

---

# **CDC Estimates of 2009 H1N1 Influenza Cases, Hospitalizations and Deaths in the United States, April – October 17, 2009**

---

November 12, 2009, 1:00 PM ET

## **Background**

Estimating the number of individual flu cases in the United States is very challenging because many people with flu don't seek medical care and only a small number of those that do seek care are tested. More people who are hospitalized or die of flu-related causes are tested and reported, but under-reporting of hospitalizations and deaths occurs as well. For this reason CDC monitors influenza activity levels and trends and virus characteristics through a nationwide surveillance system and uses statistical modeling to estimate the burden of flu illness (including hospitalizations and deaths) in the United States.

When the 2009 H1N1 flu outbreak began in April 2009, CDC began reporting the number of laboratory-confirmed cases, hospitalizations and deaths associated with 2009 H1N1 flu in the United States that were reported by states to CDC. These initial case counts, and subsequent ongoing laboratory-confirmed reports of hospitalizations and deaths, are thought to represent a significant undercount of the actual number of 2009 H1N1 flu cases in the United States. A paper in *Emerging Infectious Diseases* authored by CDC staff entitled "Estimates of the Prevalence of Pandemic (H1N1) 2009, United States, April–July 2009" reported on a study to estimate the prevalence of 2009 H1N1 based on the number of laboratory-confirmed cases reported to CDC. Correcting for under-ascertainment, the study found that every case of 2009 H1N1 reported from April – July represented an estimated 79 total cases, and every hospitalized case reported may have represented an average of 2.7 total hospitalized people. Since that time, CDC has been working to develop a way to estimate, in an ongoing way, the impact of the 2009 H1N1 pandemic on the U.S. in terms of 2009 H1N1 cases, hospitalizations and deaths.

## **Method to Estimate 2009 H1N1 Cases, Hospitalizations and Deaths**

CDC has developed a method to provide an estimated range of the total number of 2009 H1N1 cases, hospitalizations and deaths in the United States since April, 2009, as well as a breakdown of these estimates by age groups. This method uses data on influenza-associated hospitalizations collected through CDC's Emerging Infections Program (EIP), which conducts surveillance for laboratory-confirmed influenza-related hospitalizations in children and adults in 62 counties covering 13 metropolitan areas of 10 states. To determine an estimated number of 2009 H1N1 hospitalizations nationwide, the EIP hospitalization data are extrapolated to the entire U.S. population and then corrected for factors that may result in under-reporting using a multiplier from "Estimates of the Prevalence of Pandemic (H1N1) 2009, United States, April–July 2009." The lower and upper hospitalization estimates also are calculated using the EIP hospitalization

data. The national hospitalization estimates are then used to calculate deaths and cases. Deaths are calculated by using the proportion of laboratory-confirmed deaths to hospitalizations reported through CDC's web-based Aggregate Hospitalization and Death Reporting Activity (AHDRA). Cases are estimated using multipliers derived from "[Estimates of the Prevalence of Pandemic \(H1N1\) 2009, United States, April–July 2009.](#)" The lower and upper end of the ranges for deaths and cases are derived from the lower and upper hospitalization estimates. The methods used to estimate impact may be modified as more information becomes available. [More information about this methodology is available.](#)

Throughout the remainder of the 2009 H1N1 pandemic CDC will update the range of estimated 2009 H1N1 cases, hospitalizations and deaths every three or four weeks. While EIP data is reported weekly during influenza season, because the system is based on reviews of patients medical charts there are sometimes delays in reporting and it can take some time for all the data to fill in. CDC will continue to provide weekly reports of influenza activity each Friday in [FluView](#) and will update the [2009 H1N1 Situation Update](#) each Friday as well.

The estimated ranges of cases, hospitalizations and deaths generated by this method provide a sense of scale in terms of the burden of disease caused by 2009 H1N1. It may never be possible to validate the accuracy of these figures. The true number of cases, hospitalizations and deaths may lie within the range provided or it's also possible that it may lie outside the range. The underlying assumption in this method is that the level of influenza activity (based on hospitalization rates) in EIP sites matches the level of influenza like illness (ILI) activity across the states.


This methodology is not a predictive tool and cannot be used to forecast the number of cases, hospitalizations and deaths that will occur going forward over the course of the pandemic because they are based on actual surveillance data.

