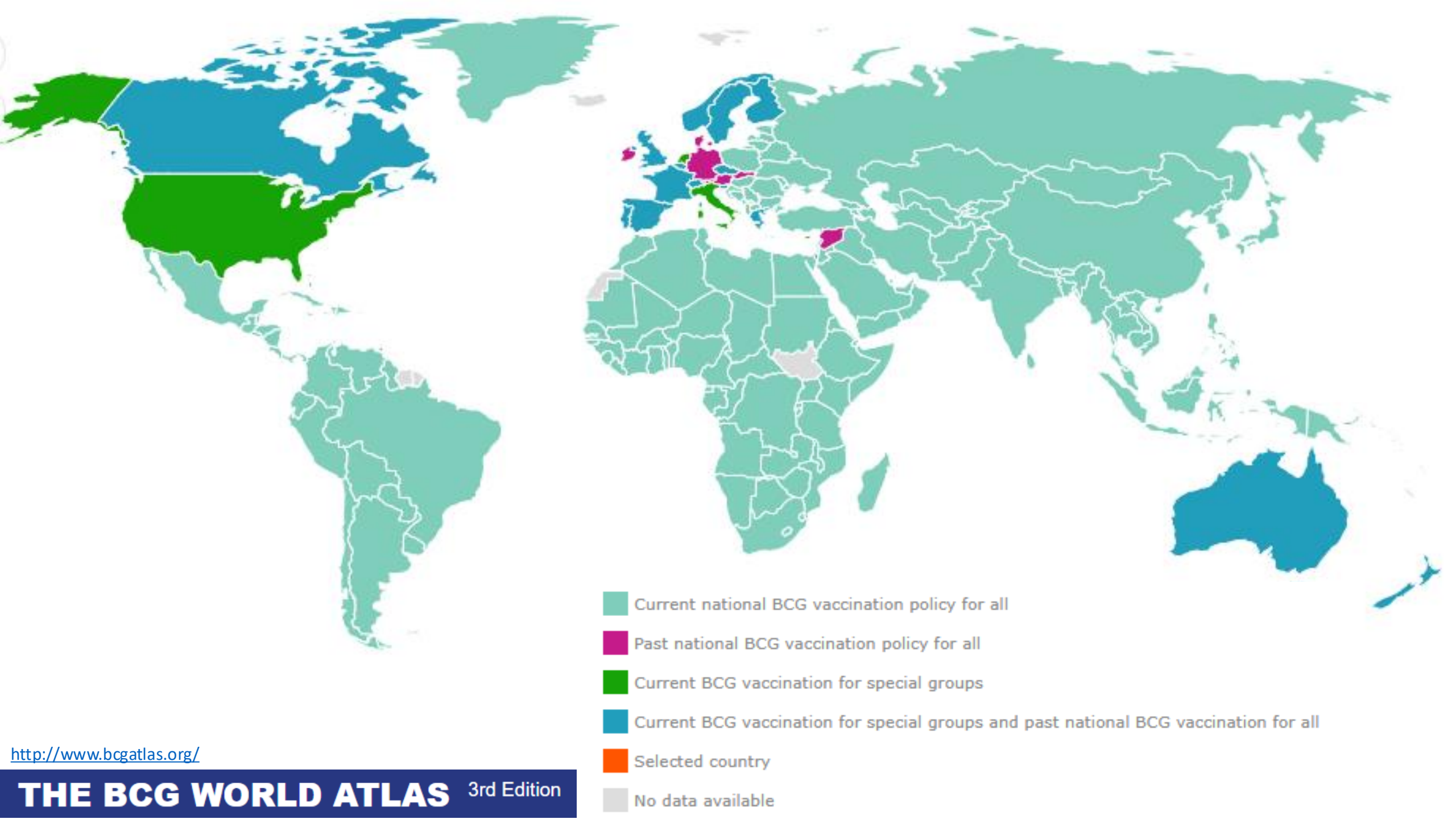
MARYLAND HEALTHY KIDS PROGRAM

Preventive Screen Questionnaire

Tuberculosis Risk Assessment: *(Starting at 1 month, 6 months of age and annually thereafter)*	**Date** ____	**Date** ____	**Date** ____	**Date** ____	**Date** ____	**Date** ____	**Date** ____
1. Has your child been exposed to anyone with a case of TB **or** a positive tuberculin skin test, **or** received a tuberculosis vaccination?	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
2. Was your child, or a household member, born in a high-risk country (countries other than the United States, Canada, Australia, New Zealand, or Western and North European countries)?	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
3. Has your child travelled (had a contact with resident populations) to a high-risk country for more than 1 week?	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
4. Does your child have daily contact with adults at high risk for TB (e.g., those who are HIV infected, homeless, incarcerated, and/or illicit drug users)?	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
5. Does your child have HIV infection?	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N

(A "yes" response or "don't know" to any question indicates a positive risk)

https://health.maryland.gov/mmcp/epsdt/healthykids/Documents/Provider%27s%20Forms/Preventive%20Screen%20Questionnaire_English.pdf



http://www.bcgatlas.org/

THE BCG WORLD ATLAS 3rd Edition

Screening methods

- Most children over age 2 should have IGRA
  - Not approved for age under 2 yrs, but can be used
  - Quantiferon Gold requires special collection kit (4 tubes) and processing within 14 hours; T-Spot requires larger blood sample, special handling
- Alternative is Tuberculin Skin Test (TST)
  - Risk of false positive with past BCG vaccination
- If either test is positive, then proceed with further evaluation (Chest radiograph, symptom screen, microbiological testing)

https://www.cdc.gov/tb/hcp/testing-diagnosis/tuberculin-skin-test.html
https://www.cdc.gov/tb/hcp/testing-diagnosis/interferon-gamma-release-assay.html
https://www.labcorp.com/tests/182879/quantiferon-tb-gold-plus
https://testdirectory.questdiagnostics.com/test/test-detail/37737/t-spottb?cc=PHP

Treatment of latent TB

- Most regimens now 4 months or less
- Once-weekly regimen (3HP) for 12 weeks, given with directly observed therapy
- Local Health Dept. may reach out to school nurse to assist with dosing.

Responding to School TB Exposure

- Tuberculosis transmission usually requires several hours of exposure.
- If there is a case in school, the local health department will work with school staff to identify highest risk individuals for testing. Children under age 5 are routinely given preventive treatment.
- Based on initial round of testing, additional groups may need to be tested

Contacts

- MDH Center for TB Control and Prevention https://health.maryland.gov/phpa/OIDPCS/CTBCP/Pages/Home.aspx
- MDH Infectious Disease Epidemiology and Outbreak Response Bureau: **410-767-6700**

Additional Information

- AAP Red Book
- MDH Clinician letter https://www.mbp.state.md.us/forms/Measles%20Clinician%20Letter_03.04.25.pdf
- CDC: https://www.cdc.gov/measles/index.html; https://www.cdc.gov/han/2025/han00522.html
- CDC “Pink Book” https://www.cdc.gov/pinkbook/hcp/table-of-contents/chapter-13-measles.html