



# National Biosurveillance Integration Center

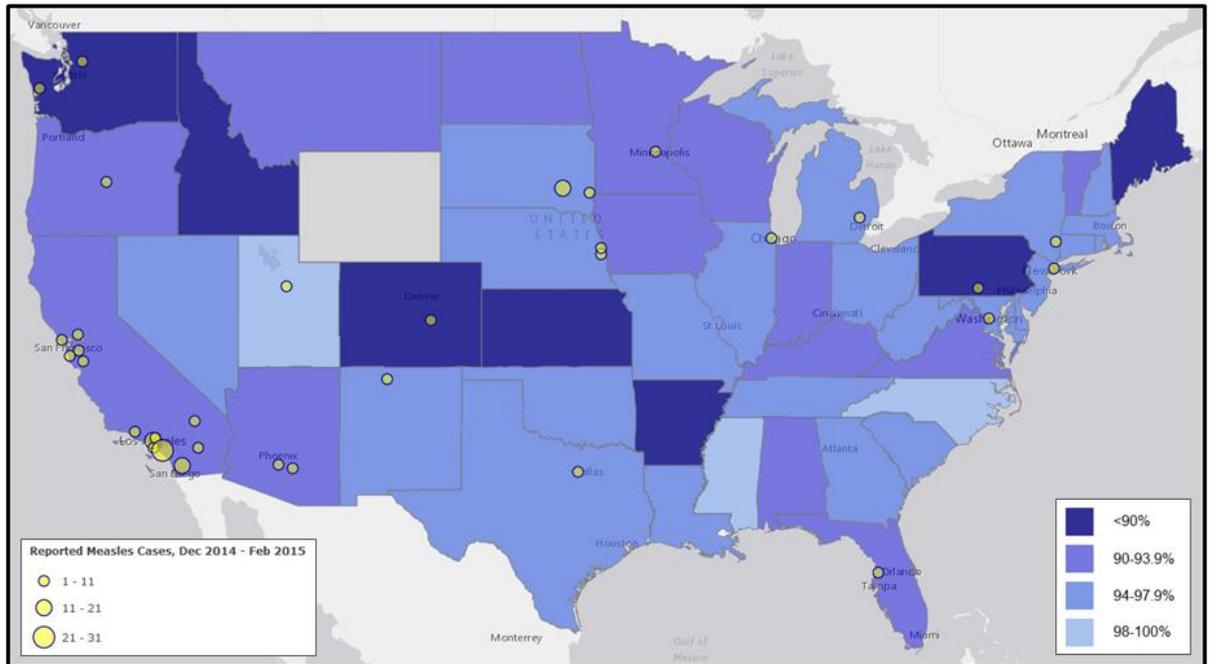
*Measles (Rubeola) in the U.S.*

05 February 2015

**Biosurveillance Event Report**

State, Local, Tribal, & Territorial Edition

**Public Health**



The map above shows reported measles cases in the United States from December 2014 through 05 February 2015, as reported by state and local Departments of Health (yellow), as well as estimated vaccination coverage with the MMR among children enrolled in kindergarten (2013-2014 school year) (blue-scale). Vaccination coverage data is drawn from [MMWR](#).

**Critical information Requirement(s):**

- 1) Anomalous levels of disease
- 2) High visibility biological event

**Significant Features:**

An outbreak of measles has spread to 14 states and resulted in over 100 sick. Measles is highly contagious and can spread rapidly in communities where groups of people are unvaccinated.

**EXECUTIVE SUMMARY**

As of 04 February 2015, the Centers for Disease Prevention and Control (CDC) and state and local health departments have reported 108 measles cases from 14 states since the beginning of the year (137 cases have been reported since December 2014 from 15 states and the District of Columbia). A majority of these cases have been associated with an ongoing outbreak associated with travel to Disneyland theme parks in California, which began in late December. In 2000, measles was considered eliminated (interruption of continuous transmission lasting over 12 months) in the U.S.; however, measles is a highly contagious viral illness that can spread rapidly in communities where groups of people are unvaccinated. The majority of cases is unvaccinated or report unknown vaccine status.