## **The Numbers**

- CDC estimates that between 14 million and 34 million cases of 2009 H1N1 occurred between April and October 17, 2009. The mid-level in this range is about 22 million people infected with 2009 H1N1.
- CDC estimates that between about 63,000 and 153,000 2009 H1N1-related hospitalizations occurred between April and October 17, 2009. The mid-level in this range is about 98,000 H1N1-related hospitalizations.
- CDC estimates that between about 2,500 and 6,000 2009 H1N1-related deaths occurred between April and October 17, 2009. The mid-level in this range is about 3,900 2009 H1N1-related deaths.

## CDC Estimates of 2009 H1N1 Cases and Related Hospitalizations and Deaths from April-October 17, 2009, By Age Group

2009 H1N1	Mid-Level Range*	Estimated Range *
<b>Cases</b>		
0-17 years	~8 million	~5 million to ~13 million
18-64 years	~12 million	~7 million to ~18 million
65 years and older	~2 million	~1 million to ~3 million
<b>Cases Total</b>	~22 million	~14 million to ~34 million
<b>Hospitalizations</b>		
0-17 years	~36,000	~23,000 to ~57,000
18-64 years	~53,000	~34,000 to ~83,000
65 years and older	~9,000	~6,000 to ~14,000
<b>Hospitalizations Total</b>	~98,000	~63,000 to ~153,000
<b>Deaths</b>		
0-17 years	~540	~300 to ~800
18-64 years	~2,920	~1,900 to ~4,600
65 years and older	~440	~300 to ~700
<b>Deaths Total</b>	~3,900	~2,500 to ~6,100

\* *Deaths have been rounded to the nearest ten. Hospitalizations have been rounded to the nearest thousand and cases have been rounded to the nearest million. Exact numbers also are available.* 

The results of this method confirm previous epidemiological data indicating that this disease primarily affects people younger than 65 year old, with the number of cases, hospitalizations and deaths overwhelmingly occurring in people 64 years and younger. This is very different from seasonal influenza, where about 60 percent of seasonal flu-related hospitalizations and 90 percent of flu-related deaths occur in people 65 years and older. The proportion of younger people being impacted by 2009 H1N1 is much greater than what occurs during seasonal flu and people 65 and older are much less affected by this virus than what routinely occurs with seasonal influenza. The results generated by this method also underscore the continued importance of the 2009 H1N1 vaccination program and support the recommended target groups for vaccination.

This methodology and the resulting estimates also underscore the substantial under-reporting that occurs when laboratory-confirmed outcomes are the sole method used to capture hospitalizations and deaths. Since the outbreak began in April, states have reported 2009 H1N1 hospitalizations and deaths to CDC. Cumulative reports of laboratory-confirmed 2009 H1N1 hospitalizations and deaths for the same period used in this analysis (April through October 17, 2009), are 17,283 hospitalizations and 1,004 deaths. CDC has maintained since the beginning of this outbreak that laboratory-

confirmed data on hospitalizations and deaths reported to CDC is an underestimation of the true number that have occurred because of incomplete testing, inaccurate test results, or diagnosis that attribute hospitalizations and deaths to other causes, for example, secondary complications to influenza. (Information about surveillance and reporting for 2009 H1N1 is available at [Questions and Answers: Monitoring Influenza Activity, Including 2009 H1N1.](#))

The estimates derived from this methodology provide the public, public health officials and policy makers a sense of the health impact of the 2009 H1N1 pandemic. While these numbers are an estimate, CDC feels that they present a fuller picture of the burden of 2009 H1N1 disease on the United States.

CDC will continue to use weekly data from systems that comprise the [National Influenza Surveillance System](#) to monitor geographic, temporal and virologic trends in influenza in the nation.

### **Background Emerging Infections Program**

The [Emerging Infections Program \(EIP\) Influenza Project](#) conducts surveillance for laboratory-confirmed influenza-related hospitalizations in children and adults in 62 counties covering 13 metropolitan areas of 10 states. (This includes San Francisco, CA; Denver, CO; New Haven, CT; Atlanta, GA; Baltimore, MD; Minneapolis/St. Paul, MN; Albuquerque, NM; Santa Fe, NM, Las Cruces, NM; Albany, NY; Rochester, NY; Portland, OR; and Nashville, TN.) Cases are identified by reviewing hospital laboratory and admission databases and infection control logs for children and adults with a documented positive influenza test conducted as a part of routine patient care. EIP estimated hospitalization rates are reported every week during the flu season. More information about the Emerging Infections Program is available at [http://www.cdc.gov/ncpcid/deiss/about\\_eip.html](http://www.cdc.gov/ncpcid/deiss/about_eip.html)

### **Seasonal Influenza-Associated Hospitalizations in the United States**

An average estimated 200,000 flu-related hospitalizations occur in the United States each year, with about 60 percent of these hospitalizations occurring in people 65 years and older.

