Practice of Epidemiology

The Burden and Severity of Illness Due to 2009 Pandemic Influenza A (H1N1) in a Large US City During the Late Summer and Early Fall of 2009


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In estimates of illness severity from the spring wave of the 2009 influenza A (H1N1) pandemic, reported case fatality proportions were less than 0.05%. In prior pandemics, subsequent waves of illness were associated with higher mortality. The authors evaluated the burden of the pandemic H1N1 (pH1N1) outbreak in metropolitan Atlanta, Georgia, in the fall of 2009, when increased influenza activity heralded the second wave of the pandemic in the United States. Using data from a community survey, existing surveillance systems, public health laboratories, and local hospitals, they estimated numbers of pH1N1-associated illnesses, emergency department (ED) visits, hospitalizations, intensive care unit (ICU) admissions, and deaths occurring in metropolitan Atlanta during the period August 16, 2009–September 26, 2009. The authors estimated 132,140 pediatric and 132,110 adult symptomatic cases of pH1N1 in metropolitan Atlanta during the investigation time frame. Among children, these cases were associated with 4,560 ED visits, 190 hospitalizations, 51 ICU admissions, and 4 deaths. Among adults, they were associated with 1,130 ED visits, 590 hospitalizations, 140 ICU admissions, and 63 deaths. The combined symptomatic case hospitalization proportion, case ICU admission proportion, and case fatality proportion were 0.281%, 0.069%, and 0.024%, respectively. Influenza burden can be estimated using existing data and local surveys. The increased severity reported for subsequent waves in past pandemics was not evident in this investigation. Nevertheless, the second pH1N1 pandemic wave led to substantial numbers of ED visits, hospitalizations, and deaths in metropolitan Atlanta.

Influenza, human; morbidity; mortality; pandemics; United States

Abbreviations: BRFSS, Behavioral Risk Factor Surveillance System; ED, emergency department; EIP, Emerging Infections Program; ICD-9, International Classification of Diseases, Ninth Revision; ICU, intensive care unit; ILI, influenza-like illness; pH1N1, pandemic H1N1.

Symptomatic Influenzavirus infection ranges from a mild illness with fever, cough, and/or sore throat to severe illness and death. In April 2009, a novel influenza A H1N1 virus that resulted in a pandemic was identified (1). In the United States, the 2009 influenza A H1N1 pandemic had 2 waves of illness—a spring wave and a late summer/early fall wave. Data from the spring wave of the pandemic were used to estimate the severity and burden of disease associated with the pandemic H1N1 (pH1N1) outbreak in the United States (2–5). These early estimates of illness severity for the novel virus classified the pandemic as category 1 (least severe) in the Pandemic Severity Index (6), with case fatality proportions ranging from 0.026% to 0.048% (2–5). However, during the 1918 influenza pandemic, subsequent waves of illness were reported to have higher mortality than the initial wave (7–9). Thus, assessments of
immunocompromised persons with system sepsis-like syndrome were preferentially tested.

markedly increased ED visits in the metro-Atlanta area

3) hospitalizations, 4) intensive care unit (ICU) admissions,

influenza hospitalizations in metropolitan Atlanta

Laboratory-confirmed influenza hospitalization in

emergency department (ED) visits,

classification during the second wave of pH1N1-associ-

We defined 5 levels of pH1N1-associated illness severity: 1) influenza-like illness (ILI) in the community and illnesses resulting in 2) emergency department (ED) visits, 3) hospitalizations, 4) intensive care unit (ICU) admissions, and 5) deaths. Our investigation focused on metro-Atlanta, defined as the 8 counties that comprise Health District 3: Clayton, Cobb, DeKalb, Douglas, Fulton, Gwinnett, Newton, and Rockdale. The time frame of August 16, 2009–September 26, 2009, was chosen to cover a period of markedly increased ED visits in the metro-Atlanta area compared with previous months, based on available syndromic surveillance data (10).

