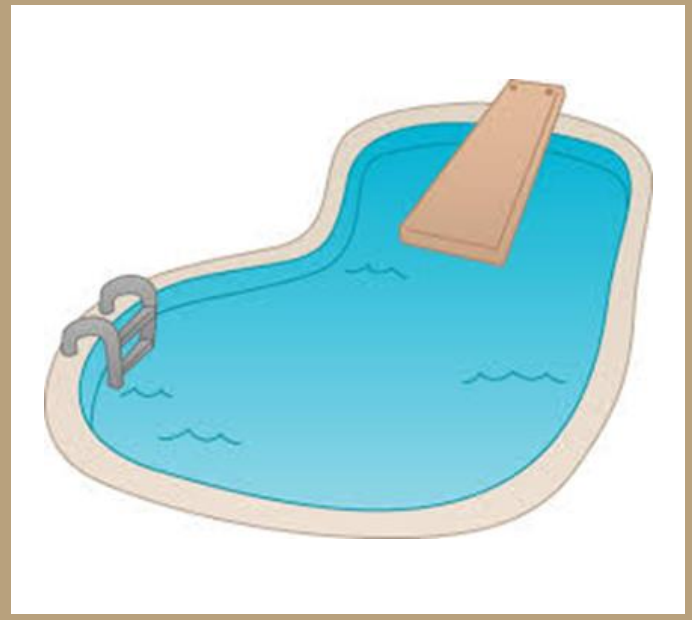


Pools, pockets, & canaries: Measles resurging in 2019

Joel Blostein, MPH

Division of Immunization

MDHHS

Michigan Department of Health & Human Services

2019 – a huge measles year


U.S. measles outbreak hits highest mark in 25 years

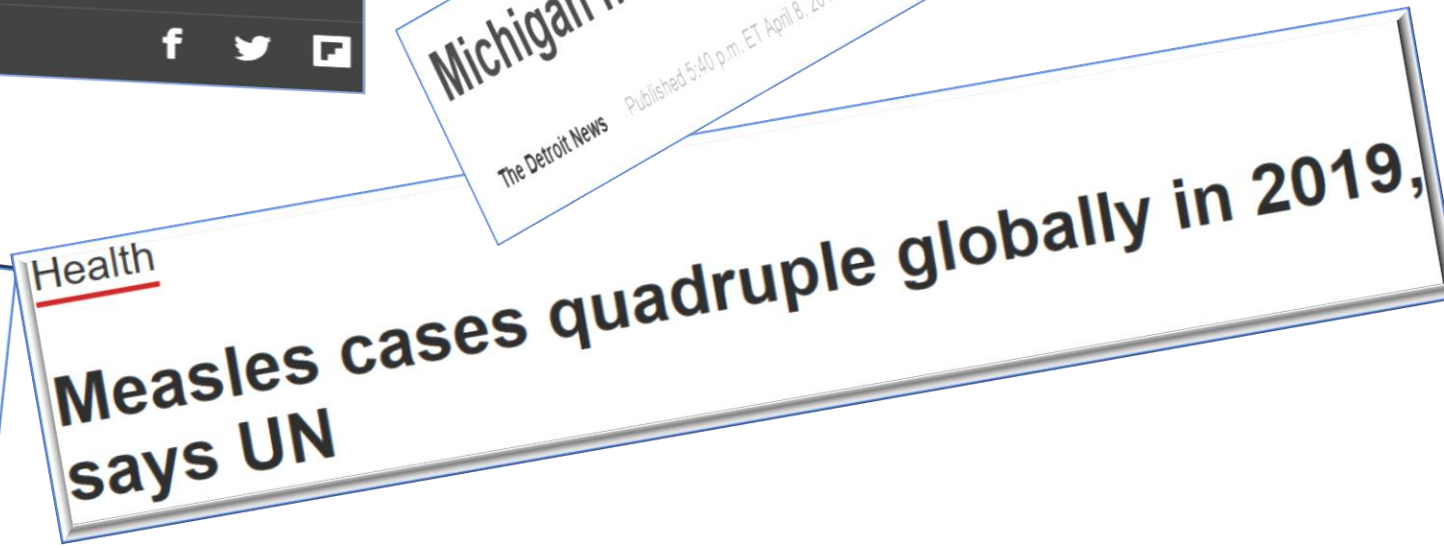
UPDATED ON: APRIL 24, 2019 / 5:00 PM / CBS/AP


Michigan measles cases climb to 41, health officials say

The Detroit News Published 5:40 p.m. ET April 8, 2019 | Updated 5:40 p.m. ET April 8, 2019


The New York Times

Measles Cases Reach Highest Level in More Than 25 Years, C.D.C. Says


Health

Measles cases quadruple globally in 2019, says UN


HEALTH AND SCIENCE

Measles cases climb to 880 in US, with most new cases in New York

PUBLISHED MON, MAY 20 2019 • 10:50 AM EDT | UPDATED MON, MAY 20 2019 • 12:46 PM EDT

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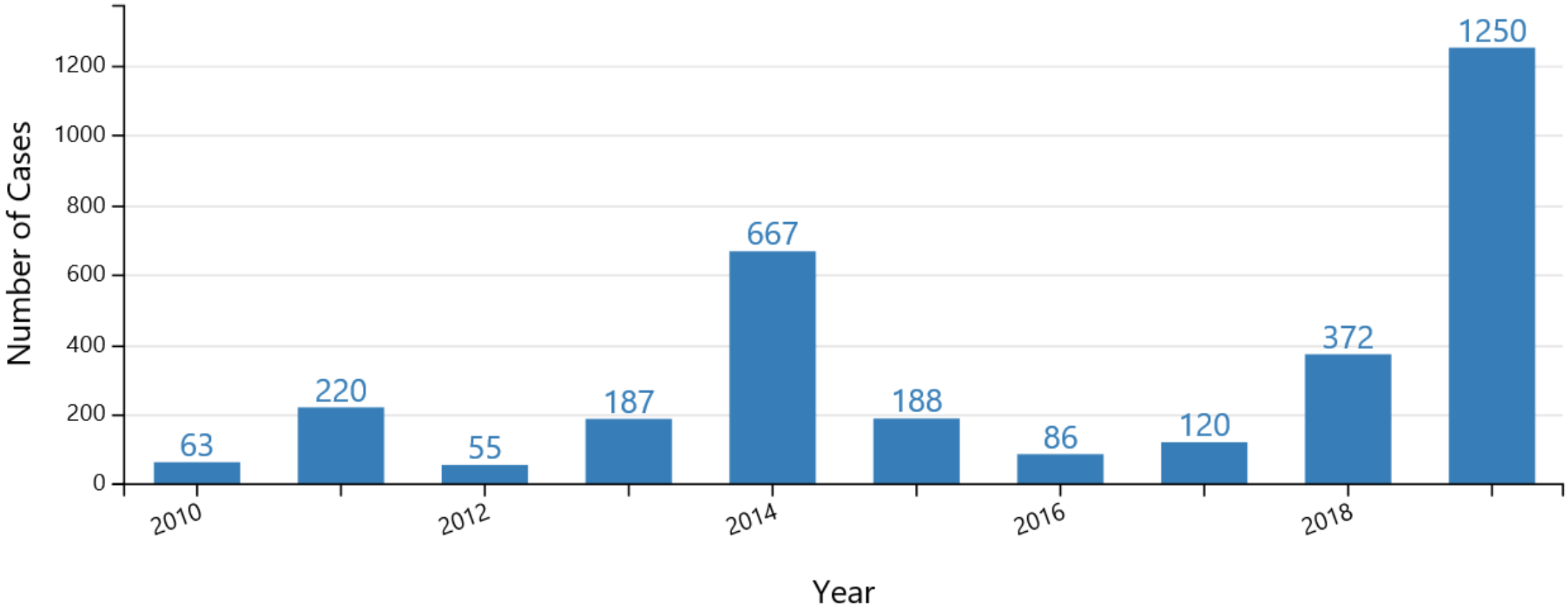
Number of Measles Cases Reported by Year -U.S.