**Background:** A study conducted by CDC and published in the [Journal of American Medical Association \(JAMA\)](#) in September 2004<sup>5</sup> provided information on the number of people in the United States that are hospitalized from seasonal influenza-related complications each year. The study concluded that, on average, more than 200,000 people in the United States are hospitalized each year for respiratory and heart conditions illnesses associated with seasonal influenza virus infections. The study looked at hospital records from 1979 to 2001. In 1979, there were 120,929 flu-related hospitalizations. The number was lower in some years after that, but there was an overall upward trend. During the 1990s, the average number of people hospitalized was more than 200,000 but individual seasons ranged from a low of 157,911 in 1990-91 to a high of 430,960 in 1997-98.

For more information about seasonal flu-related hospitalizations, visit <http://www.cdc.gov/flu/about/qa/hospital.htm>

## Seasonal Influenza-Associated Deaths

Flu-associated mortality varies by season because flu seasons often fluctuate in length and severity. CDC estimates that about 36,000 people died of flu-related causes each year, on average, during the 1990s in the United States with 90 percent of these deaths occurring in people 65 years and older. This includes people dying from secondary complications of the flu.

**Background:** This estimate came from a *2003 Journal of the American Medical Association (JAMA) study*, which looked at the 1990-91 through the 1998-99 flu seasons and is based on the number of people whose underlying cause of death on their death certificate was listed as a respiratory or circulatory disease. During these years, the number of estimated deaths ranged from 17,000 to 52,000. This number was corroborated in 2009, when a CDC-authored study was published in the journal *Influenza and Other Respiratory Viruses*. This study estimated seasonal flu-related deaths comparing different methods, including the methods used in the 2003 JAMA study but using more recent data. Results from this study showed that during this time period, 36,171 flu-related deaths occurred per year, on average. For more information about how CDC estimates seasonal flu-related deaths, visit [http://www.cdc.gov/flu/about/disease/us\\_flu-related\\_deaths.htm](http://www.cdc.gov/flu/about/disease/us_flu-related_deaths.htm)








## Under-Counting of Flu-Related Deaths

CDC does not know exactly how many people die from seasonal flu each year. There are several reasons for this:

- First, states are not required to report individual seasonal flu cases or deaths of people older than 18 years of age to CDC.
- Second, seasonal influenza is infrequently listed on death certificates of people who die from flu-related complications.
- Third, many seasonal flu-related deaths occur one or two weeks after a person's initial infection, either because the person may develop a secondary bacterial co-infection (such as a staph infection) or because seasonal influenza can aggravate an existing chronic illness (such as congestive heart failure or chronic obstructive pulmonary disease).
- Also, most people who die from seasonal flu-related complications are not tested for flu, or they seek medical care later in their illness when seasonal influenza can no longer be detected from respiratory samples. Influenza tests are most likely to detect influenza if performed soon after onset of illness.
- For these reasons, many flu-related deaths may not be recorded on death certificates.

These are some of the reasons that CDC and other public health agencies in the United States and other countries use statistical models to estimate the annual number of seasonal flu-related deaths. (Flu deaths in children were made a nationally notifiable condition in 2004, and since then, states have reported flu-related child deaths in the United States through the Influenza Associated Pediatric Mortality Surveillance System).

## Related Links

- [Estimates of the Prevalence of Pandemic](#)  (H1N1) 2009, United States, April–July 2009 
- [Questions and Answers: EID article "Estimates of the Prevalence of Pandemic \(H1N1\) 2009, United States, April-July 2009"](#)
- [Mortality Associated With Influenza and Respiratory Syncytial Virus in the United States](#) , *Journal of American Medical Association*. 2003;289:179-186.
- [Questions & Answers: Estimating Deaths from Seasonal Influenza in the United States](http://www.cdc.gov/flu/about/disease/us_flu-related_deaths.htm) [http://www.cdc.gov/flu/about/disease/us\\_flu-related\\_deaths.htm](http://www.cdc.gov/flu/about/disease/us_flu-related_deaths.htm)
- [Influenza-Associated Hospitalizations in the United States 1979 Through the 2000-2001 Respiratory Seasons](#) , *Journal of American Medical Association*. 2004; volume 292, no. 11.
- [Hospitalized Patients with 2009 H1N1 Influenza in the United States](#) , April–June 2009, *New England Journal of Medicine*. 
- [Questions and Answers: NEJM article "Hospitalized Patients with 2009 H1N1 Influenza in the United States- April-June 2009"](#)
- [Public Health Surveillance in the United States](#) , *Epidemiologic Reviews*. 1988; volume 10: 164-190