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Update: Measles — United States, January–July 2008

Sporadic importations of measles into the United States have occurred since the disease was declared eliminated from the United States in 2000 (*1*). During January–July 2008, 131 measles cases were reported to CDC, compared with an average of 63 cases per year during 2000–2007.* This report updates an earlier report on measles in the United States during 2008 (*2*) and summarizes two recent U.S outbreaks among unvaccinated school-aged children. Among those measles cases reported during the first 7 months of 2008, 76% were in persons aged <20 years, and 91% were in persons who were unvaccinated or of unknown vaccination status. Of the 131 cases, 89% were imported from or associated with importations from other countries, particularly countries in Europe, where several outbreaks are ongoing (*3,4*). The findings demonstrate that measles outbreaks can occur in communities with a high number of unvaccinated persons and that maintaining high overall measles, mumps, and rubella (MMR) vaccination coverage rates in the United States is needed to continue to limit the spread of measles.

Measles cases in the United States are reported by state health departments to CDC using standard case definitions† and case classifications. Cases acquired outside the United States are categorized as importations. Those acquired inside the United States are considered importation associated if they are linked epidemiologically via a chain of transmission to an importation or have virologic evidence of importation.§ Other cases are classified as having an unknown source. In the United States, recommendations for MMR vaccination include a single dose at age 12–15 months and a second dose at the time of school entry (*5*). Vaccination as early as age 6 months is recommended for U.S. children traveling abroad and is sometimes recommended within U.S. communities during outbreaks of measles.

During January 1–July 31, 2008, 131 measles cases were reported to CDC from 15 states and the District of Columbia (DC): Illinois (32 cases), New York (27), Washington (19), Arizona (14), California (14), Wisconsin (seven), Hawaii (five), Michigan (four), Arkansas (two), and DC, Georgia, Louisiana, Missouri, New Mexico, Pennsylvania, and Virginia (one each). Seven measles outbreaks (i.e., three or more cases linked in time or place) accounted for 106 (81%) of the cases. Fifteen of the patients (11%) were hospitalized, including four children aged <15 months. No deaths were reported.

Among the 131 cases, 17 (13%) were importations: three each from Italy and Switzerland; two each from Belgium, India, and Israel; and one each from China, Germany, Pakistan, the Philippines, and Russia. This is the lowest percentage of imported measles cases since 1996 (Figure 1). Nine of the importations were in U.S. residents who had traveled abroad, and eight were in foreign visitors. An additional 99 (76%) of the 131 cases were linked epidemiologically to importations or had virologic evidence of importation. The source of measles acquisition of 15 cases (11%) could not be determined.

* Based on nationally notifiable disease data for 2000–2007.

† CDC/Council of State and Territorial Epidemiologists measles clinical case definition: an illness characterized by a generalized maculopapular rash for ≥3 days, a temperature of ≥101°F (≥38.3°C), and cough, coryza, or conjunctivitis. A case is considered confirmed if it is laboratory confirmed (using serologic or virologic methods) or if it meets the clinical case definition and is epidemiologically linked to a confirmed case.

§ A case is considered to have virologic evidence of importation if it is within a chain of transmission from which a measles virus is identified that is not endemic in the United States.

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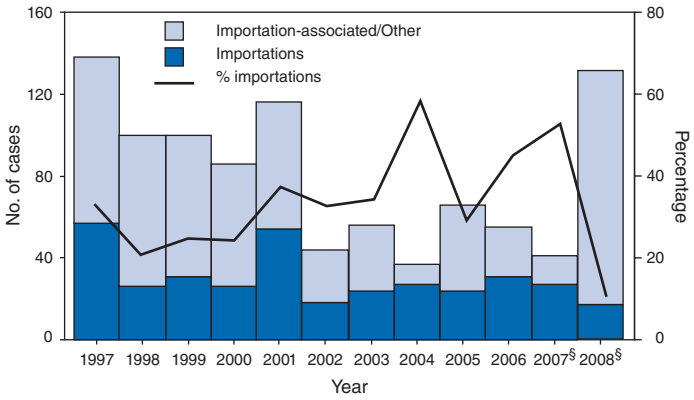
FIGURE 1. Trend in cases of imported measles* as a proportion of all measles cases† — United States, 1997–July 2008



* Measles infection acquired outside of the United States.
† Includes importation, importation-associated (acquired inside the United States but linked epidemiologically to an importation), and other (source unknown) measles cases.
§ Provisional; 2008 data are for January–July only.

