

Non-Medical Exemptions and Vaccine Refusal Put People at Risk. Examine the Evidence for Yourself.

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1. **Measles – United States, January 1, 2020–March 28, 2024.** Mathis AD, Raines K, Masters NB, et al. CDC. *Morbidity and Mortality Weekly Report (MMWR)*, April 11, 2024; 73(14):295–300.

SUMMARY: Summary: During January 1, 2020–March 28, 2024, CDC was notified of 338 confirmed measles cases which occurred in 30 jurisdictions; 29% of these cases occurred in the first quarter of 2024. Among the 338 cases, the median age was 3 years (range 0–64) and 309 (91%) were unvaccinated or had unknown vaccination status. The 338 cases represented 92 identified chains of transmission, 20 (22%) of which were associated with outbreaks of 3 or more cases. Clusters of unvaccinated people placed communities at risk of large outbreaks as was seen in central Ohio in 2022. There were 86 cases identified and the outbreak lasted 63 days; 94% of cases were unvaccinated and 42% were hospitalized.

KEY FINDINGS: The article affirms that measles elimination in the U.S. has been maintained and highlights the risk for reintroduction of measles due to ongoing outbreaks overseas and lower global measles vaccination coverage. Among 93 measles cases that were directly imported from another country, 63% occurred in U.S. residents, 90% of whom were eligible for vaccination but were unvaccinated or their vaccination status was unknown. Two-dose MMR coverage in the U.S., has remained below 95% for three consecutive years and some jurisdictions have reported coverage below 90%. For the 2022–2023 school year, 10 states reported exemptions rates among kindergarten children of >5%. Maintaining measles elimination will require increasing MMR coverage, identifying undervaccinated communities, encouraging vaccination prior to international travel, and maintaining a strong surveillance system.

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

2. **Community Outbreak of Measles – Clark County, Washington, 2018–2019.** Carlson A, Riethman M, Gastañaduy P, et al. CDC. *Morbidity and Mortality Weekly Report (MMWR)*, May 17, 2019; 68(19):446–7.

SUMMARY: On December 31, 2018, Clark County Public Health in Washington was notified of a suspected case of measles in an unvaccinated 10-year-old child, who had recently arrived from Ukraine. By January 16, an additional 12 laboratory-confirmed cases led to an approximately 200 person multiagency response. As of March 28, measles had been confirmed among 71 Clark County residents, with rash onsets from December 30, 2018 to March 13, 2019.

KEY FINDINGS: Among the 71 patients with confirmed measles, ages ranged from 1 to 39 years; 52 (73%) were children younger than 10 years. Sixty-one (86%) were unvaccinated, 3 (4%) had receive 1 dose of MMR before measles exposure, and vaccination status was unknown for 7 (10%).

LINK: www.cdc.gov/mmwr/volumes/68/wr/mm6819a5.htm

3. **Notes from the Field: Tetanus in an Unvaccinated Child – Oregon, 2017.** Weekly, March 8, 2019; 68(9). Guzman-Cottrill R, Lancioni C, Eriksson C, Yoon-Jae C, Liko J. CDC. *Morbidity and Mortality Weekly Report (MMWR)*, March 8, 2019; 68(9):231–2.

SUMMARY: The article describes a case of tetanus in an unvaccinated 6-year-old boy after he sustained a forehead laceration while playing outdoors on a farm. Six days later he developed episodes of crying, jaw clenching, and involuntary upper extremity muscle spasms, followed by arching of the neck and back (opisthotonus) and generalized spasticity. He was brought for medical care after having difficulty breathing and a diagnosis of tetanus was made. The child made a full recovery but required 57 days of inpatient care and 17 days of inpatient rehabilitation at a cost of over \$800,000. The family declined subsequent doses of DTaP and other recommended vaccinations.

KEY FINDINGS: Tetanus, caused by *Clostridium tetani*, is a serious bacterial infection and can be prevented with vaccination with any available tetanus toxoid-containing vaccine (DTaP, Td, Tdap). With widespread use of these vaccines, cases of tetanus in the U.S. have declined by 95% and tetanus-related deaths by 99%. From 2009 to 2015, 197 tetanus cases and 16 tetanus-associated deaths were reported in the United States. Unvaccinated or inadequately vaccinated people are at risk for tetanus, as this case demonstrates. Recovery from tetanus disease does not confer immunity so follow up vaccination is important.