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## EVENT FEATURES

- On 07 January 2015, the California Department of Public Health announced seven confirmed and three suspected measles cases in residents of California. All confirmed reported visiting Disneyland or Disney California Adventure Park in Orange County, California between 15 and 20 December 2014. The announcement also stated that two measles cases in Utah were associated with the adventure park during similar time frames.
- On 23 January 2015, the CDC issued a Health Advisory to notify state and local health departments and healthcare facilities about the status of the measles outbreak and provide guidance to healthcare providers. The advisory noted that 51 confirmed cases of measles linked to Disneyland Resort Theme Parks had been reported to the CDC from 7 states. In addition, 1 case was reported from Mexico.
- On 29 January 2015, the CDC held a [press briefing](#) on the measles situation in the U.S. In the briefing, Dr. Anne Schuchat, Assistant Surgeon General, U.S. Public Health Service and director of the CDC's National Center for Immunization and Respiratory Diseases stated that the outbreak may have begun with a traveler overseas. In addition, Dr. Schuchat stated that in this particular outbreak, more adult cases have been recorded than during typical outbreaks.
- As of 30 January 2015, the CDC had reported 102 measles cases from 14 states since the start of the year. 92% of these cases (94 of 102) are epidemiologically linked to the Disneyland outbreak.
- On 31 January 2015, New York State health officials announced that a college student diagnosed with measles recently traveled across New York on a train from New York City's Penn Station to Rhinecliff, NY.
- On 02 February 2015, the CDC stated that 102 people from 14 states had been diagnosed with measles from 1 January to 30 January 2014.
- On 02 February 2015, Toronto Public Health (Canada) announced the confirmation of four cases of measles; the source of the illness had not been identified at the time of posting.
- On 04 February 2015, the California Department of Public Health announced the confirmation of 99 measles cases within the state since the beginning of the year. Thirty-nine cases visited Disneyland during 17-20 December 2014, where they were believed to be exposed; 23 are household or close contacts of a confirmed case, and 3 were exposed in a community setting. Thirty-four cases have an unknown exposure.



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**Table 1. Number of reported measles cases reported within U.S. states from December 2014 to February 2015 or from January to February 2015.**

State	Reported Measles Cases (Dec 2014 – Feb 2015)	Cases Linked to Disneyland Outbreak	Date of reference
California	99	65	04 Feb 2015
Arizona	7	7	30 Jan 2015
Colorado	1	1	02 Feb 2015
Illinois	1	0	27 Jan 2015
Minnesota	1	0	02 Feb 2015
Michigan	1	Not reported	23 Jan 2015
Nebraska	2	1	29 Jan 2015
New Mexico	1	Not reported	03 Dec 2014
New York	3	Not reported	30 Jan 2015
Oregon	1	1	02 Feb 2015
Pennsylvania	1	0	29 Jan 2015
South Dakota	14	0	02 Feb 2015
Texas	1	0	02 Feb 2015
Utah	3	3	17 Jan 2015
Washington	2	2	09 Jan 2015
Washington D.C.	1	Not reported	30 Jan 2015
<b>Total</b>	<b>137</b>	<b>89 accounted cases (CDC has reported that 94 cases have been associated with the Disneyland Parks)</b>	