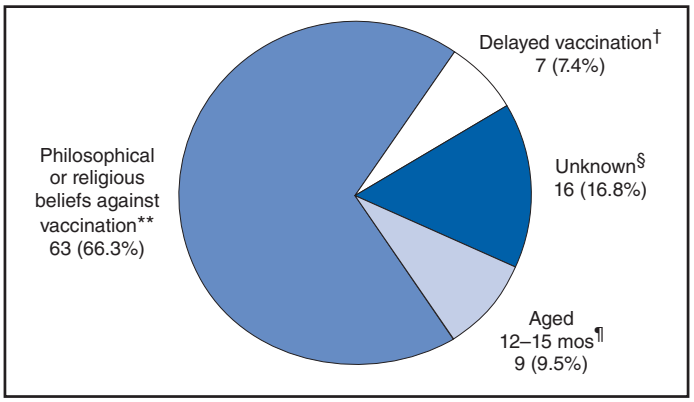
Among the 131 measles patients, 123 were U.S. residents, of whom 99 (80%) were aged <20 years (Table). Five (4%) of the 123 patients had received 1 dose of MMR vaccine, six (5%) had received 2 doses of MMR vaccine, and 112 (91%) were unvaccinated or had unknown vaccination status. Among these 112 patients, 95 (85%) were eligible for vaccination, and 63 (66%) of those were unvaccinated because of philosophical or religious beliefs (Figure 2).

Washington. On April 28, 2008, the Washington State Department of Health received a report of several suspected measles cases in a Grant County household. The index patient had rash onset on April 12. During April 18–21, the other seven children in the household became ill with fever and rash. Three of the children developed pneumonia and were evaluated by a health-care provider who suspected measles; all three tested positive for measles-specific IgM antibody. Rash onset occurred during April 13–May 30 in 11 additional cases identified in Grant County. All of the 19 cases were linked epidemiologically, and all but one occurred in children and adolescents aged 9 months to 18 years. The 19 cases included 16 in school-aged children, among whom 11 were home schooled. Because of their parents' philosophical or religious beliefs, none of the 16 children had received measles-containing vaccine. Specimens from eight patients were submitted for virologic testing, and all contained genotype D5, which had been circulating in Japan and parts of Europe. A possible source of the outbreak was a church conference, held March 25–29 in King County, Washington, that was attended by four of the patients, including the index patient. The conference was attended by approximately 3,000

TABLE. Number and percentage of U.S. residents with measles, by age group and vaccination status — United States, January–July 2008

	Age group											
	<12 mos		12–15 mos		16 mos–4yrs		5–19 yrs		20–49 yrs		≥50 yrs		Total	
Vaccination status	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**
Unvaccinated														
Too young (aged <12 mos)	16	(100.0)											**16**	**(13.0)**
Born before 1957											1	(50.0)	**1**	**(0.8)**
Philosophical or religious beliefs against vaccination					9	(50.0)	52	(94.5)	2	(9.1)			**63**	**(51.2)**
Missed opportunity or reason unknown			8	(80.0)	7	(38.9)			1	(4.5)	1	(50.0)	**17**	**(13.8)**
Vaccinated (≥1 dose)			1	(10.0)	2	(11.1)	3	(5.5)	5	(22.7)			**11**	**(8.9)**
Unknown vaccination status			1	(10.0)					14	(63.6)			**15**	**(12.2)**
Total	**16**		**10**		**18**		**55**		**22**		**2**		**123**	

FIGURE 2. U.S. residents with measles who were eligible* for vaccination against measles, by reason for not receiving measles vaccine — United States, January–July 2008



* N = 95. Does not include infants aged <12 months, persons born before 1957, foreign visitors, and persons who were vaccinated.
† Includes children aged 16 months to 4 years who had not been vaccinated.
§ Includes persons who were age eligible for vaccination but whose vaccination status was unknown or who were unvaccinated for unknown reasons.
¶ Includes eight children eligible for vaccination, but not yet vaccinated, and one child whose vaccination status was unknown.
** Includes persons who were unvaccinated because of their own or their parents' beliefs. This category includes 61 persons aged ≤18 years and two persons aged 20–50 years. None of the persons in this category cited medical reasons for not having been vaccinated.

persons, primarily students from junior high through university age from 18 states, DC, and several foreign countries. None of these countries or states has since reported confirmed cases of measles among persons who attended this conference.