2010-2019**(as of October 3, 2019)



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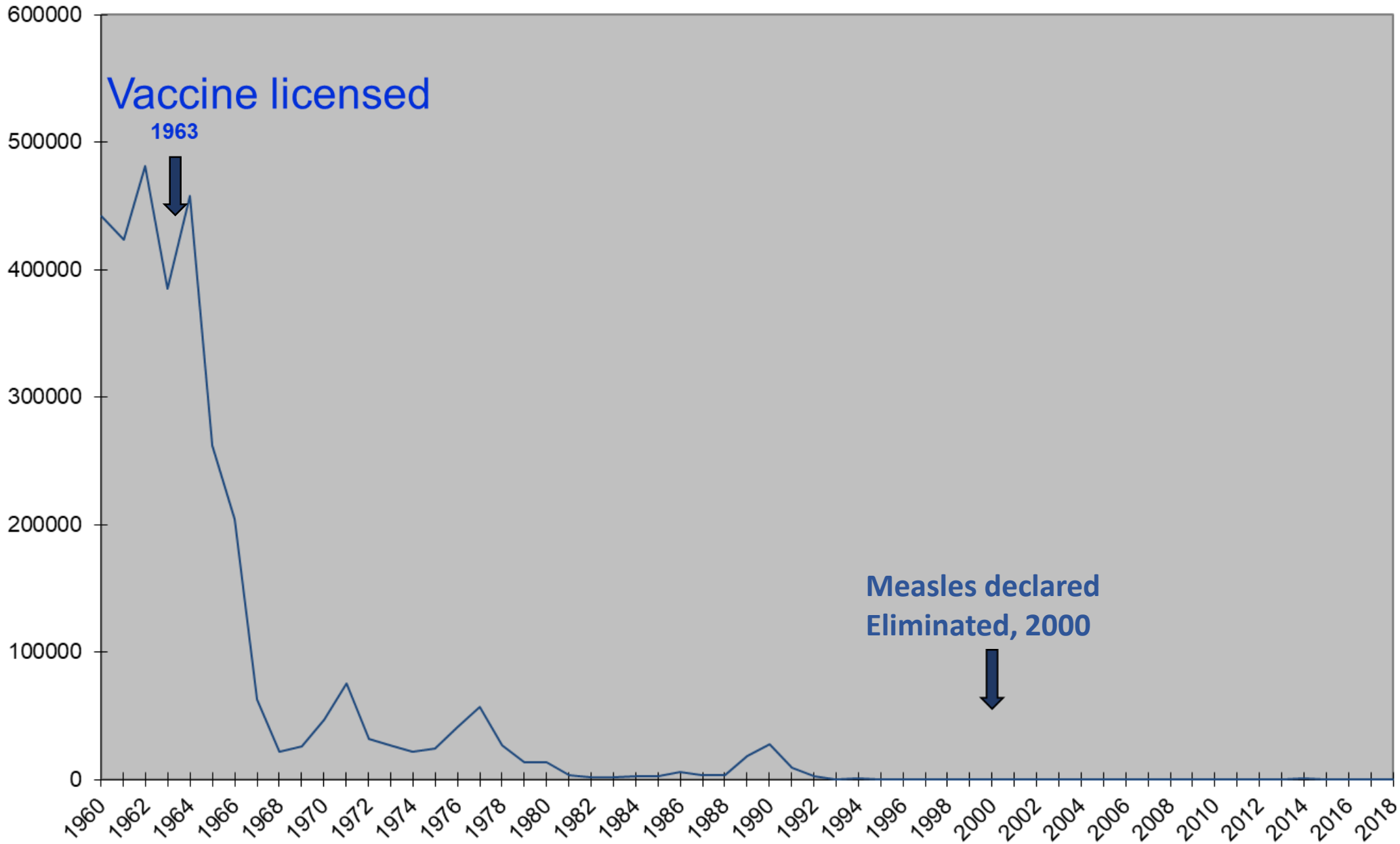
Reported Cases of Measles, United States



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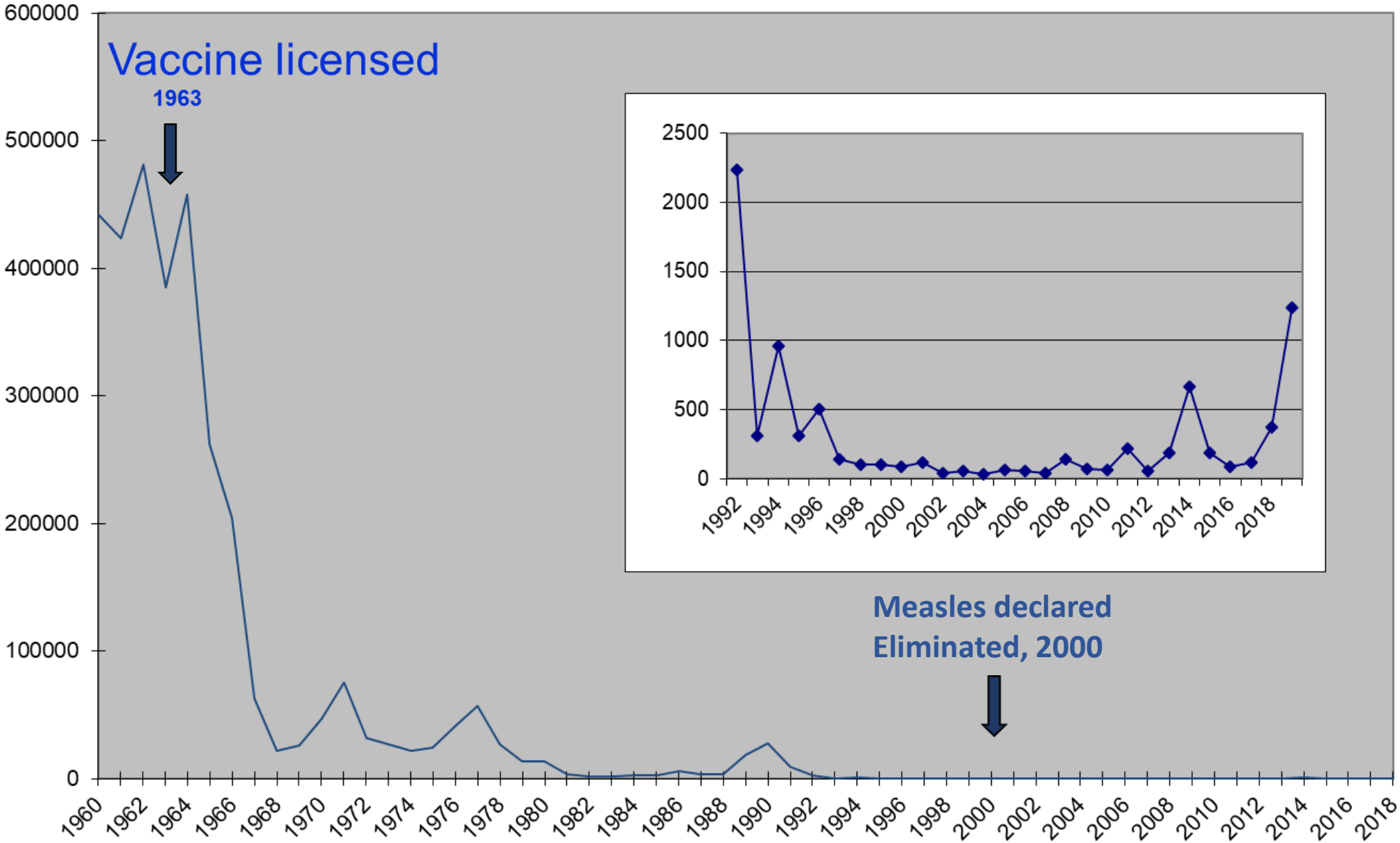
Reported Cases of Measles, United States



