Influenza-Like Illness in the Community during the Emergence of 2009 Pandemic Influenza A(H1N1) – Survey of 10 States, April 2009

Carrie Reed,1 Frederick J. Angulo,2 Matthew Biggerstaff,1 David Swerdlow,2 and Lyn Finelli1

1Influenza Division and 2National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention, Atlanta, Georgia

Following the emergence of 2009 pandemic influenza A(H1N1) virus (pH1N1) in the United States, the incidence of pH1N1 in the community was unclear, because not all persons with influenza come to medical attention. To better estimate the incidence of pH1N1 in the community early in the pandemic, a telephone survey was conducted in 10 states. The community incidence of influenza-like illness in April 2009 was 4.7 per 100 adults (95% confidence interval: 2.8-6.6); half of adults reported seeking medical care for their illness. Such surveys may be important tools for assessing the level of illness in the general population, including those who do not seek medical care and are thus not captured using traditional surveillance methods.

Influenza viruses circulate every winter in the Northern Hemisphere, primarily between October and April, with activity often peaking in February. In mid-April 2009, the first cases of 2009 pandemic influenza A(H1N1) (pH1N1) were identified in the United States [1], while 2008–09 seasonal influenza activity was decreasing in the United States. Over the following weeks, infection with the novel virus was identified throughout the United States, and activity continued to increase [2]. Surveillance for influenza in the United States is composed of a series of sentinel systems that monitor medically attended influenza-like illness (ILI) and influenza-related morbidity through reports of hospitalizations and deaths [2]. These systems are important tools for monitoring trends in influenza activity over time, including when and how fast activity is increasing, and for comparing activity between geographic regions. These sentinel systems, however, do not capture the full burden of influenza in a population, because individuals must present to medical establishments to be identified and included. Many people with influenza do not seek medical care for their illness and may be cared for by themselves or family members who live in the household.

To better estimate the burden of ILI in the community at the time of the emergence of pH1N1, we conducted a population-based telephone survey in 10 states for the month of April 2009 to assess the incidence of ILI, health seeking behavior, and treatment with anti-viral medications.

METHODS

An influenza morbidity survey was developed in 2006 by the Centers for Disease Control and Prevention (CDC) and members of the Emerging Infections Program (EIP) Influenza Network to estimate the community incidence of ILI (defined as fever plus cough and/or sore throat), influenza testing, and treatment of influenza with antiviral medications. This ILI survey was originally conducted in 9 states as a module in the 2007 Behavioral Risk Factor Surveillance Survey (BRFSS), a nationwide random-digit dialed telephone survey that has operated annually in the United States since 1984. The 9 original states included California, Colorado,
Connecticut, Georgia, Maryland, Minnesota, New Mexico, Oregon and Tennessee.

Following the emergence of pH1N1 in April 2009, the same series of ILI questions with a set of limited demographic questions was used in a telephone survey in the 9 original states plus New York. This cross-sectional telephone survey was conducted over a 3 week period between 20 May and 7 June 2009, with April 2009 as the reference period for survey questions. Telephone numbers were randomly selected using weighting methodology similar to that used for the BRFSS, stratified by state [3]. A nonrandom adult age ≥18 years from each selected household was interviewed and was also asked to provide information on each other household member, including children.

SAS software version 9.2 (SAS Institute) was used to calculate population-weighted point estimates for the incidence of ILI and corresponding standard errors, taking into account the design of the sampling methodology. Weighting and weighting formulas were the same as those referenced in the BRFSS Operational and User’s Guide [3]. Point estimates among household members were not weighted, because weights were not calculated for each household member, but for the primary respondent based on the age and sex distribution of the adult population by state. Ninety-five percent confidence intervals (95% CI) for estimates were calculated by multiplying 1.96 by the standard error of the point estimate. Unstable data estimates were noted when the relative standard error (RSE) was ≥30% of the estimate.

Survey response rates were estimated using the Council of American Survey Research Organizations (CASRO) method, which reflects the percentage of eligible households who are contacted, and the Cooperation method, which reflects the proportion of contacts that completed interviews. Formulas for these measures were obtained from the CDC 2008 BRFSS Summary Data Quality Report [4].

## RESULTS

Of eligible phone numbers, 46.4% were successfully contacted and 88% of persons contacted completed the survey, for a total of 1790 respondents. Among respondents, 1198 (67%) were female, and the median age was 54 years, with a range of 18–94 years. The median household size, including the respondent, was 2 persons, with a range of 1–12 persons. Among household members of the respondent, the median age was 30 years, with a range of 1–98 years.

