2009 H1N1 Influenza Issue Brief

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Where Does H1N1 Influenza Information Come from? An Overview of Influenza Surveillance in the United States

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The U.S. Centers for Disease Control and Prevention (CDC) tracks influenza illness in the United States through a combination of disease and syndrome-based surveillance systems. Here we provide a brief summary of the main data sources for the CDC, explain what these sources can and cannot tell about an outbreak, and explain the differences in data collection during the spring wave of the 2009 H1N1 influenza A pandemic, the outbreaks during the summer months, and those now occurring.

Virologic Surveillance

Information on the influenza virus comes from the combined reports of 80 U.S.-based World Health Organization (WHO) Collaborating Laboratories and 70 National Respiratory and Enteric Virus Surveillance System (NREVSS) laboratories. The 80 WHO Collaborating labs include all state and some county public health laboratories, as well as some large tertiary care or academic medical centers; the 70 NREVSS labs are primarily hospital laboratories.[1]

Each week, these laboratories report to the CDC the total number of respiratory specimens that they test as well as the number that are found positive for influenza A and B. Most participating laboratories also report virus subtype (eg, H1 or H3) and the age of the patient from whom a sample was obtained. A small subset of samples is sent on to the CDC for gene sequencing, antiviral resistance testing, and antigenic determination.[1]

The CDC monitors antiviral resistance in 2 ways: some virus isolates are tested for their ability to be inhibited by antivirals, and some viruses are tested for the presence of a genetic mutation known to be associated with antiviral resistance. These data may come from tests that the CDC performs and/or from other laboratories that report data to the CDC.[2]

Detection of novel influenza viruses: The CDC also has maintained a separate system for detecting novel influenza viruses. Since 2007, human infection with a novel influenza A virus different from viruses already circulating has been a nationally notifiable condition. Under this program, states are asked to report cases of novel influenza A infection within 24 hours of confirmation of a case. States participate in this system via the Nationally Notifiable Diseases Surveillance System, which operates on a voluntary basis.[3] Individual state law determines the extent to which and how data will be reported to state health departments, which may then voluntarily report information to CDC.

These existing virologic surveillance systems provide a good sense of the predominant hemagglutinin subtypes (ie, H3 or H1) and the age groups most affected. Because not all labs characterize viruses any further, it is also possible, but to a lesser extent, to understand how frequently a specific influenza virus strain appears (for example, H1N1 versus H3N2). These systems can provide an alert if a new or antiviral-resistant influenza virus begins to circulate. However, because influenza is usually diagnosed

clinically, without laboratory confirmation, virologic surveillance systems generally cannot provide a count of the numbers of people who are becoming sick with influenza.

Outpatient Surveillance

The CDC monitors patient visits to healthcare providers for influenza-like illness (ILI). These data are collected through the U.S. Outpatient Influenza-like Illness Surveillance Network (ILINet). The total number of patients seen and the number of those patients with ILI are reported by age group to the CDC by approximately 3,000 providers at 1,400 outpatient care sites distributed across all 50 states. This percentage is then weighted on the basis of a state's population and compared with the national and regional baselines.[1]

While ILI-based surveillance systems can provide a general sense of the timing, volume, and geographic spread of ILI in the U.S., they do not provide specific understanding of influenza. As of the week ending October 17, 2009, CDC reports that 37.5% of clinical specimens tested for influenza were positive.[2] This percentage is up from 29.4% in the previous week, illustrating the fluctuations in sensitivity of ILI as an indicator of influenza. Outside of a known influenza epidemic, most ILI is not influenza, but during influenza season there typically is an increase in percentage of ILI due to influenza.

Geographic Spread

Additionally, the CDC receives state and territorial epidemiology reports on the estimated level of influenza activity in each state. This information is used to create national maps that illustrate influenza activity. Epidemiologists consider both the extent of ILI and confirmed influenza infection to estimate the spread of influenza activity within their states.[1]

Epidemiology reports and the ILINet help the CDC determine where influenza activity is occurring regionally and nationally. While this surveillance system can provide a general sense of the extent of influenza activity, it cannot provide a count of the number of people who are infected with influenza or ILI, nor can it provide information about the strains of influenza that are circulating.