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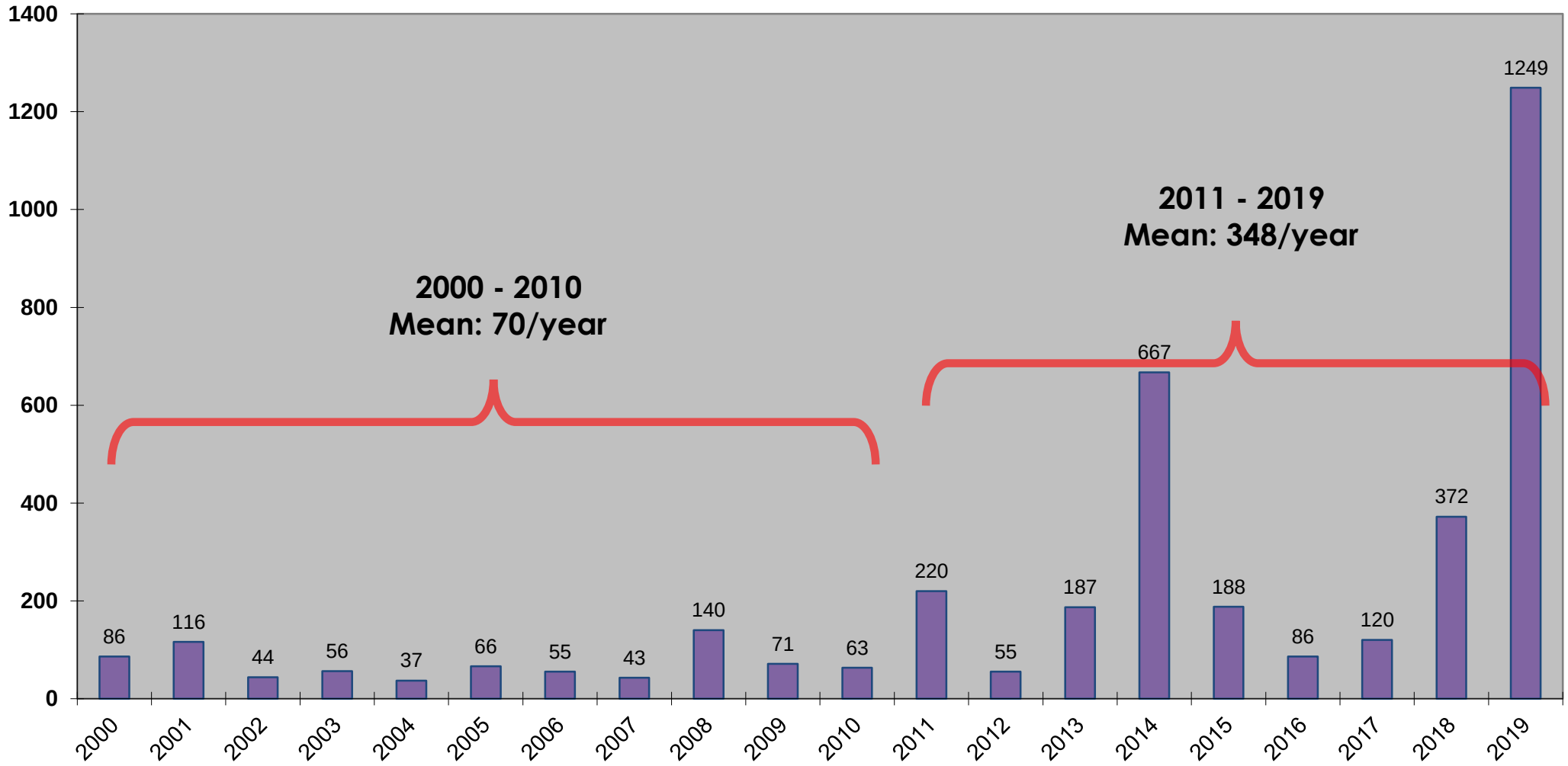
Reported Cases of Measles, United States 2000 – 2019



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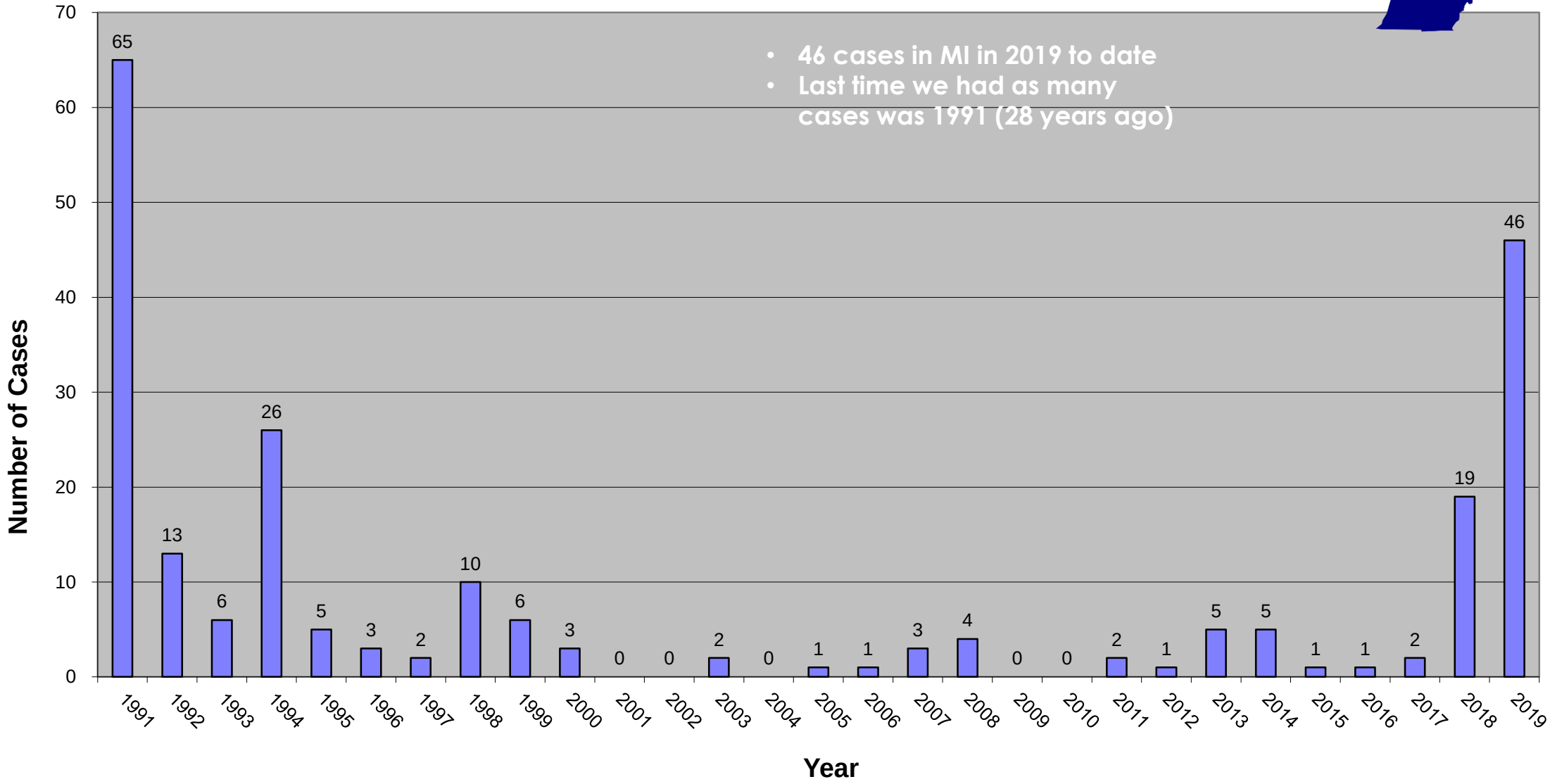
Reported Measles, Michigan, 1991-2019 (as of 9/10/2019)