LINK: www.cdc.gov/mmwr/volumes/68/wr/mm6809a3.htm

4. **Public Health Consequences of a 2013 Measles Outbreak in New York City.** Rosen JB, Arciuolo RJ, et al. *JAMA Pediatr.* 2018; 172(9): 811–7.

SUMMARY: Between March 13, 2013 and June 9, 2013, 58 persons in New York City with a median age of 3 years were identified as having measles. Among these individuals, 45 (78%) were at least 12 months old and were unvaccinated owing to parental refusal or intentional delay. In total, 3,351 exposed contacts were identified.

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Total direct costs to the New York City DOHMH were \$394,448, and a total of 10,054 hours were consumed responding to and controlling the outbreak.

KEY FINDINGS: This outbreak was fueled by the introduction of measles virus into a small number of families who had previously declined vaccination. The outbreak was prolonged, in part, owing to the spread of measles to infants too young to have been vaccinated and to the delay of vaccination among children. Geographic clustering of persons who refuse or decline vaccination, as observed in this and other outbreaks, has led to outbreaks following importations of a single case of measles. The response and containment of the 2013 measles outbreak were resource intensive. The response required assistance from a large number of staff, of whom almost one-third performed duties outside of their routine job descriptions, resulting in resources away from other public health activities.

LINK: <https://www.ncbi.nlm.nih.gov/pubmed/30073293>

5. Containing a Measles Outbreak in Minnesota, 2017: Methods and Challenges. Banerjee E, Griffith J, Kenyon C, et al. , first published September 4, 2019

SUMMARY: The Minnesota Department of Health undertook rapid public health actions within 2 hours of confirmation of the first cases of measles. A total of 75 cases were identified from March 30 to August 25, 2017: 81% were Somali Minnesotan, 91% were unvaccinated, and 28% were hospitalized. Median age of cases was 2 years (range: 3 mos to 57 yrs). Most transmission (78%) occurred in childcare centers and households. At least 8,490 individuals were exposed to measles. Over 500 persons were excluded from childcare and schools. State and key public health partners spent an estimated \$2.3 million on the response.

KEY FINDINGS: This outbreak demonstrated the necessity of immediate, targeted disease control actions and strong public health, healthcare, and community partnerships to end a measles outbreak.

LINK: <https://doi.org/10.1177/1757913919871072>

6. Association between vaccine refusal and vaccine-preventable diseases in the United States: a review of measles and pertussis. Phadke VK, Bednaraczyk RA, Salmon DA, Omer SB. *JAMA* 2016; 315(11): 1149–58.

SUMMARY: A review of 18 published reports of U.S. measles outbreaks from January 2000 through November 2015 and 32 published pertussis outbreaks from January 1977 through November 2015 to assess disease risk in the context of vaccine delay or exemption.

KEY FINDINGS: The researchers found that more than half of the measles cases (56.8%) occurred in children whose parents refused measles vaccination. In the pertussis studies, many of the cases (24%–45%) in the five largest statewide pertussis outbreaks occurred in unvaccinated or undervaccinated populations. In addition, both the measles and the pertussis outbreaks occurred not only among unvaccinated individuals but also among vaccinated individuals in geographic locations with a high prevalence of vaccine exemptions.

LINK: <https://www.ncbi.nlm.nih.gov/pubmed/26978210>

7. Measles – United States, January 4–April 2, 2015. CDC. *Morbidity and Mortality Weekly Report (MMWR)*, April 17, 2015; 64(14):73–6.

SUMMARY: To update surveillance data on current measles outbreaks, CDC analyzed cases reported during January 4–April 2, 2015. A total of 159 cases were reported during this period; over 80% of the cases occurred among persons who were unvaccinated or had unknown vaccination status.

KEY FINDINGS: A total of 111 of the 159 cases were associated with an outbreak that originated in late December 2014 in Disney theme parks in Orange County, California. Cases associated with this outbreak were reported from seven U.S. states, Mexico, and Canada. Other smaller outbreaks without a link to the Disney outbreak occurred in Illinois (15 cases), Nevada (9), and Washington (5). The majority of the 159 cases were either unvaccinated (71 [45%]) or had unknown vaccination status (60 [38%]); 28 (18%) had received measles vaccine.

