

**2009 H1N1-Related Deaths, Hospitalizations and Cases:
Details of Extrapolations and Ranges: United States,
Emerging Infections Program (EIP) Data**

December 10, 2009

In order to provide a fuller and more accurate picture of the burden of the 2009 H1N1 pandemic on the United States, CDC has developed a methodology to estimate ranges of 2009 H1N1 cases and related hospitalizations and deaths. This method uses raw data on 2009 H1N1 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. The estimated ranges generated by this methodology 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 ranges provided or it's also possible that they may lie outside the ranges. This methodology is not predictive 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. More information about this methodology is contained in this document.

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**EIP: Reports and extrapolations:
Sept 01 to Nov 14, 2009^a**

Reported

Hospitalizations (lab confirmed)	4,992
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Extrapolated to entire U.S.

Hospitalizations	71,118¶
	(51,446 – 101,292)§

**TOTALS: April through Nov 14,
2009**

Deaths‡‡#

0-17 yrs	1,089 (784 – 1,545)
18-64 yrs	7,441 (5,358 - 10,558)
+65 yrs	1,277 (919 – 1,811)
sub-totals	9,807 (7,061 – 13,915)

Hospitalizations‡

0-17 yrs	71,029 (51,141 - 100,783)
18-64 yrs	121,244 (87,296 – 172,032)
+65 yrs	20,751 (14,941 – 29,443)
sub-totals	213,024 (153,378 – 302,258)

Cases‡‡‡#

0-17 yrs	16,000,321 (11,520,267 – 22,702,714)
18-64 yrs	26,746,513 (19,257,551 – 37,950,393)
+65 yrs	4,499,588 (3,323,714 - 6,384,426)
sub-totals	47,246,422 (34,017,532 – 67,037,534)

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a. For EIP data covering period Weeks 35 (Aug 29 – Sept. 04) to Week 45 (week ending Nov 14, 2009). EIP data for that time period has been updated as of 12/09/2009.

¶ EIP extrapolation: Calculated rate per 100,000 per EIP site. To “balance” for different levels of influenza activity, for each reporting week, we divide the 10 EIP sites, based on rates of hospitalization, into 3 equal groups – low, medium, high. We then calculate the median, low, and high rates of hospitalization for each of these 3 groups. We next divide the 50 states, based on reported percent of physician visits that are for ILI (<http://www.cdc.gov/flu/weekly/>), into 3 equal groups – low, medium, high. We then match EIP hospitalization rates to states (low-to-low, etc), and extrapolate the relevant EIP hospitalization rate to the populations in those states similarly categorized. We repeat as needed to provide median, low and high estimates for each group of states. For example, median number of hospitalizations for a given week and state was calculated as follows: Median (point) estimate of number of hospitalizations in a state categorized as having “mid” level of influenza activity = (Median rate of hospitalization from EIP sites categorized as “mid” level of hospitalization rates.)* Population of the state categorized as having mid level of influenza activity/ 100,000. This calculation is repeated for each state, using the appropriate categorizations of “low,” “mid” and “high” categories of hospitalizations and levels of influenza activity. Finally, the estimates for each state are then added up to provide a total median (point) estimate for all 50 states for that week.

§ Ranges calculated using the same system as calculating the median (point) estimate, except instead of using the median rate of hospitalization we used either the low or high estimate of rates of hospitalization. For example, the low number of hospitalization for a given week and state was calculated as follows: Low estimate of number of hospitalizations in a state categorized as having “mid” level of influenza activity = (Low rate of hospitalization from EIP sites categorized as “mid” level of hospitalization rates.)* Population of the state categorized as having mid level of influenza activity/ 100,000. This calculation is repeated for each state, using the appropriate categorizations of “low,” “mid,” and “high” categories of hospitalizations and levels of influenza activity. Finally, the estimates for each state are then added up to provide a total low estimate for all 50 states for that week.

‡ Corrected for under-reporting: Extrapolations of EIP hospitalizations to entire U.S. are corrected for under-reporting. Corrected by multiplying the extrapolated EIP hospitalizations by a factor of 2.7 (Reed et al., Emerg Infect Dis, Dec, 2009: available at: <http://cdc.gov/eid/content/15/12/pdfs/09-1413.pdf>).