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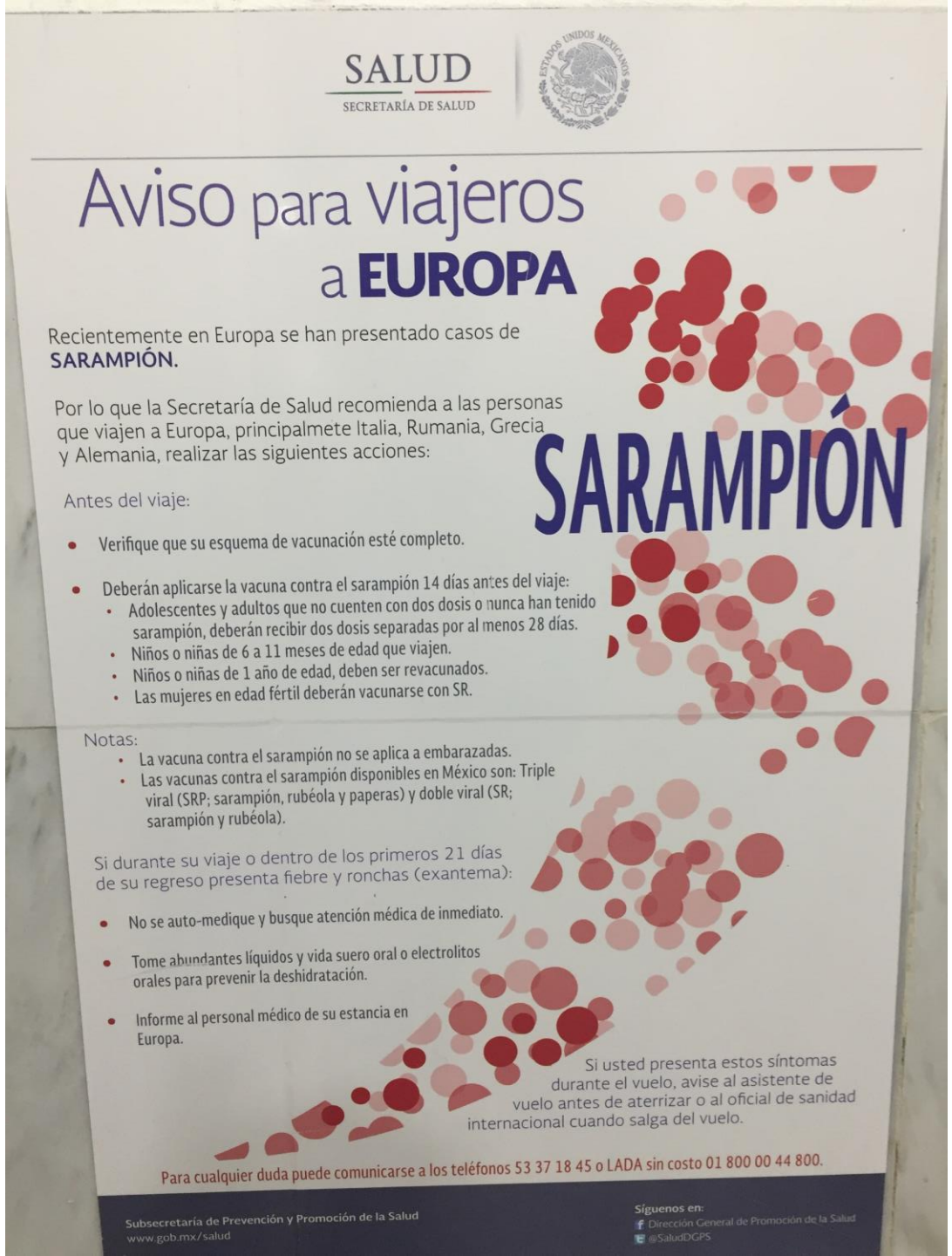
ARTESANIAS

Sign at Mexico City's Benito Juarez International Airport, Spring 2019



*"Warning for travelers to **Europe**…*

MEASLES"

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World measles situation 2019

- Multiple large outbreak areas and hot-spots
- Resurging incidence globally
- UK and at least 3 other European countries have recently lost of *Measles Elimination* status
- Domestic outbreaks can occur when travelers contract measles outside U.S. and then transmit infection to unvaccinated persons they expose in U.S.

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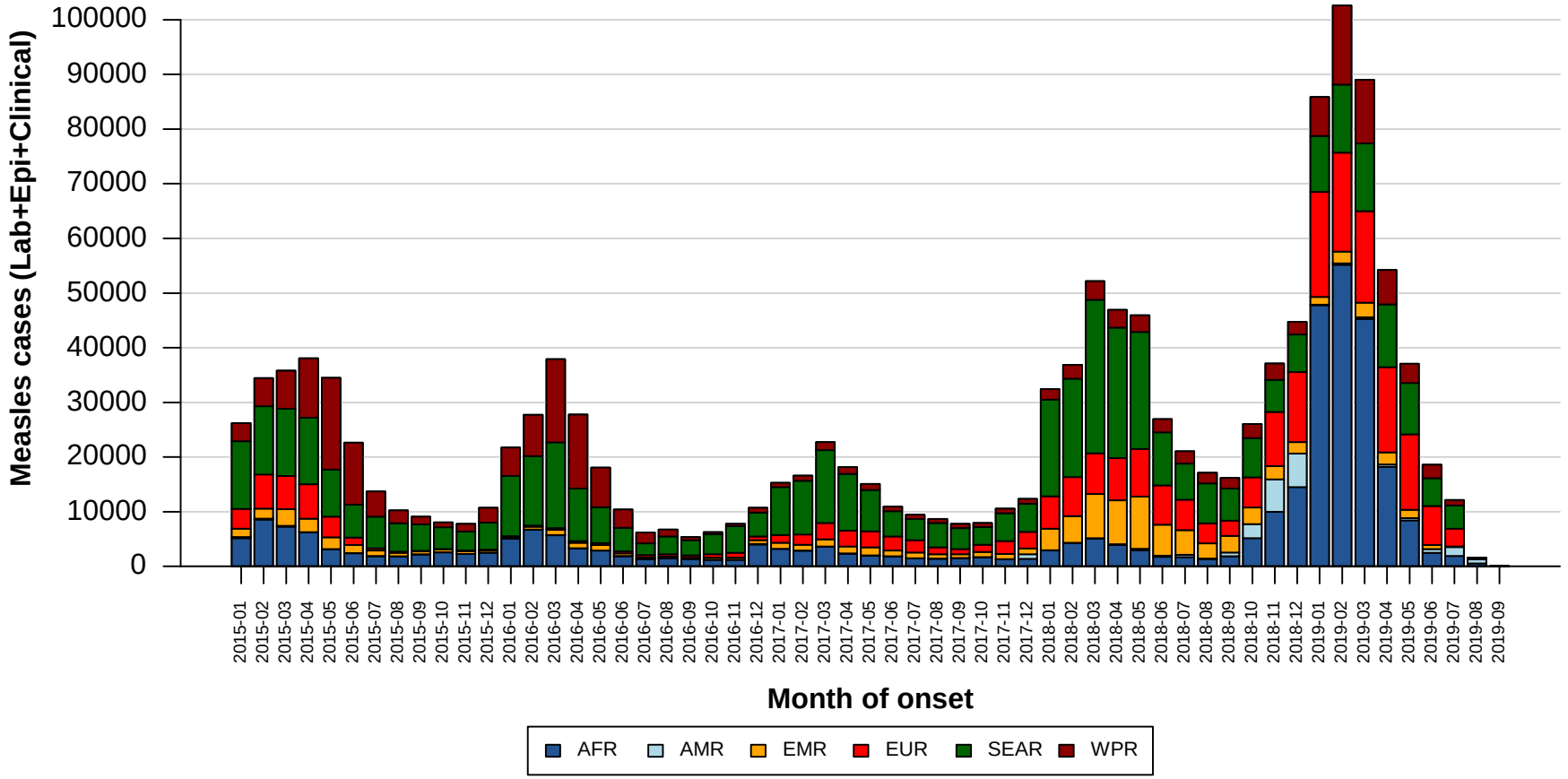
Measles case distribution by month and WHO Region (2015-2019)



Notes: Based on data received 2019-09 - Data Source: IVB Database - This is surveillance data, hence for the last month(s), the data may be incomplete.

2019-09-09

Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Early Release / Vol. 68
October 4, 2019

National Update on Measles Cases and Outbreaks — United States, January 1–October 1, 2019

Manisha Patel, MD[1]; Adria D. Lee, MSPH[1]; Nakia S. Clemmons, MPH[1]; Susan B. Redd[1]; Sarah Poser[1]; Debra Blog, MD[2]; Jane R. Zucker, MD[3,4]; Jessica Leung, MPH[1]; Ruth Link-Gelles, PhD[1]; Huong Pham, MPH[1]; Robert J. Arciuolo, MPH[3]; Elizabeth Rausch-Phung, MD[2]; Bettina Bankamp, PhD[1]; Paul A. Rota, PhD[1]; Cindy M. Weinbaum, MD[4]; Paul A. Gastañaduy, MD[1]

During January 1–October 1, 2019, a total of 1,249 measles cases and 22 measles outbreaks were reported in the United States. This represents the most U.S. cases reported in a single year since 1992 (*1*), and the second highest number of reported outbreaks annually since measles was declared eliminated* in the United States in 2000 (*2*). Measles is an acute febrile rash illness with an attack rate of approximately 90% in susceptible household contacts (*3*). Domestic outbreaks can occur when travelers contract measles outside the United States and subsequently transmit infection to unvaccinated persons they expose in the United States. Among the 1,249 measles cases reported in 2019, 1,163 (93%) were associated with the 22 outbreaks, 1,107 (89%) were in patients who were unvaccinated or had an unknown vaccination status, and 119 (10%) measles patients were hospitalized. Closely related outbreaks in New York City (NYC) and New York State (NYS; excluding NYC), with ongoing transmission for nearly 1 year in large and close-knit Orthodox Jewish communities, accounted for 934 (75%) cases during 2019 and threatened the elimination status of measles in the United States. Robust responses in NYC and NYS were effective in controlling transmission before the 1-year mark; however, continued vigilance for additional cases within these communities is essential to determine whether elimination has been sustained. Collaboration between public health authorities and undervaccinated communities is important for preventing outbreaks and limiting transmission. The combination of maintenance of high national vaccination coverage with measles, mumps, and rubella vaccine (MMR) and rapid implementation of measles control measures remains the cornerstone for preventing widespread measles transmission (*4*).