LINK: www.cdc.gov/mmwr/preview/mmwrhtml/mm6414a1.htm

8. Outbreak of pertussis in a school and religious community averse to health care and vaccinations – Columbia County, Florida, 2013. CDC. *MMWR*, August 1, 2014; 63(30):655.

SUMMARY: Health department staff in a Florida county investigated a report of an unvaccinated student who had lab-confirmed pertussis. The 316 students in the affected school were part of a larger community that was averse to health care and vaccinations. For example, only five (15%) of 34 students in kindergarten and one (5%) of 22 students in seventh grade were fully vaccinated; of those who were not fully vaccinated, 84% had religious exemptions.

KEY FINDINGS: Despite the availability of free vaccine through the local health department, very few persons from the community took advantage of the offer. At the conclusion of the outbreak, the investigation found a total of 109 cases in the community, including 94 students and one teacher in the affected school and 14 household contacts of the initial case.

LINK: www.cdc.gov/mmwr/preview/mmwrhtml/mm6330a3.htm

9. Religious exemptions for immunization and risk of pertussis in New York state, 2000–2011. Imdad A, Tserenpuntsag B, Blog DS, Halsey NA, Easton DE, Shaw J. *Pediatrics* 2013;132(1):37–43.

SUMMARY: Researchers reviewed reported religious vaccination exemptions to the NYS Department of Health from 2000 through 2011. Changes in exemptions were assessed against incidence rates of childhood pertussis.

KEY FINDINGS: Counties with higher exemption rates had higher rates of reported pertussis among exempted and vaccinated children when compared with counties having low exemption rates.

LINK: www.ncbi.nlm.nih.gov/pubmed/23733795

10. An outbreak of measles in an undervaccinated community. Gahr P, DeVries AS, Wallace G, et al. *Pediatrics*. July 2014; 134(1):e220–8.

SUMMARY: In March 2011, measles was confirmed in a Minnesota child without travel abroad. An investigation was initiated to determine the source, prevent transmission, and examine measles-mumps-rubella (MMR) vaccine coverage in the affected community.

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KEY FINDINGS: Twenty-one measles cases were identified. The median age was 12 months (range, 4 months to 51 years) and 14 (67%) were hospitalized (range of stay, 2–7 days). The source was a 30-month-old U.S.-born child of Somali descent infected while visiting Kenya. Measles spread in several settings, and over 3000 individuals were exposed. Sixteen case-patients were unvaccinated; 9 of the 16 were age-eligible: 7 of the 9 had safety concerns and 6 were of Somali descent. MMR vaccine coverage among Somali children declined significantly from 2004 through 2010 starting at 91.1% in 2004 and reaching 54.0% in 2010 ($P < 0.001$). This was the largest measles outbreak in Minnesota in 20 years, and aggressive response likely prevented additional transmission. Measles outbreaks can occur if undervaccinated subpopulations exist. Misunderstandings about vaccine safety must be effectively addressed.

LINK: <https://www.ncbi.nlm.nih.gov/pubmed/24913790>

11. Measles – United States, January 1-May 23, 2014. CDC. *MMWR*, June 6, 2014; 63(22):496–9.

SUMMARY: To update national measles data in the United States, CDC evaluated cases reported by states from January 1 through May 23, 2014. A total of 288 confirmed measles cases have been reported to CDC, surpassing the highest reported yearly total of measles cases since elimination (220 cases reported in 2011). Fifteen outbreaks accounted for 79% of cases reported, including the largest outbreak reported in the United States since elimination (138 cases and ongoing).

KEY FINDINGS: The large number of cases this year emphasizes the need for health-care providers to have a heightened awareness of the potential for measles in their communities and the importance of vaccination to prevent measles. Most of the 288 measles cases reported this year have been in persons who were unvaccinated (200 [69%]) or who had an unknown vaccination status (58 [20%]); 30 (10%) were in persons who were vaccinated. Among the 195 U.S. residents who had measles and were unvaccinated, 165 (85%) declined vaccination because of religious, philosophical, or personal objections, 11 (6%) were missed opportunities for vaccination, and 10 (5%) were too young to receive vaccination.