** Deaths are calculated as a percentage of hospitalizations using data from the Aggregate Hospitalization and Death Reporting Activity (AHDRA) surveillance system. This system has up to 35 states reporting. Using data from AHDRA, by age group as reported through week 45, deaths as a percentage of hospitalizations were: 0-18 years of age – 1.46%; 19-64 years of age – 5.96%; 65+ years of age – 6.28%. We used, to simplify the process, the following percentages in our calculations: Deaths among 0-18 years of age – 1.5% of hospitalizations in that

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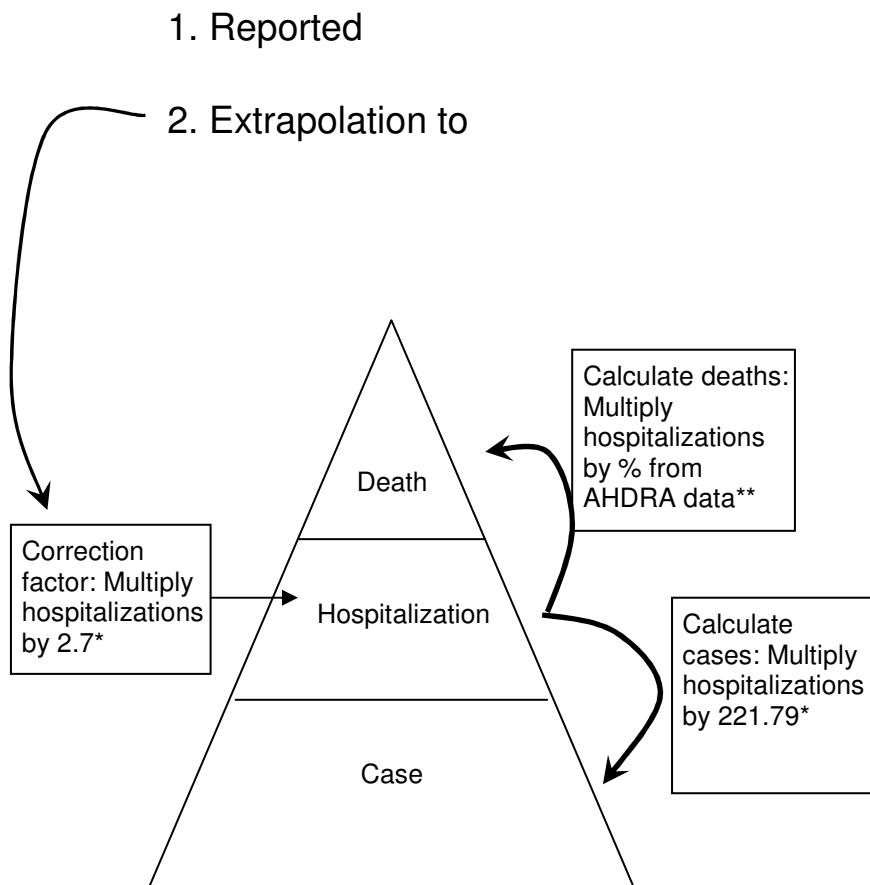
age group; Depths among adults (all ages) – 6.0% of hospitalizations in those age groups. We applied these percentages to all hospitalizations for all time periods covered in this Table.

Corrected for under-reporting: Cases: Cases estimated by using a multiplier of 221.79 cases per one hospitalization (for all age groups). This factor was calculated using the median estimates of cases (3.052 million) and hospitalizations (13,764) from Reed et al.

The range for deaths and cases were calculated using the same percentages as from the hospitalizations (see other notes for explanation of how hospitalization ranges were calculated). Upper limits are calculated as 142% of the point estimate of hospitalizations; the lower limit is calculated as 72% of point estimate of hospitalizations

An illustration of this methodology is below.

EIP: Steps



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*Data for multiplication factors and % of cases that result in hospitalization from Reed et al, EID, 2009

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