We used syndromic data collected from a community survey, Georgia’s State Electronic Notifiable Disease Surveillance System, the Georgia branch of the 122 Cities Mortality Reporting System (11), and 5 large metro-Atlanta hospitals (Table 1). To estimate the number of pH1N1 cases for each level of illness severity, we applied the proportion of respiratory specimens from metro-Atlanta residents that tested positive for pH1N1 virus at the Georgia Public Health Laboratory to estimates of respiratory syndromic illness for each week (Figure 1). The number of respiratory specimens tested for pH1N1 increased during the investigation time frame, but the overall proportions of positive tests from metro-Atlanta residents and Georgia residents were similar. During the investigation time frame, the Georgia Public Health Laboratory was priority-testing hospitalized patients (A. Reeves, Georgia Department of Community Health, personal communication, 2010). Laboratory results from a representative sample of outpatients were not available. We calculated 95% confidence intervals for the proportion of positive tests for a standard distribution based on the number of specimens tested. We calculated low and high point estimates of pH1N1-associated illness by applying the limits of these confidence intervals for proportion of positive tests to estimates of respiratory syndromic illness.

Estimates for adults (ages ≥18 years) and children (ages <18 years) were calculated separately for each level, except for deaths, where the age cutoffs for reporting were ≥25 years for adults and <25 years for children based on the surveillance system that was used as our data source (12) (Table 1). We calculated weekly estimates to account for variations in influenza activity during the investigation time.
frame. The sums of the weekly estimates comprised our total estimates of pH1N1-associated illness for each layer of severity. The symptomatic case fatality proportion was calculated by dividing the estimated number of deaths due to pH1N1 by the estimated total number of symptomatic pH1N1 cases in the community. Similarly, the case hospitalization proportion was calculated by dividing the estimated number of pH1N1 hospitalizations by the total number of cases, and the case ICU admission proportion was calculated by dividing the estimated number of pH1N1 ICU admissions by the total number of cases.

**Community illness**

To assess the amount of illness in the community, we conducted a door-to-door community survey for ILI, defined as more than 1 day of illness that included fever plus either cough or sore throat within the prior month. The in-town suburb of metro-Atlanta we surveyed during September 26, 2009–October 10, 2009 covers 4.2 square miles (6.7 km²) and has a population of 18,147 (12). A simple random sample of 400 households allowed us to estimate the proportion of residents with ILI within 5%. In order to account for ineligible addresses (i.e., vacant buildings, businesses, dormitories, and buildings containing institutionalized populations), we approached 500 randomly selected addresses from a master list of all residential addresses within the in-town suburb’s city limits. If no one from the household was available after at least 3 attempted contacts on separate days, we made 3 additional attempts to contact the household by phone.

A standardized questionnaire was given to the initial respondent, who answered for all household members after we obtained verbal consent. We estimated an average weekly percentage of ILI for children and adults by dividing the percentage of ILI by 30 to obtain the average daily ILI percentage and then multiplying by 7. If dates within the month prior to the interview date fell outside of the investigation time frame, we weighted the response appropriately when calculating the weekly ILI percentages.

**ED visits**

Data on ED visits for ILI were obtained via the State Electronic Notifiable Disease Surveillance System (10) (Table 1), which collects data on all ED visits for 14 (54%) of the 26 hospital emergency departments in Georgia’s Health District 3 (metro-Atlanta area). These 14 hospitals represented approximately 63% of adult ED visits and 76% of pediatric ED visits in metro-Atlanta, based on 2007 data from the Georgia Department of Public Health (13). We adjusted the data on pH1N1-associated ED visits from the State Electronic Notifiable Disease Surveillance System to account for metro-Atlanta EDs not included in surveillance.

**Hospitalizations and ICU admissions**

To estimate numbers of hospitalizations associated with pH1N1 virus infection in metro-Atlanta, we used the Georgia Emerging Infections Program (EIP) population-based active surveillance for hospitalized laboratory-confirmed pH1N1 virus infections (Table 1). We assumed that some influenza-associated hospitalizations were not reported to Georgia EIP surveillance because not all patients hospitalized with respiratory illness were tested for influenza. Therefore, we estimated pediatric and adult correction factors to apply to the Georgia EIP surveillance data. Correction factors were estimated by comparing Georgia EIP hospitalization data from 5 hospitals (3 adult-care and 2 pediatric) to syndromic data for pneumonia and influenza hospitalizations, obtained from International Classification of Diseases, Ninth Revision (ICD-9), discharge codes, multiplied by the weekly proportion of respiratory specimens that tested positive for pH1N1. The adult hospitals consisted of 3 community hospitals in the northern metro-Atlanta area with 105 beds, 448 beds, and 572 beds, respectively. They comprised 16% of the total number of hospital beds in metro-Atlanta, including 98 combined ICU beds. The 2 pediatric hospitals were tertiary-care centers located in the city of Atlanta and had a combined 520 beds, including 170 ICU beds. These 2 hospitals accounted for 87% of all pediatric laboratory-confirmed pH1N1 hospitalizations during the investigation time frame. All 5 hospitals had diagnostic real-time reverse-transcriptase polymerase chain reaction influenza testing available during the investigation time frame.