LINK: https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6322a4.htm?s_cid=mm6322a4_w

12. Communication and mass vaccination strategies after pertussis outbreak in rural Amish communities-Illinois, 2009-2010. Medina-Marino A, Reynolds D, Finley C, Hays S, Jones J, Soyemi K. *J Rural*. 2013 Fall;29(4):413-9.

SUMMARY: During January 2010, 2 infants from an Amish community in east-central Illinois were hospitalized with pertussis. The local health department (LDH) intervened to control disease transmission, identify contributing factors, and determine best communications methods to improve vaccination coverage.

KEY FINDINGS: Forty-seven cases were identified, with onsets during December 2009–March 2010. Median age was 7 (interquartile range 1–12) years. Nineteen (40%) patients were male; 39 (83%) were aged <18 years; 37 (79%) had not received any pertussis-containing vaccine. Presenting symptoms did not differ substantially between vaccinated and unvaccinated patients. Duration of cough was longer among unvaccinated

than vaccinated patients (32 vs. 15.5 days, $P=0.002$). Compared with vaccinated patients, proportionately more unvaccinated patients reported secondary household transmission (30% vs. 72%; $P=0.012$). Through enhanced vaccination campaigns, 251 (~10%) Amish community members were administered 254 pertussis-containing vaccines. Targeted health communication and outreach resulted in a successful vaccine campaign and long-running monthly vaccination clinic. Amish do not universally reject vaccines, and their practices regarding vaccination are not static.

LINK: <https://www.ncbi.nlm.nih.gov/pubmed/24088215>

13. Measles in the United States during the postelimination era. Parker Fiebelkorn A, Redd SB, Gallagher K, et al. 2010; 202(10):1520–8.

SUMMARY: A descriptive analysis of all cases of measles reported in the United States during 2001–2008.

KEY FINDINGS: A total of 557 confirmed cases of measles and 38 outbreaks were reported during 2001–2008. Of these outbreaks, the 3 largest occurred primarily among personal belief excluders (defined as persons who were vaccine eligible, according to recommendations of the Advisory Committee on Immunization Practices or the World Health Organization, but remained unvaccinated because of personal or parental beliefs). During 2004–2008, a total of 68% of reported measles cases were among unvaccinated U.S. residents, who were age-eligible for vaccination but who claimed a personal belief exemption to state immunization requirements.

LINK: <https://www.ncbi.nlm.nih.gov/pubmed/20929352>

14. Measles outbreak in a highly vaccinated population, San Diego, 2008: role of the intentionally undervaccinated. Sugerman DE, Barskey AE, Delea MG, et al. *Pediatrics* 2010;125(4):747–55.

SUMMARY: Researchers mapped vaccination-refusal rates by school and school district, analyzed measles-transmission patterns, and conducted discussions and surveys to examine beliefs of parents who decline vaccination for their children.

KEY FINDINGS: An intentionally unvaccinated 7-year-old child who was unknowingly infected with measles returned from Switzerland, resulting in 11 additional measles cases and in known measles exposure of more than 800 people. In San Diego, high personal belief exemption (PBE) rates were found in 10 schools (range, 42%–100%); schools and districts with high refusal rates were clustered geographically. Across all surveyed kindergartens, higher PBE rates correlated strongly with lower measles vaccination rates.

LINK: www.ncbi.nlm.nih.gov/pubmed/20308208

15. Parental refusal of varicella vaccination and the associated risk of varicella infection in children. Glanz JM, McClure DL, Magid DJ, Daley MF, France EK, Hambidge SJ. *Adolescent Medicine* 2010; 164(1):66–70.

SUMMARY: A case-control study of 133 physician-diagnosed cases of varicella among Kaiser Permanente Colorado members between 1998 and 2008; each case was matched with 4 randomly selected controls (i.e., people who did not have varicella disease).