Measles cases are classified according to the Council of State and Territorial Epidemiologists' case definition for measles (*5*). Cases are considered internationally imported if at least part of the exposure period (7–21 days before rash onset) occurred outside the United States and rash occurred within 21 days of entry into the United States, with no known exposure to measles in the United States during the exposure period. An outbreak of measles is defined as a chain of transmission of three or more cases linked in time and place as determined by local and state health department investigations.

During January 1–October 1, 2019, a total of 1,249 measles cases were reported in 31 states and New York City,† including 1,211 (97%) among U.S. residents. Median patient age was 6 years (interquartile range [IQR] = 2–22 years); 13% were infants aged <12 months (not routinely recommended to receive MMR vaccine), 31% were children aged 1–4 years, 27% were school-aged children aged 5–17 years, and 29% were adults aged ≥18 years (Table). Among all measles patients, 1,107 (89%) were unvaccinated or vaccination status was unknown, and 142 (11%) had received ≥1 MMR vaccination. Most cases (1,054, 84%) were laboratory-confirmed; among 714 (57%) cases for which specimens were available for molecular sequencing, genotypes B3 (49, 7%) and D8 (665, 93%) were identified. Overall, 119 (10%) patients were hospitalized (median age 6 years, IQR = 1–33 years; 20% were infants aged <12 months), 60 (5%) had pneumonia, and one (0.1%) had encephalitis; no deaths were reported to CDC. Eighty-one cases

* According to the World Health Organization, measles elimination status is based on the absence of endemic measles transmission in a defined geographical area (e.g., region or country) for ≥12 months in the presence of a well-performing surveillance system. https://www.who.int/immunization/policy/position_papers/measles/en/.

† Alaska (1), Arizona (1), California (68), Colorado (1), Connecticut (3), Florida (3), Georgia (7), Hawaii (1), Idaho (2), Illinois (9), Indiana (1), Iowa (2), Kentucky (2), Maine (1), Maryland (5), Massachusetts (2), Michigan (46), Missouri (1), Nevada (1), New Hampshire (1), New Jersey (18), New Mexico (1), New York State (309; excludes New York City), New York City (605; excludes New York State), Ohio (1), Oklahoma (4), Oregon (24), Pennsylvania (16), Tennessee (5), Texas (21), Virginia (1), and Washington (86).

The NEW ENGLAND JOURNAL of MEDICINE

Perspective

April 17, 2019
DOI: 10.1056/NEJMp1905099

Measles in 2019 — Going Backward

Catharine I. Paules, M.D., Hilary D. Marston, M.D., M.P.H., and Anthony S. Fauci, M.D.

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What's going on?

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2019 measles situation

- **Does not** represent a failure of measles vaccine in any way.
  - Vaccine continues to work great

- Rather, this is *a failure to vaccinate* and a failure to utilize measles vaccine to its potential

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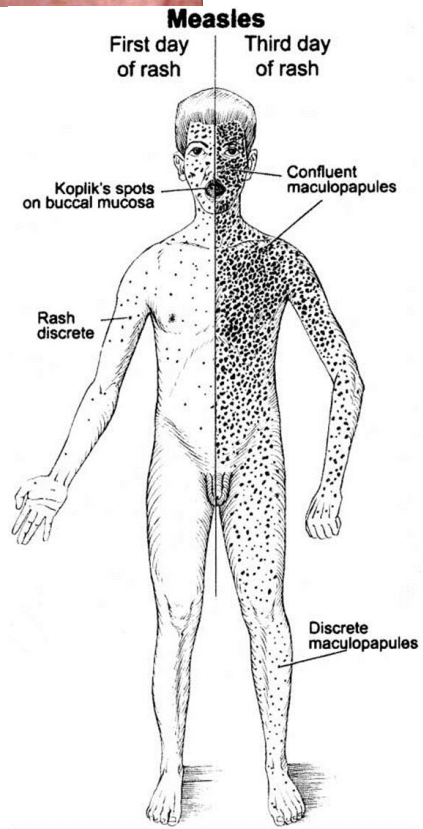

Brief review: measles disease

- Highly-contagious respiratory disease caused by a virus
- High fever, cough, coryza, conjunctivitis
- Red, raised rash later appears on head/face, then progresses to full body rash, becomes blotchy, lasts several days

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RESEARCH ARTICLE

Measles virus infection diminishes preexisting antibodies that offer protection from other pathogens

Michael J. Mina[1,2,3,*,†], Tomasz Kula[1,2], Yumei Leng[1], Mamie Li[2], Rory D. de Vries[4], Mik...

+ See all authors and affiliations

Science 01 Nov 2019:
Vol. 366, Issue 6465, pp. 599-606
DOI: 10.1126/science.aay6485

RESEARCH ARTICLE | INFECTIOUS DISEASES

Incomplete genetic reconstitution of B cell pools contributes to prolonged immunosuppression after measles

Velislava N. Petrova[1,*], Bevan Sawatsky[2], Alvin X. Han[3,4], Brigitta M. Laksono[5], Lisa W...

+ See all authors and affiliations

Science Immunology 01 Nov 2019:
Vol. 4, Issue 41, eaay6125
DOI: 10.1126/sciimmunol.aay6125

2 studies published last week, in *Science* and *Science Immunology:*

- Illustrate how measles virus causes long-term damage to immune system
- Measles virus infection creates a form of “immune amnesia”
- Can leave children at increased risk of illness from other diseases for years

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Measles transmission

- Measles is highly contagious and easily spread!
- Airborne transmission from respiratory secretions (coughing/sneezing)
- Attack rate of 90% in susceptible household contacts
- In a susceptible population, one person with measles on average will give it to 16-18 people

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Reasons for less than 100% immune individuals

- **Biological** failure: some people (immune systems) fail to respond

- **Programmatic** failures:
  - "Spoiled" vaccine
    - storage/handling issues
  - Vaccine administration errors
    - wrong route, wrong dose, wrong schedule, etc

- Non-vaccinators:
  - Medical contra-indication
  - Religious or personal belief exemptors (waivers)

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Herd immunity (community immunity) concepts

- The overall population has protection when a sufficient proportion (%) of the members is immune to a disease,
- Thus, even persons without immunity get protection because disease has less opportunity to be spread in the community.
- We depend on herd immunity to protect those who can't be vaccinated
  - infants too young to get vaccine
  - persons with immune deficiency disorders or cancer
- The community -- the public's health -- benefits from this.

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Herd immunity with respect to measles

- Because measles is so contagious, must have very high level of population immunity to prevent spread and outbreaks
- Threshold level of community/herd immunity for measles needs to be **at least** 95% to prevent outbreaks
- With measles, very little “wiggle room”

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Pool of susceptibles

- Over time the reservoir, or pool, of susceptible persons accumulates and grows bigger
- “fuel for the fire”
- Increases the risk of measles outbreaks