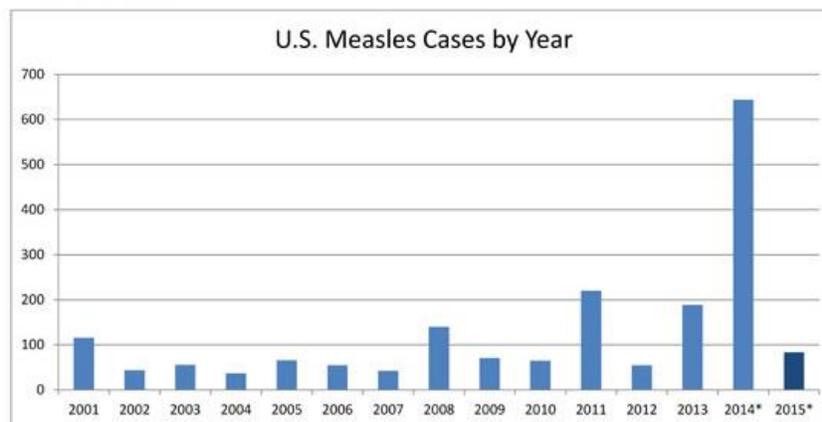
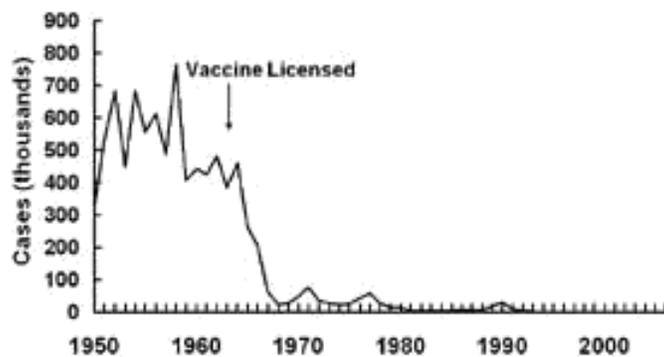


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## CONTEXTUAL INFORMATION AND ANALYSIS

- Measles has been a nationally notifiable disease in the United States since 1912.
- Measles cases in the U.S. have dramatically declined since the availability of the first measles vaccine in 1963, from approximately 900,000 annually in the 1940s to a median annual number of 60 cases during the years of 2001 through 2012.
- In 2000, measles was declared eliminated (interruption of continuous transmission lasting over 12 months) in the U.S. The majority of U.S. infections since the declaration have been associated with travel outside the Western Hemisphere. (Over 90% of the 222 reported U.S. measles cases in 2011 are direct importations.)
- In 2014, a record number of measles cases (644 cases) were reported to the CDC's National Center for Immunization and Respiratory Diseases. The virus is highly contagious and can spread rapidly in unvaccinated communities. There were 23 domestic measles outbreaks in 2014; the largest resulted in 383 cases, most of them identified within a community of unvaccinated Amish (CDC, 2015) (Figure 1).

**Figure 1. The number measles cases reported to the CDC's National Center for Immunization and Respiratory Diseases (CDC, 2014; 2015).**



\*Provisional data reported to CDC's National Center for Immunization and Respiratory Diseases



- Measles is still a common disease in many regions of the world. The World Health Organization (WHO) estimates that more than 20 million infections occur annually, and measles remains a significant cause of death among children worldwide, resulting in the death of more than 145,000 in



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2013.

- There was a particularly large outbreak of measles in the Philippines in 2014; over 57,000 cases were reported from 01 January to 20 December 2014, according to the WHO. Additional information on international efforts to control the virus is available at the [Measles & Rubella Initiative website](#).

## **Vaccine Development**

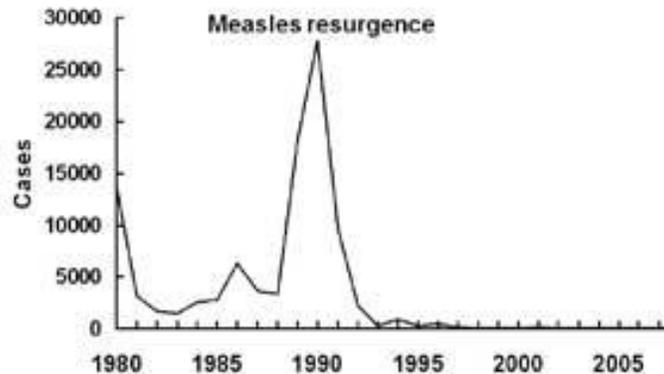
- In an effort to create a measles vaccine, the virus was first isolated from a school-aged child's (David Edmonston) blood in 1954.
- In 1963 the first live, attenuated measles vaccine (Edmonston B strain) was licensed and available under the trade name Rubeovax.
- In 1968, an improved and further attenuated vaccine (Moraten or Edmonston-Enders strain) was made available under the trade name Moraten.
- Live, attenuated measles vaccines, majority of which were derived from the Edmonston strain, are available as a monovalent vaccine or in a vaccine cocktail with the rubella vaccine or mumps and rubella vaccines.
- In 1971, the U.S. government licensed the first measles, mumps and rubella combination vaccine (MMR).
- In the U.S., widespread use of measles vaccine has led to a greater than 99% reduction in measles cases when compared to the period before the vaccine was available (CDC, 2015).
- Between 2000 and 2013 measles vaccination resulted in a 75% decrease in measles-associated deaths (prevented an estimated 15.6 million deaths) worldwide (WHO, 2015). Additional advances in measles vaccine development are displayed within the [College of Physicians of Philadelphia Medical Society](#) timeline.