Overall Mortality

The CDC relies on the 122 Cities Mortality Reporting System to acquire data on the overall number of deaths related to influenza. In this system, 122 cities report weekly the total number of death certificates received, as well as the number for which pneumonia or influenza was listed as an underlying or contributing cause of death. The percentage of reported deaths due to pneumonia and influenza (P&I) are compared with a seasonal baseline of P&I deaths.[1]

These data are reported by age group on a national level only and can provide an estimate of the burden of deaths from influenza and influenza-associated conditions within the nation. These data also determine when the "epidemic threshold" of influenza has been reached. This determination is based on a statistical algorithm applied to the seasonal baseline of P&I deaths.

Additionally, through the Nationally Notifiable Diseases Surveillance System, the CDC receives reports of laboratory-confirmed influenza deaths in children under 18 years of age.

Hospitalizations

Two hospital-based surveillance programs complete the CDC's influenza surveillance system. One is the Emerging Infections Program (EIP), through which laboratory-confirmed, influenza-related hospitalizations are identified when routine patient care results in a documented positive influenza test. The scope of this program is limited because it covers only 12 metropolitan areas in 10 states.[1]

The other program is the New Vaccine Surveillance Network (NVSN), in which NVSN hospitals prospectively enroll children under 5 years of age who have fever or respiratory symptoms. Respiratory samples from these patients are tested by RT-PCR and viral culture. This program is limited to 3 counties in Ohio, Tennessee, and New York.[1]

Hospital surveillance data provides estimates of influenza related hospitalizations that are population-based and laboratory confirmed. Changes in overall or age-specific rates of hospitalizations due to influenza may provide some sense of changes in severity; however, because these data are collected from only limited geographic areas, they do not provide a complete national assessment of hospitalization rates.

Other State-based Surveillance Programs

Since August 30, 2009, states have reported and CDC has tracked on a weekly basis all hospitalizations and deaths due to confirmed-influenza and pneumonia-syndrome.[2]

The CDC also receives data from other syndrome-based surveillance programs, many of which operate primarily at the state level. For example, through the BioSense program, the CDC receives from states data that are extracted from health-related transactions, such as emergency department records. States may operate systems for monitoring and/or tracking 911 calls, purchase of over the counter medication, prescriptions filled, and school absenteeism. A review of such systems found that they are most developed in states with the cities at the highest risk for terrorism.[4]

Information from these systems may provide additional evidence for tracking the progress of influenza outbreaks, including the relative demands for medical care in different regions. However, coverage from these systems is not comprehensive and occasionally returns spikes in activity that reflect the influence of factors such as media coverage, rather than actual influenza activity.[5]

Changes in H1N1 Surveillance Since Spring

The CDC typically maintains the surveillance systems described above during influenza season–October until mid-May. However, when the 2009 H1N1 virus was first identified in April 2009, the CDC implemented a separate system to track individual cases of illness and deaths associated with the novel virus.[6]

On August 30, 2009, the CDC stopped counting individual cases of confirmed 2009 H1N1 infection. Since then, the virus is tracked via the seasonal influenza systems described above. To account for changes in case definitions that have occurred since the spring, surveillance numbers were reset to zero on August 30, 2009.[2] This allows comparison of the current 2009-2010 influenza season with previous seasons. However, the systems currently in use do not provide counts of illnesses and deaths specifically caused by the 2009 H1N1 influenza virus.

Conclusion

Our current understanding of the 2009 H1N1 influenza pandemic is derived in large part from where and how the CDC and state health departments collect data. To that end, it is important to know what types of information are explicitly collected and what is inferred. For instance, from the data currently collected by the CDC there is no clear way to count the actual total number of deaths from H1N1 influenza. However, the CDC collects other data—such as P&I deaths, pediatric mortality, and virologic surveillance—that provide some information on mortality. Together, the data collected by the CDC and states create a composite picture of the current H1N1 influenza outbreak.

In the U.S., systems for tracking seasonal influenza are highly developed, particularly when compared with systems for tracking other respiratory or enteric diseases. However, despite the progress made in improving influenza surveillance, the current systems still do not provide a complete picture. For example, in the first few weeks of the 2009 H1N1 influenza outbreak, it was difficult to gauge the severity of the outbreak, because none of the systems provided an accurate count of the total numbers of individuals infected with influenza. As stated above, there are limitations to using ILI-based systems to estimate the total numbers of individuals infected with influenza, particularly when cases occur outside of the usual flu season, as happened in the spring.

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