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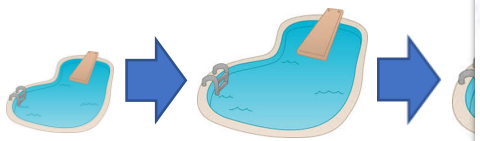
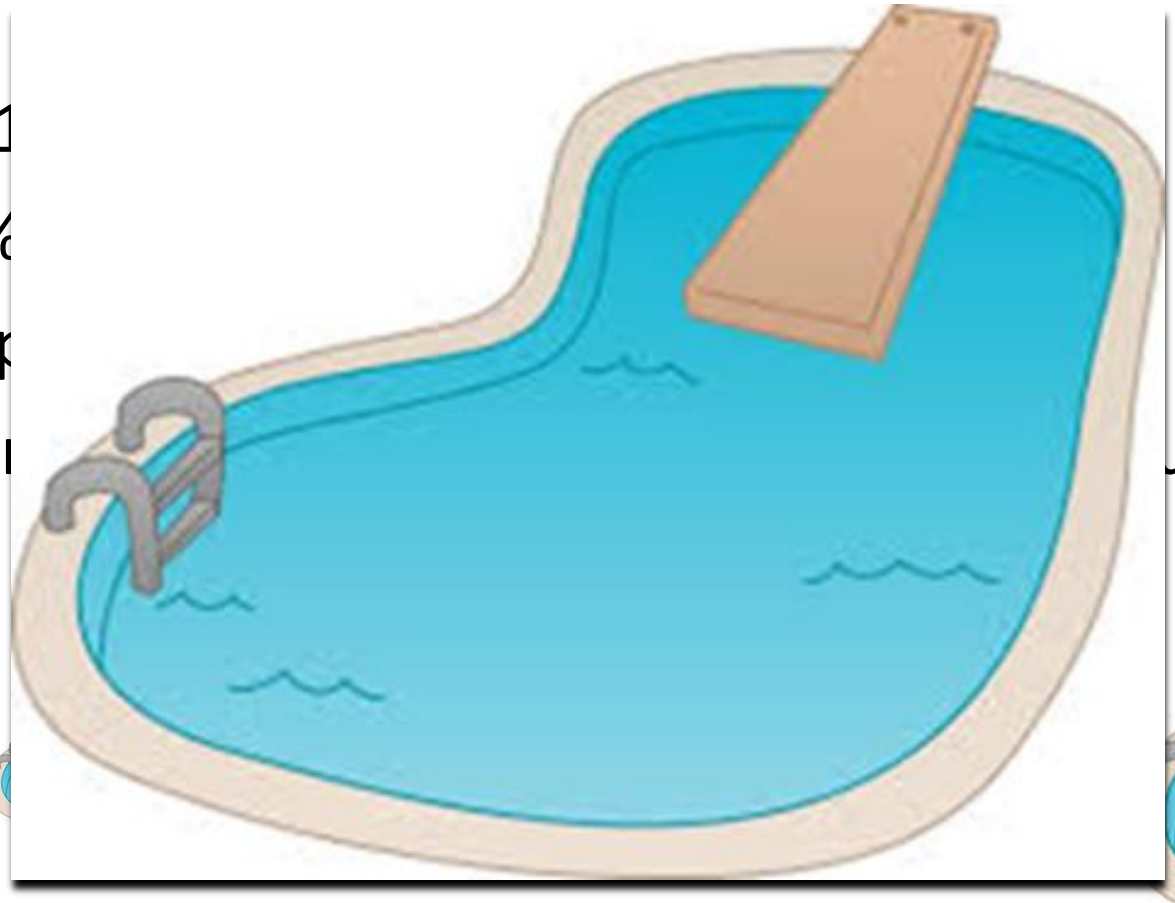
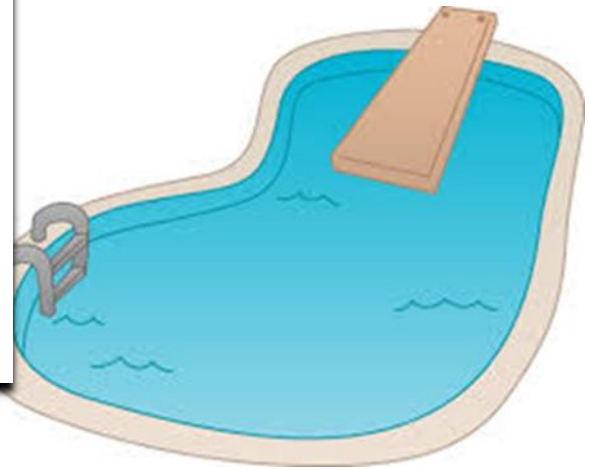
Pool of susceptibles accumulates, grows

- Michigan: ~1
- Assume 98%
- 2,200 suscep
- Over 20 yea usceptible to measles







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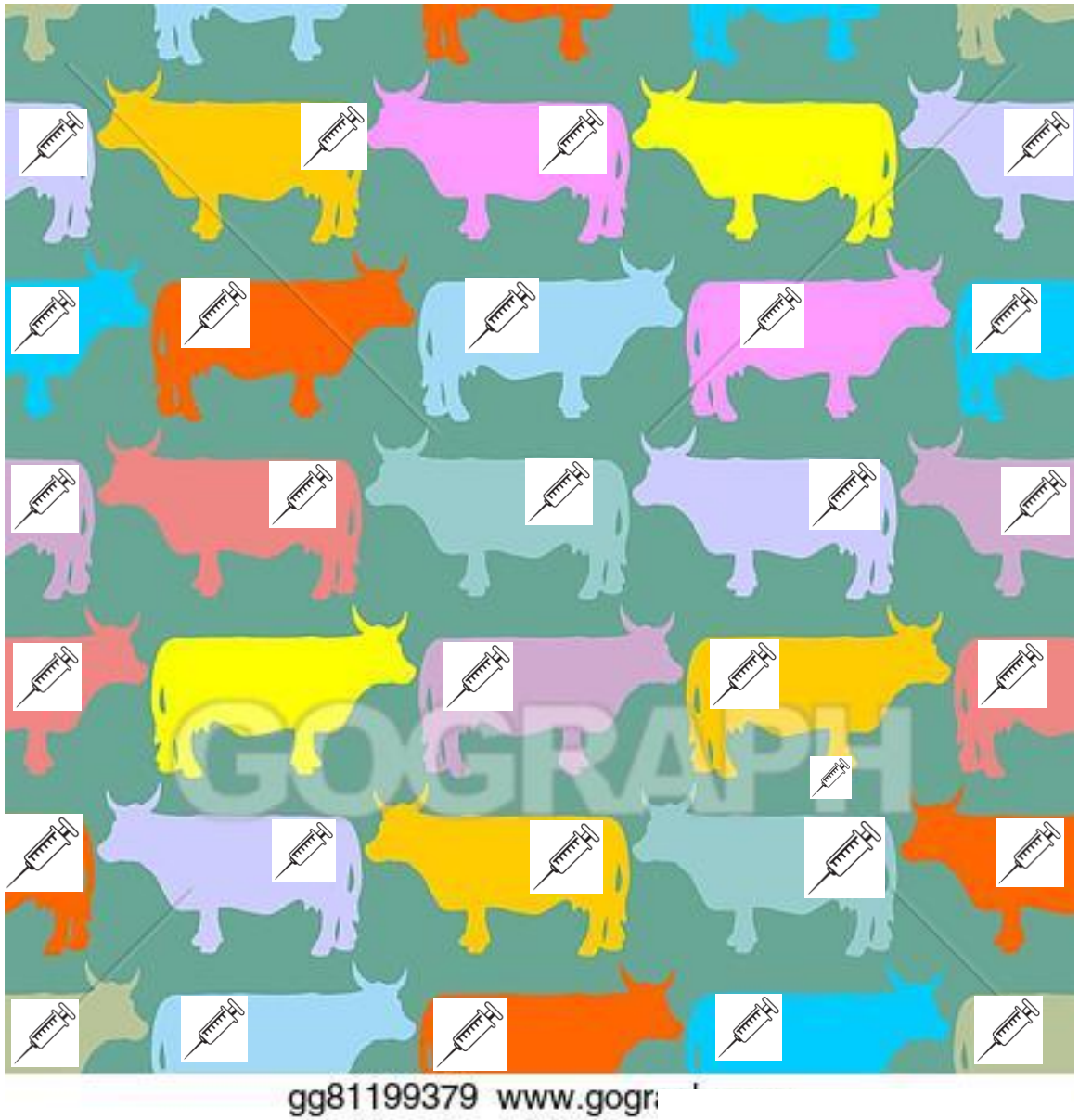