## **Vaccine Schedule**

- The CDC recommends that the MMR vaccine be administered to infants at least 12 months of age. (MMR given before 12 months should be counted as a valid dose.) The second dose is recommended to be given at 4 to 6 years of age; however, the second dose may be administered as early as 4 weeks after the first.
- In 1989-1991, a resurgence of measles was reported in the United States (Figure 2). During this outbreak the cases were predominantly unvaccinated preschoolers; however, many college students who had only received only one dose of the vaccine were also affected. Health officials determined that the unusually high number of college student cases was not associated with waning immunity but rather a failure to make adequate immune response after single dose of measles (Orenstein, 2006).

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**Figure 2. The number measles cases reported to the CDC's National Center for Immunization and Respiratory Diseases during 1980-2009 (CDC, 2014).**



- In 1989, the CDC recommended a second dose of the measles vaccine. More than 95% of individuals receiving a single vaccine dose produced immunity to the measles and two doses of measles-containing vaccine are considered more than 99% effective in preventing measles (CDC, 2015). The WHO also supports the use of a second dose of measles; they state that approximately 15% of vaccinated children fail to develop immunity from the first dose (WHO, 2015).

## Vaccine Coverage

- In 1989-1991, a resurgence of measles was reported in the U.S; the incidence of reported measles increased sixfold to ninefold over the median annual incidence (1.3 per 100,000 population). Over 55 thousand cases and 123 measles-associated deaths were reported within the three years. The most significant cause of the increase was low vaccine coverage amongst preschool-aged children (CDC, 1992).
- The majority of those not receiving the vaccine are due to philosophical and religious beliefs; however, others may be ineligible or have missed opportunities.
- The CDC reports that 1 in 12 children in the U.S are not receiving their first dose of the MMR vaccine on time and 17 states have less than 90% of children having received at least one dose (CDC, 2015).
- The CDC evaluated vaccination coverage in 49 states and DC and vaccination exemption rates in 46 states and DC for children enrolled in kindergarten during the 2013–14 school year; median vaccination coverage was 94.7% (range = 81.7% in Colorado to  $\geq 99.7\%$  in Mississippi) for 2 doses of MMR vaccine and median total exemption rate was 1.8% (range =  $< 0.1\%$  in Mississippi to 7.1% in Oregon) (Seither et al., 2014).
- There is evidence of an increase in vaccine refusals across the U.S. and of geographic clustering of refusals. Between 1991 and 2004, the mean state-level rate of nonmedical exemptions increased from 0.98 to 1.48%. The increase in exemptions was not however uniform across states and regions. For example in the state of Washington during the period of 2006 through 2007, the nonmedical-exemption rate across the state was 6%; however, the county level ranged from 1.2 to 26.9% (Omer et al., 2009).
- The timing and scheduling of the first and second dose varies across countries and regions throughout the world; however, as of 2008, 192 WHO member states recommended children receive two vaccine doses (WHO, 2009).
- Worldwide vaccine coverage has increased; in 2013 approximately 84% of the world's children received one dose of measles by their first birthday, up from 73% in 2000 (the CDC recommends infants receive their first measles vaccine after 12 months) (WHO, 2014).

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## Immunity

- More than 95% of individuals receiving a single vaccine dose produced immunity to the measles and two doses of measles-containing vaccine are considered more than 99% effective in preventing measles (CDC, 2015).
- In general, those that were born before 1957 can be considered to have previously been infected with the measles and in many circumstances age can be considered an acceptable evidence of immunity to measles (CDC, 2014).
- More than 95% of population age 6-49 years of age (males 95.8%, females 95.9%) are seropositive to measles antibody (McQuillan et al., 2007).