For the month of April 2009, 88 respondents with ILI and 239 household members with ILI were identified in 10 states. The population-weighted incidence of ILI among respondents was estimated to be 4.7 (95% CI: 2.8–6.6) per 100 persons, and ranged from 1.9 (95% CI: 0.6–3.2) per 100 among adults aged ≥65 years to 5.9 (95% CI: 1.9–9.9) among adults aged 49–64 years (Table 1), although confidence intervals overlapped considerably. Among household members, the unweighted incidence of ILI overall was 7.9 (95% CI: 6.9–8.8) per 100 persons with 4.7 (95% CI: 3.8–5.7) per 100 adults and 13.5 (11.5–15.7) per 100 children; the highest incidence reported among children aged 0–4 years at 23.1 (95% CI: 18.1–28.1) per 100 persons.

Characteristics of respondents and household members with ILI are displayed in Table 2. Questions about 3 underlying medical conditions were included in the survey – asthma, diabetes, and cardiovascular disease. Of the 88 respondents with ILI, 43% had at least one of these medical conditions: asthma (31.8%; 95% CI: 21.6–42.1), diabetes (10.3%; 95% CI: 3.7–16.7), or cardiovascular disease (19.2%; 95% CI: 11.0–27.7). No respondents reported being pregnant. Overall, 61.4% (95% CI: 50.8–71.9) of respondents with ILI reported that they sought medical care for their illness. Respondents were not significantly more likely to have sought medical care if they reported asthma, diabetes, or cardiovascular disease (68.4%) than if they did not (56.0%; P = .24). Among those who sought medical care, 21.6% (95% CI: 9.1–34.1) reported being tested for influenza, and 7.4% (95% CI: 0.2–14.6) were treated with a neuraminidase inhibitor medication (ie, oseltamivir or zanamivir).

A total of 239 household members were reported to have ILI in April. Among household members with ILI, 20.2% had an underlying medical condition, including asthma (15.5%), diabetes (4.2%), and cardiovascular disease (4.6%). No household members were known to be pregnant. Fifty-five percent of household members with ILI reportedly sought medical care. Children under the age of 5 years were more likely to have received medical care (70.3%) than older children (53.7%, P = .04) or adults (45.9%, P < .01). Of all household members who sought medical care, 28.8% were tested for influenza, and 4.5% were treated with a neuraminidase inhibitor medication (ie, oseltamivir or zanamivir).

## DISCUSSION

In April 2009, following the emergence of pH1N1 in the United States, a telephone survey in 10 states indicated the incidence of ILI in the community to be 4.7 per 100 persons, with the lowest incidence in persons aged >65 years and the highest incidence among household members <5 years. Although traditional influenza surveillance relies on reports of medically attended ILI from healthcare providers, methods such as this may capture a fuller picture of the incidence of ILI in the population, because just over half of the adult respondents with ILI in this survey reported that they had visited a healthcare provider for their illness. Persons with underlying medical conditions such as asthma, diabetes, or heart disease that are known to be risk factors for complications from influenza [5], were slightly more likely to seek medical care for ILI, although this was not...
statistically significant, and the small sample size precluded definitive conclusions. Among household members, only very young children were more likely to visit a healthcare provider for ILI.

Telephone surveys have been used previously to better understand the burden of influenza in the community, including those who do not seek medical attention. In New York City, a telephone survey for ILI was used to provide context for the city’s clinical surveillance of ILI visits to emergency departments and found that each visit to an emergency department for ILI represented approximately 60 persons in the community with ILI [6]. Telephone surveys have also been used to assess the social and economic impact of influenza in the population, including missed school or work due to ILI [7, 8].

At the time of this survey, seasonal influenza activity had declined throughout the United States, and pH1N1 was beginning to emerge nationwide [1]. Infections with pH1N1 had been increasingly detected by the end of April in all 10 states included in the survey. Our estimates from this time period in 2009 are slightly lower than those from a similar telephone survey conducted in New York City covering the first 3 weeks of May 2009, a time when cases continued to increase, especially in New York City which experienced a large spring outbreak. That survey estimated that approximately 6.9% of NYC residents reported ILI during May, including the highest incidence in young children and the lowest in older adults [9].