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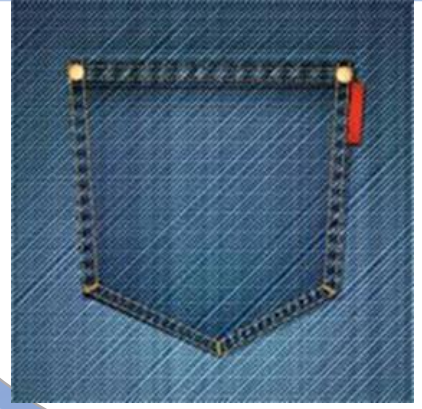
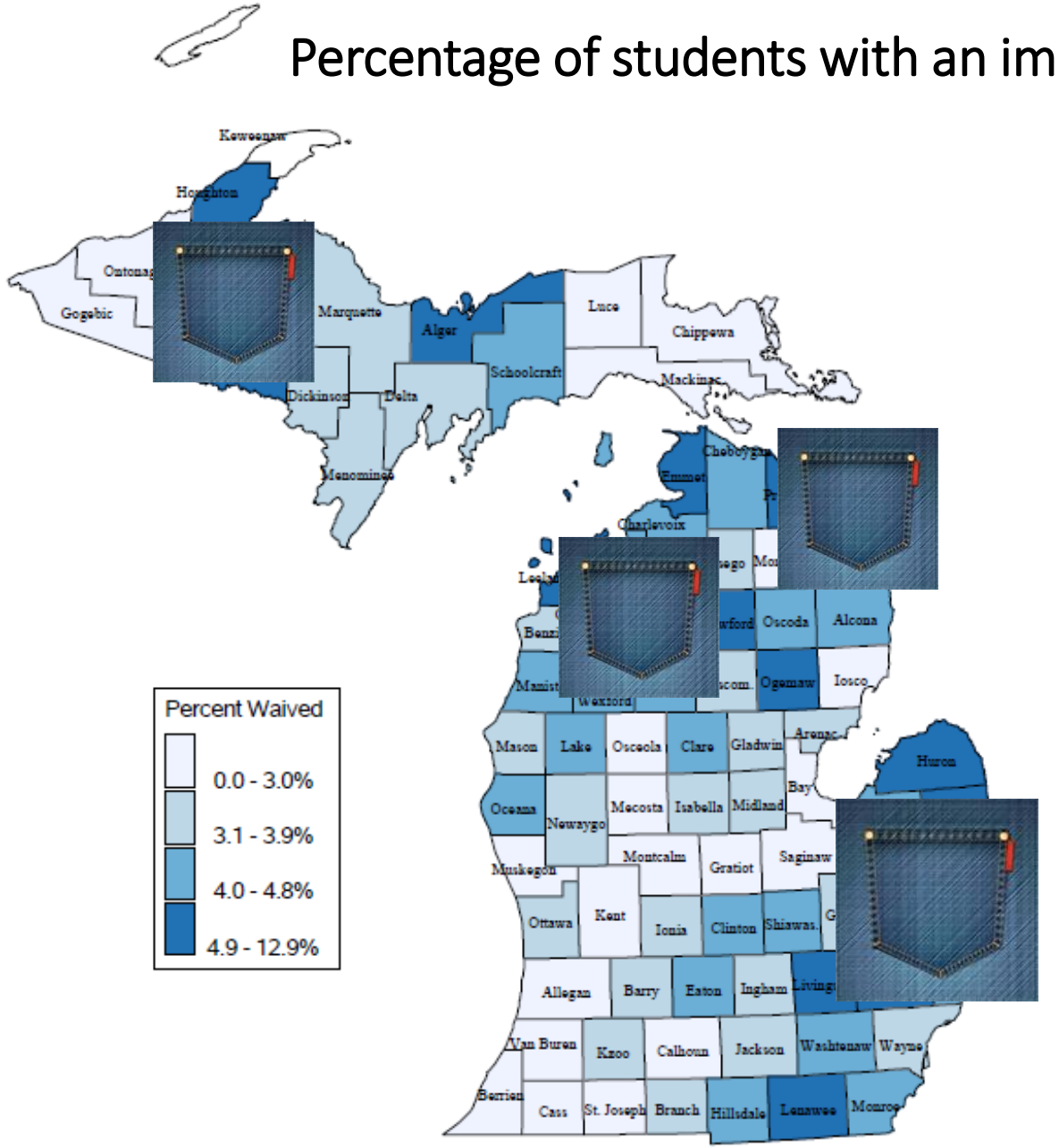


Pockets: concentrated geographic areas of low vaccination rates (lots of susceptibles)

- Like-minded vaccine avoiders tend to congregate together (“birds of a feather…”)
- Geographic areas with high levels of susceptibles
- High risk for outbreaks and sustained transmission if measles virus is introduced

Percentage of Students with an Immunization Waiver by County, 2018 Final Data

Percentage of students with an immunization waiver, 2018



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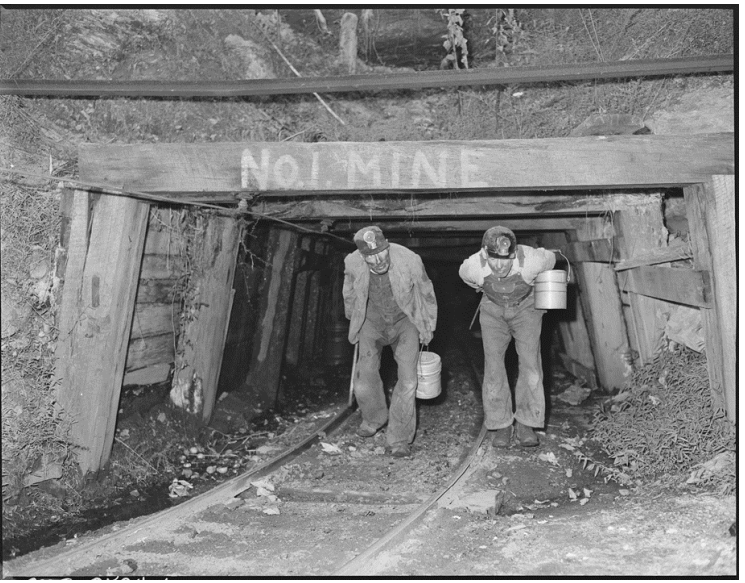
Measles as warning "Canary"

- Measles – essentially a sentinel vaccine-preventable disease
  - Like proverbial "canary in coal mine"
  - Serves to warn us



- If our vaccination rates are not good enough – measles likely to be the first VPD to appear and cause outbreaks because it is so highly contagious

- But it won't be the only VPD challenging us…

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ASSOCIATION OF STATE AND TERRITORIAL HEALTH OFFICIALS

PRESS ROOM

Health Officials Alarmed by Declining U.S. Vaccination Rates, Country Could Face Scenario Like Europe's Measles Outbreak

ARLINGTON, VA (Oct. 25, 2018)—The Association of State and Territorial Health Officials (ASTHO) is concerned about the latest skepticism and resistance originating from the anti-vaccination movement, especially as we enter another deadly flu season. Health officials are alarmed that this pushback may put our country at risk for significant infectious disease outbreaks and their related health consequences, including death, because of declining vaccination rates.

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Measles

“I consider it really an irony that you have one of the most contagious viruses known to man juxtaposed against one of the most effective vaccines that we have -- and yet we don’t do, and have not done, what could be done, namely completely eliminate and eradicate this virus.”

Dr. Anthony Fauci, director of the National Institute for Allergy and Infectious Diseases, told House Energy and Commerce oversight committee Feb 27, 2019

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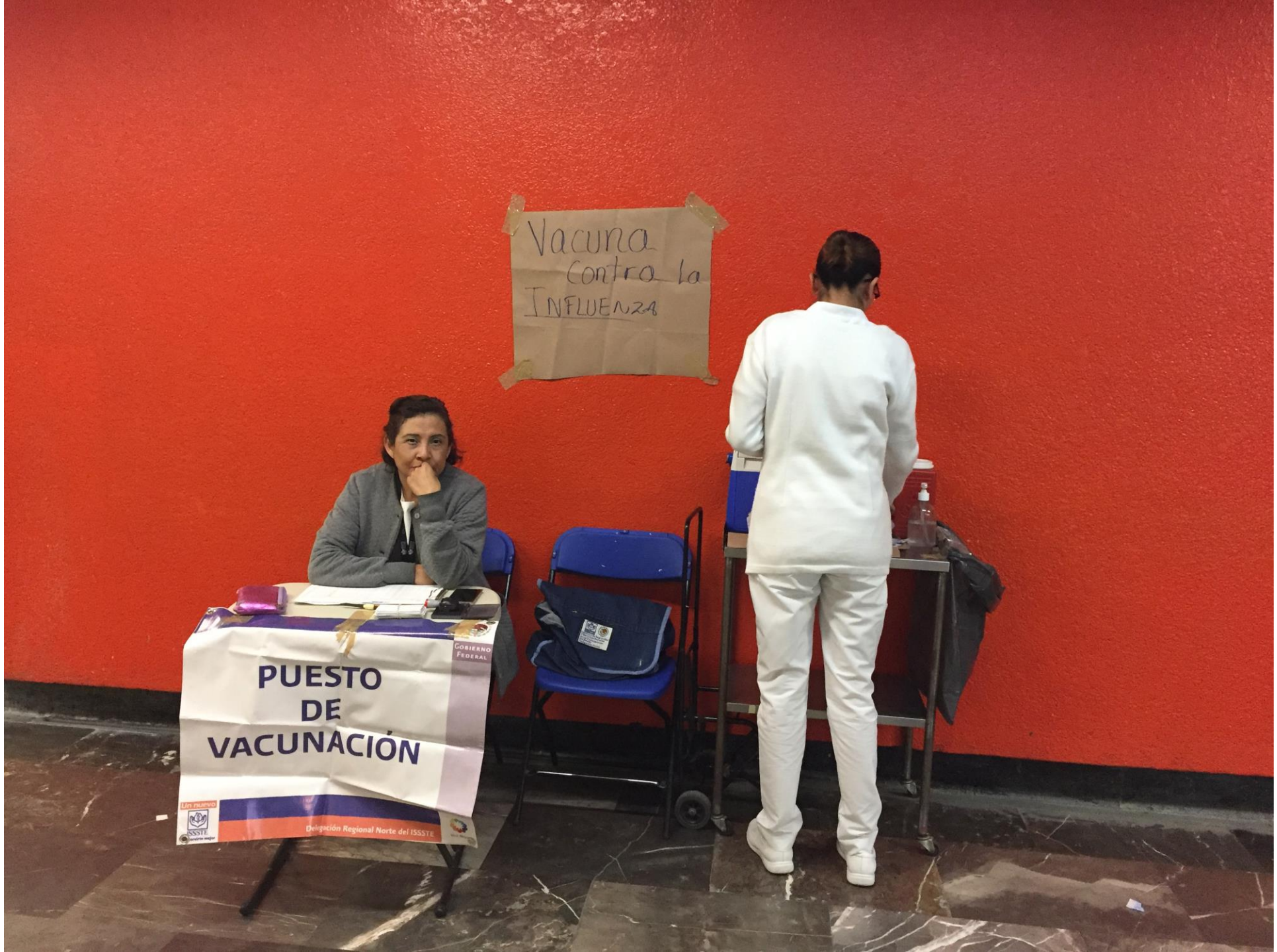

