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

November 12, 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 Oct 17, 2009[a]
Reported	
Hospitalizations (lab confirmed)	**2,240**
Extrapolated to entire U.S.	
Hospitalizations	**28,345¶** *(18,243 – 44,561)§*

		TOTALS: Through Oct. 17, 2009
Deaths‡‡#		
0-17 yrs		540 *(317 - 849)*
18-64 yrs		2,919 *(1,874 - 4,589)*
+65 yrs		435 *(279 - 684)*
	sub-totals	*3,893 (2,499 - 6,120)*
Hospitalizations‡		
0-17 yrs		36,220 *(23,253 - 56,938)*
18-64 yrs		52,529 *(33,724 - 82,576)*
+65 yrs		8,788 *(5,642 - 13,815)*
	sub-totals	*97,536 (62,618 - 153,327)*
Cases‡‡‡#		
0-17 yrs		8,280,091 *(5,315,818 - 13,016,303)*
18-64 yrs		11,506,079 *(7,386,903 - 18,087,556)*
+65 yrs		1,846,390 *(1,185,382 - 2,902,525)*
	sub-totals	*21,632,560 (13,888,104 - 34,006,384)*

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a. For EIP data covering period Weeks 35 (Aug 29 – Sept. 04) to Week 41 (Oct. 10-16). EIP data for that time period has been updated as of 11/09/2009.

¶ EIP extrapolation: Calculate rate per 100,000 per EIP site. To balance for levels of influenza activity, for each reporting week, we then divided the EIP sites into 3 equal groups – "low," "mid," "high" rates of 2009 H1N1-related hospitalizations. We then calculated the median, low, and high rates of hospitalization of each of these 3 groups. Then we used ILINet (www.cdc.gov/flu/weekly) data to divide the 50 States in 3 equal groups (low, mid, high) by level of influenza activity as measured by ILINet. Then we matched rates from EIP sites to states (low-to-low, etc) to calculate hospitalizations in each state. 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 of hospitalizations and deaths from AHDRA, by age group as reported through week 43, we calculated deaths as a percentage of hospitalizations to be: 0-18 years of age – 1.489%; 19-64 years of age – 5.556%; 65+ years of age – 4.946%. To calculate deaths, these percentages were applied to all hospitalizations for all time periods covered in this Table.
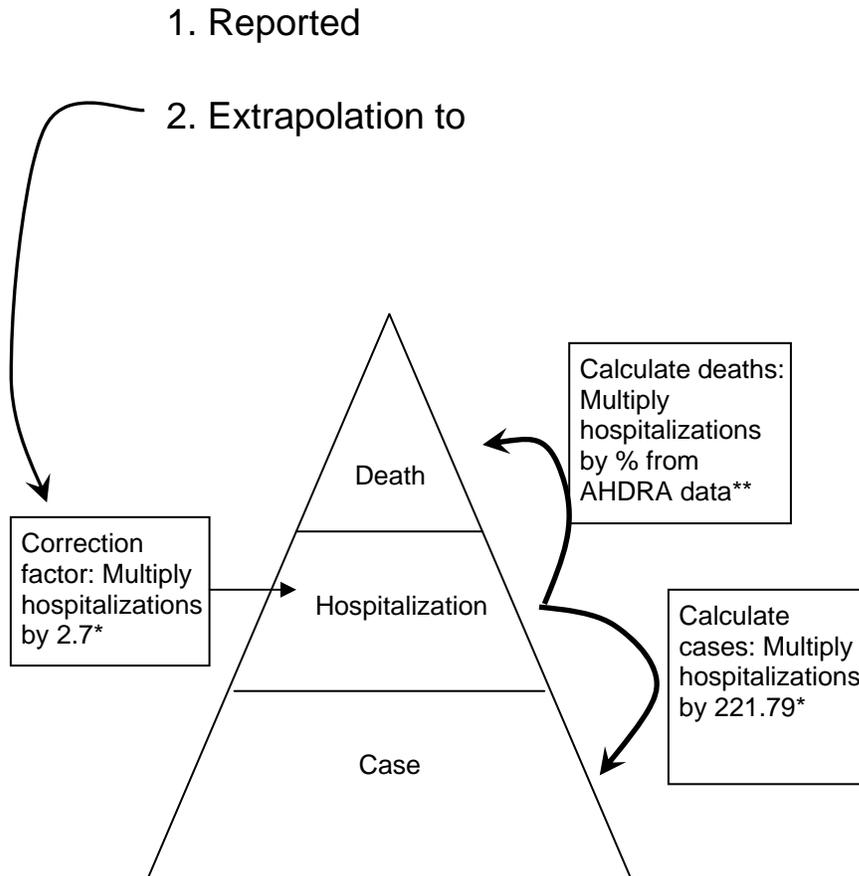
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‡‡‡ Corrected for under-reporting: Cases: Case estimates calculated as 221.79 of hospitalizations. This factor was calculated using the median estimates of cases (3.052 million) and hospitalizations (13,764) from Reed et al.
# The range for deaths 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 157.2% of the point estimate of hospitalizations; the lower limit is calculated as 64.4% of point estimate of hospitalizations.

An illustration of this methodology is below.

EIP: Steps

1. Reported

2. Extrapolation to

Correction factor: Multiply hospitalizations by 2.7*

Death

Hospitalization

Case

Calculate deaths: Multiply hospitalizations by % from AHDRA data**

Calculate cases: Multiply hospitalizations by 221.79*

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

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