Although this survey had a high cooperation rate — 88% of contacted persons completed the survey — telephone surveys have several limitations [10]. Due to the rapid increase in the prevalence of adults in wireless-only households, noncoverage bias due to land-line-only telephone surveys has been of increasing concern. These biases can be minimized, although not eliminated, with the use of demographic population weights that are adjusted to compensate for the exclusion of phoneless households [11], as used in the BRFSS. Unlike the annual BRFSS, however, this survey was only conducted during 1 month in 10 states; thus, these adjustments may not fully account for such selection biases. In addition, responses were self-reported and influenza or pH1N1 was not laboratory confirmed. Other illnesses can also resemble ILI, and seasonal influenza cannot be distinguished from pH1N1 without laboratory testing. Although seasonal influenza activity was low in the United States at the time, and other respiratory illnesses are also less common at this time of the year, with the media attention and

<table>
<thead>
<tr>
<th>Table 1. Community Incidence of Influenza-Like Illness (ILI) in 10 US States in April 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics</td>
</tr>
<tr>
<td>Age group, years</td>
</tr>
<tr>
<td>0–4</td>
</tr>
<tr>
<td>5–17</td>
</tr>
<tr>
<td>18–49</td>
</tr>
<tr>
<td>&gt;65</td>
</tr>
</tbody>
</table>

NOTE: Only adults aged >18 years were included as primary respondents for the telephone survey. Each primary respondent answered questions on behalf of other household members, including children.

Population weighted.

Relative standard error >30%.

<table>
<thead>
<tr>
<th>Table 2. Characteristics of Respondents and Household Members With Influenza-Like Illness (ILI) in 10 US States in April 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristic</td>
</tr>
<tr>
<td>Sought medical care</td>
</tr>
<tr>
<td>Tested for influenza</td>
</tr>
<tr>
<td>Received antiviral treatment</td>
</tr>
<tr>
<td>Underlying medical condition, including any of the following:</td>
</tr>
<tr>
<td>Asthma</td>
</tr>
<tr>
<td>Diabetes</td>
</tr>
<tr>
<td>Cardiovascular disease</td>
</tr>
</tbody>
</table>

NOTE: Data are percentage (95% confidence interval [CI]). Only adults aged >18 years were included as primary respondents for the telephone survey. Each primary respondent answered questions on behalf of other household members, including children.

Unweighted.

Relative standard error >30%.
public awareness surrounding the emergence of pH1N1, recall bias could have led to overreporting of illness by respondents about themselves or their household contacts.

Our study provides an estimate of ILI in the community at a time when pH1N1 was emerging in the United States. The module used in this survey was developed to be incorporated into the BRFSS, an existing and well-characterized telephone survey. In September 2009, this module began to be included in the annual BRFSS to provide an ongoing estimate of community ILI. The inclusion of all 50 states and a larger sample size will be able to provide more robust estimates of community ILI and health-seeking behavior throughout the fall and winter of 2009–2010. Telephone surveys such as this are one tool available for assessing the community incidence of ILI, and ongoing use of this survey within and between influenza seasons may provide a standardized method of monitoring and interpreting influenza activity in the United States.

Acknowledgments

The authors would like to thank Laurie Kamimoto and members of the Emerging Infections Program (EIP) Influenza Surveillance Network for the development of the Influenza-like Illness survey module. The Network includes California EIP, Oakland, California; Colorado Department of Public Health and Environment, Denver, Colorado; Connecticut EIP, Yale University, New Haven, Connecticut; Georgia EIP—a collaboration between Georgia Division of Public Health, Emory University and the Atlanta Veterans Administration Medical Center, Atlanta, Georgia; Maryland Department of Health and Mental Hygiene, Baltimore, Maryland; Minnesota Department of Health, St. Paul, Minnesota; New Mexico Department of Health, Santa Fe, New Mexico; New York State Health Department, Albany, New York; Center for Community Health and Department of Medicine, University of Rochester School of Medicine and Dentistry, Rochester, New York; Oregon Public Health Division, Portland, Oregon; Tennessee Department of Health, Nashville, Tennessee; and Department of Preventive Medicine, Vanderbilt University School of Medicine, Nashville, Tennessee.

Supplement sponsorship. Published as part of a supplement entitled “The 2009 H1N1 Influenza Pandemic: Field and Epidemiologic Investigations,” sponsored by the Centers for Disease Control and Prevention.

Potential conflicts of interest. All authors have no conflicts of interest.

References