In national estimates, the number of hospitalized patients with pH1N1 infection among adults aged ≥65 years was lower than that in younger age groups (4). However, the number of pneumonia and influenza hospitalizations among persons aged ≥65 years from the 5 hospitals did not reflect lower numbers of hospitalizations for elderly adults. Therefore, to avoid overestimating pH1N1 hospitalizations among persons aged ≥65 years, we excluded this age group from the correction factor calculation. However, once it was estimated, the correction factor was applied to
Georgia EIP data for all age groups. Thus, we avoided overestimating pH1N1 infections in elderly adults but still accounted for testing practices in this age group.

Pneumonia and influenza ICD-9 data from hospitalizations with ICU admissions were obtained from 19 (92%) of 22 metro-Atlanta hospitals with an ICU (Table 1). We adjusted for those hospitals that did not report data.

Deaths

We used Georgia data from the 122 Cities Mortality Reporting System (11) surveillance for deaths due to pneumonia and influenza (based on International Classification of Diseases, Tenth Revision, codes) to estimate deaths due to pH1N1. Georgia surveillance is limited to Fulton County, which comprises 26.4% of the metro-Atlanta population; we adjusted these data for metro-Atlanta.

RESULTS

Symptomatic pH1N1-associated illness in the community

We approached 500 sampled addresses in one metro-Atlanta community, of which 415 were eligible households; 280 (68%) of these households completed the survey, comprising 702 persons. Of the respondents, 71 persons (10%, accounting for household clustering) reported having ILI during the prior month; ILI was reported for 34 of 496 (7%) adults and 37 of 197 (19%) children. Extrapolating to metro-Atlanta, we estimated that 264,250 persons had symptomatic pH1N1-associated infection during the investigation time frame.

Compared with census data from metro-Atlanta, survey respondents consisted of proportionately more children under 5 years of age (10.7% vs. 7.9%) and more adults aged ≥65 years (10.2% vs. 7.7%). After age adjustment, we estimated that 279,610 persons in metro-Atlanta had symptomatic pH1N1 illness. The proportion of individual respondents who were white (83%) and non-Hispanic (94%) was greater than that of metro-Atlanta (50% and 89%, respectively) (data not shown).

ED visits associated with pH1N1 virus infection

There were 1,480 adult and 7,154 pediatric ED visits for ILI syndrome in metro-Atlanta reported to the State Electronic Notifiable Disease Surveillance System by participating hospitals during the investigation time frame (Figure 2). Based on the available laboratory data, we estimated that there were 1,130 adult and 4,560 pediatric ED visits due to pH1N1 at all hospitals in metro-Atlanta during the investigation time frame (Table 2).

Hospitalizations associated with pH1N1 virus infection

Five hospitals reported a total of 27 adult and 65 pediatric hospitalizations for laboratory-confirmed pH1N1 virus infections to Georgia EIP surveillance during the investigation time frame. Among the adults, 21 (78%) were aged 18–49 years, 5 (19%) were aged 50–64 years, and 1 (4%) was aged ≥65 years. Among 363 adult hospitalizations with pneumonia and influenza ICD-9 codes from the 5 hospitals, 29% of the patients were aged 18–49 years, 21% were aged 50–64 years, and 49% were aged ≥65 years; we excluded patients aged ≥65 years to determine the correction factor for adults. Among pediatric hospitalizations, 338 had pneumonia and influenza ICD-9 codes. We estimated that 90 adult and 167 pediatric hospitalizations with pneumonia and influenza ICD-9 codes were associated with pH1N1 virus infection at the 5 hospitals.