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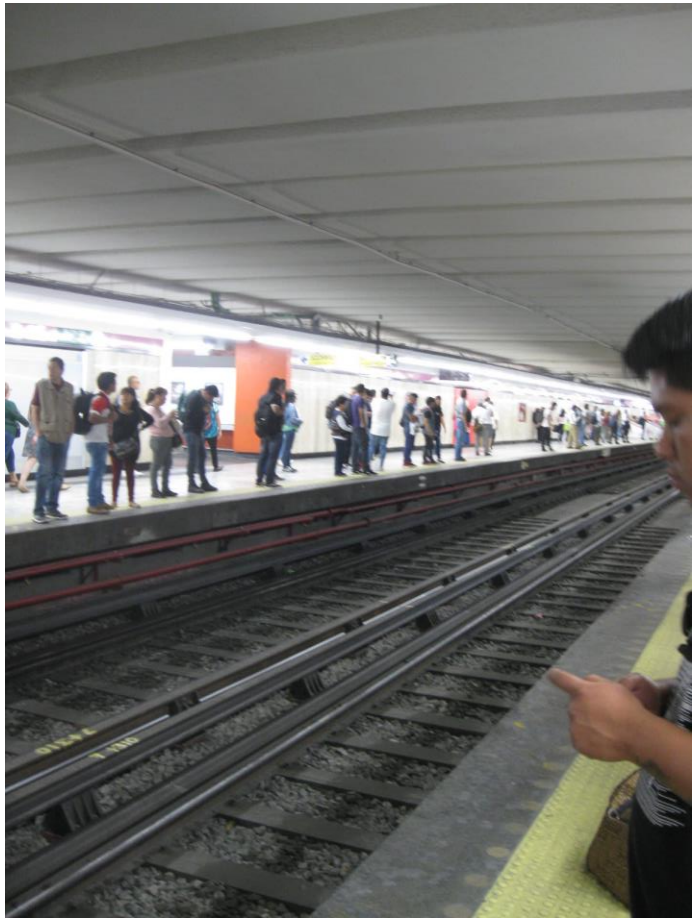

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Summary

- 2019: worrisome measles resurgence – U.S., Michigan, worldwide
- A threat to U.S. **Measles Elimination** status
- Factors:
  - Measles is highly contagious
  - Endemic in much of world;
  - Accumulation & growth of pool of susceptibles over time;
  - Concentrated areas (“pockets”) with low vaccination rates
  - Vaccine hesitancy/refusal
- Measles may be harbinger of more VPD problems to come

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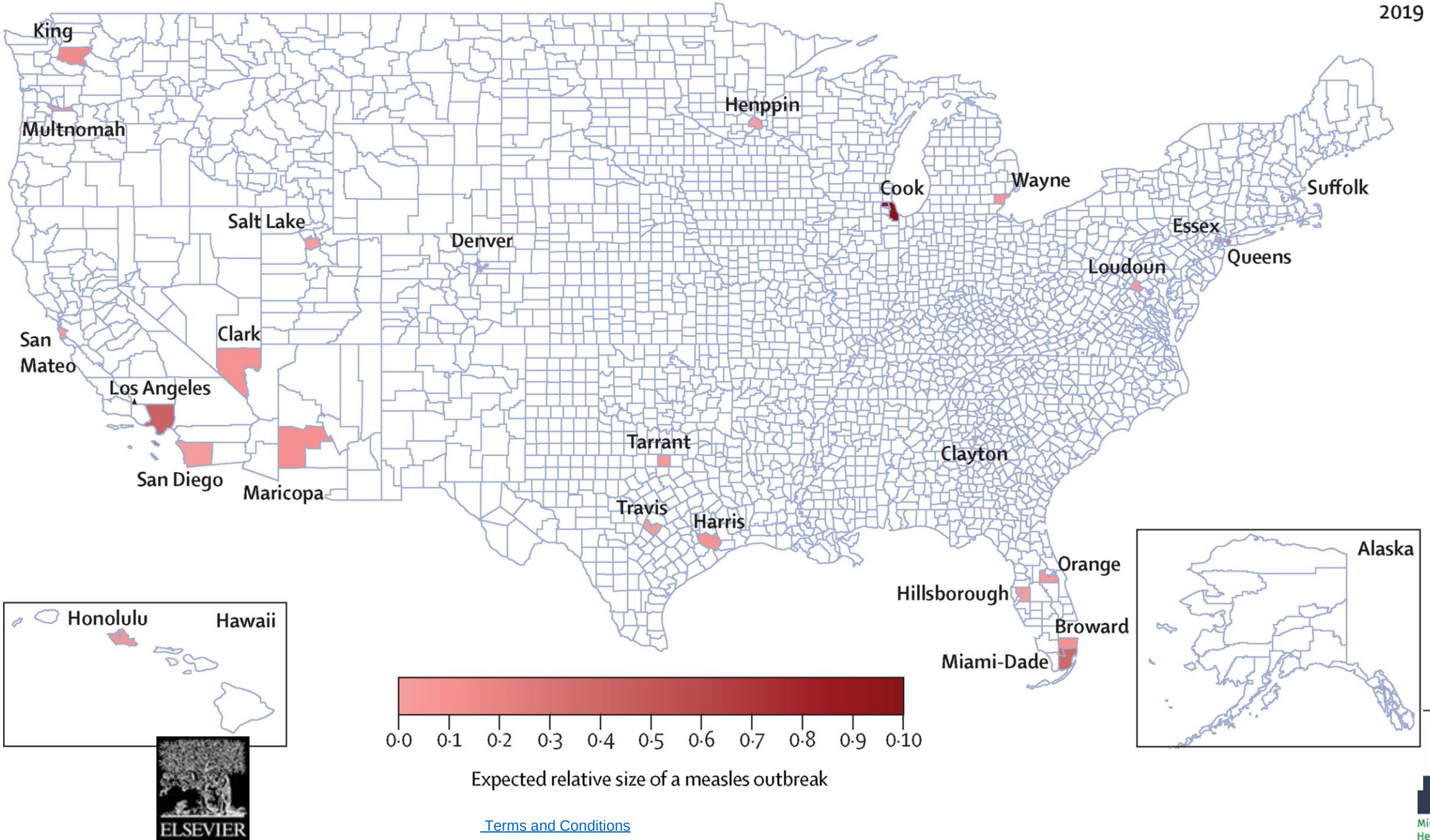

Michigan measles, 2018 - 19 cases

Case 1 (March) – 21y.o. F, not vx'd - contracted during travel in India

Case 2 (June) – 49 y.o. M, unk vx status - contracted in Italy

Case 3 (July) – 36 y.o. M, unk vx status contracted during travel in Philippines

Case 4 (July) – 22 y.o. F, not vx'd - contracted during travel in Europe

- **Cases 5 – 10** (July): unvaccinated siblings of Case 4

Cases 11 & 12 (October) – 25 y.o. M, 2 y.o. son - contracted in Israel

- **Cases 13-19** (November): unvaccinated household contacts of Cases 11/12

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