Illinois. On May 19, 2008, the Illinois Department of Public Health was notified by the DuPage County Health Department about a suspected case of measles. By May 27, four confirmed cases of measles had been reported to the county, three of which were laboratory confirmed. Among the four cases, rash onsets occurred during May 17–19, suggesting a common exposure. The four patients were unvaccinated girls aged 10–14 years; all had attended an event May 5 and might have attended a home gathering 2 days earlier. Both events were attended by a teenager who had recently returned from Italy and reportedly had developed fever and rash. Although attempts to obtain further information about the traveler were unsuccessful, viral isolation from one of the four patients yielded genotype D4, a strain circulating in Italy. Through July 31, 26 additional measles cases were reported, all with epidemiologic links to the first four cases. Among the 30 cases, 14 were confirmed in DuPage County, 11 in suburban Cook County, and five in Lake County. One case occurred in a person aged 43 years. The remaining 29 cases were in persons aged 8 months–17 years, including 25 (83%) school-aged children, all of whom were home schooled and not subject to school-entry vaccination requirements. Because of their parents' beliefs against vaccination, none of the 25 had received measles-containing vaccine.

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Editorial Note: The number of measles cases reported during January 1–July 31, 2008, is the highest year-to-date since 1996. This increase was not the result of a greater number of imported cases, but was the result of greater viral transmission after importation into the United States, leading to a greater number of importation-associated cases. These importation-associated cases have occurred largely among school-aged children who were eligible for vaccination but whose parents chose not to have them vaccinated. One study has suggested an increasing number of vaccine exemptions

among children who attend school in states that allow philosophical exemptions (*6*). In addition, home-schooled children are not covered by school-entry vaccination requirements in many states. The increase in importation-associated cases this year is a concern and might herald a larger increase in measles morbidity, especially in communities with many unvaccinated residents.

In the United States, measles caused 450 reported deaths and 4,000 cases of encephalitis annually before measles vaccine became available in the mid-1960s (*1*). Through a successful measles vaccination program, the United States eliminated endemic measles transmission (*1*). Sustaining elimination requires maintaining high MMR vaccine coverage rates, particularly among preschool (>90% 1-dose coverage) and school-aged children (>95% 2-dose coverage) (*7*). High coverage levels provide herd immunity, decreasing everyone's risk for measles exposure and affording protection to persons who cannot be vaccinated. However, herd immunity does not provide 100% protection, especially in communities with large numbers of unvaccinated persons. For the foreseeable future, measles importations into the United States will continue to occur because measles is still common in Europe and other regions of the world. Within the United States, the current national MMR vaccine coverage rate is adequate to prevent the sustained spread of measles. However, importations of measles likely will continue to cause outbreaks in communities that have sizeable clusters of unvaccinated persons.

Measles is one of the first diseases to reappear when vaccination coverage rates fall. Ongoing outbreaks are occurring in European countries where rates of vaccination coverage are lower than those in the United States, including Austria, Italy, and Switzerland (*3,4*). In June 2008, the United Kingdom's Health Protection Agency declared that, because of a drop in vaccination coverage levels (to 80%–85% among children aged 2 years), measles was again endemic in the United Kingdom (*3,8*), 14 years after it had been eliminated. Since April 2008, two measles-related deaths have been reported in Europe, both in children ineligible to receive MMR vaccine because of congenital immunologic compromise (*4,8*). Such children depend on herd immunity for protection from the disease, as do children aged <12 months, who normally are too young to receive the vaccine. Otherwise healthy children with measles also are at risk for severe complications, including encephalitis and pneumonia, which can lead to permanent disability or death.

The measles outbreaks in Illinois and Washington demonstrate that measles remains a risk for unvaccinated persons and those who come in contact with them (*9,10*). Each school year, parents should ensure that their children's vaccinations are current, regardless of whether the children are returning to school, attending day care, or being schooled at home. Adults without evidence of measles immunity[¶] should receive at least 1 dose of MMR vaccine. All persons who travel internationally also should be up-to-date on their measles vaccination and other vaccinations recommended for countries they might visit. These recommendations include a single dose of MMR vaccine for infant travelers aged 6–11 months and 2 doses, administered at least 28 days apart, for children aged ≥12 months (*5*).

[¶] Documented receipt of 2 doses of live measles virus vaccine, laboratory evidence of immunity, documentation of physician-diagnosed measles, or birth before 1957.

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Nonfatal, Unintentional, Non–Fire-Related Carbon Monoxide Exposures — United States, 2004–2006

Carbon monoxide (CO) is a colorless, odorless, nonirritating gas that is produced through the incomplete combustion of hydrocarbons. Sources of CO include combustion devices (e.g., boilers and furnaces), motor-vehicle exhaust, generators and other gasoline or diesel-powered engines, gas space heat-