## SELECTED U.S. GOVERNMENT ACTIONS

### DHS

The National Biosurveillance Integration Center (NBIC) is currently monitoring the outbreak to coordinate information in response to the event. Appropriate Federal agencies are coordinating their activities and surveillance measures. The National Biosurveillance Integration System will continue to monitor the outbreak and provide situational awareness.

### HHS

The CDC, state, and local health departments continue to investigate this outbreak as well as monitor and report all identified measles cases. The CDC's National Center for Immunization and Respiratory Diseases develops measures for the prevention of disease, disability, and death through immunization and by control of diseases. The CDC has issued a Health Advisory to notify public health departments and healthcare facilities regarding this outbreak and has provided guidance for healthcare providers nationwide. Additional guidance and awareness may be found on the CDC [measles website](#). Additional vaccine information is available through the CDC's [Vaccine Information Statements](#).

The Food and Drug Administration (FDA) Center for Biologics Evaluation and Research (CBER) regulates vaccine products.

The Advisory Committee on Immunization Practices is a group of medical and public health experts that develops recommendations on how to use vaccines to control diseases in the U.S. The recommendations stand as public health advice that will lead to a reduction in the incidence of vaccine preventable diseases and an increase in the safe use of vaccines and related biological products.

### State and Local Health Departments

State and local health departments continue to investigate this outbreak as well as monitor and report all identified measles cases.

## BACKGROUND INFORMATION

### Agent

Measles is a single-stranded RNA paramyxovirus within the genus Morbillivirus. The virus has two envelope glycoproteins which are essential for pathogenesis. There is only one antigenic type of measles virus, and humans are the only known host. Although the virus is known to be highly contagious and may be spread by air; the virus is not environmentally hardy and is rapidly inactivated by heat and light.

### Disease

The first symptoms of measles usually occur from 7 to 21 days after exposure and typically begin with a high fever, cough, runny nose, and red, watery eyes. A few days after initial symptoms begin, tiny white spots (Koplik spots) may appear inside the mouth. The characteristic red, blotch rash typically occurs after initial symptoms around 14 days (range, 7–18 days) after exposure. The rash usually begins on the face and lasts 4 to 7 days. Commonly reported disease complications include diarrhea (8%), middle ear infection (7% to 9%), and pneumonia (1% to 6%). Encephalitis is a severe complication and occurs in approximately 1 per 1,000–2,000 cases of measles. For most cases, fever and rash subside within a few days. Persistent infections are rare; however, cases with persistent infections may develop subacute



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sclerosing panencephalitis, which is serious degenerative central nervous system disease with a defective measles virus. This disorder which progresses to coma and death is estimated to occur in 1 per 100,000 cases. Severe complications are more common in populations with poor nutritional status, those with insufficient vitamin A, or those whose immune systems have been weakened (WHO, 2015; CDC, 2012).

## **Transmission**

Measles is one of the most contagious viral diseases; transmission rates are reported to be greater than 90% in susceptible close contacts. Measles is transmitted person to person by large respiratory droplets or can be spread by aerosolized and airborne droplets. Infected individuals may be contagious 4 days before rash appears until about 4 days after that (CDC, 2012).

## **Diagnosis**

A confirmed case of measles is one that is either laboratory-confirmed or that meets the clinical case definition and is epidemiologically linked to a confirmed case. A clinical case is defined as an illness with the following symptoms: generalized maculopapular rash lasting  $\geq 3$  days, a fever of  $\geq 101^{\circ}\text{F}$  ( $38.3^{\circ}\text{C}$ ), and cough, coryza, or conjunctivitis. The criteria for a laboratory confirmed diagnosis includes any of the following: a positive serologic test for measles IgM, IgG seroconversion, a significant rise in measles IgG level by any standard serologic assay, isolation of measles virus, or identification by PCR of measles virus RNA from a clinical specimen.

## **Treatment and Prevention**

Vaccination is the best method to avoid illness. The only available treatment is supportive. The WHO recommends administering vitamin A for all children with acute measles.

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