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- KEY FINDINGS:** Compared with children of vaccine-accepting parents, children of vaccine-refusing parents had a 9-fold higher risk of varicella illness. Overall, 5% of varicella cases in the study population were attributed to vaccine refusal.
- LINK:** <https://www.ncbi.nlm.nih.gov/pubmed/20048244>
- 16. Invasive *Haemophilus influenzae* type b disease in five young children – Minnesota, 2008.** CDC. *Morbidity and Mortality Weekly Report (MMWR)* 2009;58(03):58–60.
- SUMMARY:** In 2008, during routine surveillance conducted by public health workers in Minnesota for invasive type b (Hib) disease, five children ages 5 months to 3 years were reported with invasive Hib disease; one child died.
- KEY FINDINGS:** Three of the five children with invasive Hib disease had not been vaccinated. One of the children was too young to complete the primary series of Hib vaccine, and another child, who had completed the primary series, was found to have an immune disorder that impairs response to vaccination.
- LINK:** www.cdc.gov/mmwr/preview/mmwrhtml/mm5803a4.htm
- 17. Geographic clustering of nonmedical exemptions to school immunization requirements and associations with geographic clustering of pertussis.** Omer SB, Enger KS, Moulton LH, Halsey NA, Stokley S, Salmon DA. *Am J Epidemiol* 2008;168:1389–96.
- SUMMARY:** Researchers evaluated the geographic clustering of personal belief exemptions in Michigan (1991–2004: N=4,495 schools) and measured the geographic overlap between exemption clusters and clusters of reported pertussis cases (1993–2004: N=1,109 cases among people 18 years and younger).
- KEY FINDINGS:** Researchers reported significant overlap between clusters of exemptions and clusters of pertussis cases. In addition, exemption rates appear to be increasing in Michigan, and nonmedical exemptions tend to be geographically clustered.
- LINK:** <https://www.ncbi.nlm.nih.gov/pubmed/18922998>
- 18. Nonmedical exemptions to school immunization requirements: secular trends and association of state policies with pertussis incidence.** Omer SB, Pan WK, Halsey NA, et al. *JAMA* 2006; 296(14):1757–63.
- SUMMARY:** Analysis of children claiming nonmedical exemptions at school entry, 1991–2004, and incidence of pertussis in children ages 18 years and younger, 1986–2004.
- KEY FINDINGS:** Exemption rates for states that allowed only religious exemptions remained at about 1% between 1991 and 2004; however, in states that allowed exemptions for personal beliefs, the mean exemption rate increased from 0.99% to 2.54%. The study found associations between increased pertussis incidence and state policies that allowed personal belief exemptions or easily-obtained exemptions in general.
- LINK:** <https://www.ncbi.nlm.nih.gov/pubmed/17032989>
- 19. Implications of a 2005 measles outbreak in Indiana for sustained elimination of measles in the United States.** Parker AA, Staggs W, Dayan GH, et al. *N Engl J Med* 2006;355:447–55.
- SUMMARY:** A case-series investigation of the largest documented U.S.-based measles outbreak since 1996; included molecular typing of viral isolates, surveys of vaccination rates, interviews about vaccination attitudes, and cost surveys.
- KEY FINDINGS:** This U.S. measles outbreak was caused when an unvaccinated teenager returned from Romania and introduced measles into a group of children whose parents objected to vaccination. Among people exposed at a church gathering, 50 lacked immunity to measles, 16 (32%) of whom acquired measles. During the 6 weeks after the gathering, a total of 34 cases of measles were confirmed. Of the people with confirmed measles, 97% were members of the church, 94% were unvaccinated, and 82% were children ages 5 to 19 years. In this outbreak, 68% of the containment cost was incurred by a single hospital, where an undervaccinated employee potentially exposed children, immunocompromised patients, and employees to measles.
- LINK:** <https://www.ncbi.nlm.nih.gov/pubmed/16885548>
- 20. Individual and community risk of measles and pertussis associated with personal exemptions to immunizations.** Feikin DR, Lezotte DC, Hamman RF, Salmon DA, Chen RT, Hoffman RE. *JAMA*. 2000; 284(24):3145–50.
- SUMMARY:** A population-based, retrospective cohort study of all reported measles and pertussis cases among children ages 3–18 years in Colorado during 1987–1998.
- KEY FINDINGS:** Exemptors were 22.2 times more likely to acquire measles and 5.9 times more likely to acquire pertussis than were vaccinated children. At least 11% of vaccinated children in measles outbreaks acquired infection through contact with exemptors.
- LINK:** <https://www.ncbi.nlm.nih.gov/pubmed/11135778>