Figure 2. Numbers of adult and pediatric emergency department visits for influenza-like illness (ILI) reported to Georgia’s State Electronic Notifiable Disease Surveillance System, by week, metropolitan Atlanta, Georgia, 2009.
We estimated correction factors of 3.5 (90/26) and 2.6 (167/65) for adult and pediatric hospitalizations, respectively (Table 3). Applying the correction factors to Georgia EIP hospitalization data for all metro-Atlanta hospitals, we estimated that there were 590 adult and 190 pediatric pH1N1 hospitalizations in metro-Atlanta during the investigation time frame. By combining the adult and pediatric data, we estimated that every pH1N1 hospitalization reported to Georgia EIP represented 3.2 total pH1N1 hospitalizations in metro-Atlanta (Table 3).

ICU admissions associated with pH1N1 illness

Data for ICU admissions associated with pH1N1 illness were obtained from 19 of 22 adult hospitals that comprise 92% of all adult ICU beds in metro-Atlanta, as well as from the only 2 hospitals with pediatric ICU beds in metro-Atlanta. The estimated numbers of adult, pediatric, and total pH1N1 cases that required ICU admission were 140, 51, and 190, respectively (Table 2). Among adults, the age distribution of ICU admissions was 22% for ages 18–49 years, 26% for ages 50–64 years, and 52% for ages ≥65 years.

Fatalities associated with pH1N1

We estimated 63 adult and 4 pediatric pH1N1-associated deaths in metro-Atlanta during the investigation time frame (Table 2): 69% of adult deaths occurred among persons aged ≥65 years. Seven pH1N1-associated deaths among metro-Atlanta residents were reported to the Georgia Department of Public Health during the same time frame; reporting for adult deaths due to pH1N1 began in August 2009.

Burden of pH1N1 illness

The estimated rate of symptomatic pH1N1 illness in the metro-Atlanta community during the investigation time frame was 4,792 cases per 100,000 adults and 13,269 cases per 100,000 children (Table 2). Among adults with symptomatic pH1N1 illness, we estimated that 1 in 117 visited the ED, 1 in 224 was hospitalized, 1 in 944 required ICU admission, and 1 in 2,099 died. Among children with pH1N1 virus infections, we estimated that 1 in 29 visited the ED, 1 in 695 was hospitalized, 1 in 2,572 required ICU admission, and 1 in 33,077 died. Our combined estimates for symptomatic case fatality proportion (the proportion of symptomatic pH1N1-infected persons who died), case ICU

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Table 2. Estimates of Symptomatic Community Illness, Emergency Department Visits, Hospitalizations, and Deaths Due to 2009 Influenza A H1N1 Infection, Metropolitan Atlanta, Georgia, August 16, 2009–September 26, 2009a

<table>
<thead>
<tr>
<th></th>
<th>Calculated Estimate (No. of Cases)</th>
<th>95% Confidence Interval</th>
<th>Rate Per 100,000 Persons</th>
<th>Comparison With Community ILI</th>
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<tr>
<td></td>
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<td>Ratio</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Children (ages &lt;18 years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deaths</td>
<td>4</td>
<td>3, 5</td>
<td>0.4</td>
<td>1:33,077</td>
</tr>
<tr>
<td>ICU admissions</td>
<td>51</td>
<td>40, 63</td>
<td>5.2</td>
<td>1:2,572</td>
</tr>
<tr>
<td>Hospitalizations</td>
<td>190</td>
<td>150, 240</td>
<td>19</td>
<td>1:695</td>
</tr>
<tr>
<td>ED visits</td>
<td>4,560</td>
<td>3,550, 5,580</td>
<td>458</td>
<td>1:29</td>
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<tr>
<td>ILI in the community</td>
<td>132,140</td>
<td>101,480, 162,810</td>
<td>13,269</td>
<td>1:1</td>
</tr>
<tr>
<td>Adults (ages ≥18 years)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Deaths</td>
<td>63</td>
<td>48, 78</td>
<td>2.3</td>
<td>1:2,099</td>
</tr>
<tr>
<td>ICU admissions</td>
<td>140</td>
<td>110, 170</td>
<td>5.1</td>
<td>1:944</td>
</tr>
<tr>
<td>Hospitalizations</td>
<td>590</td>
<td>480, 680</td>
<td>21</td>
<td>1:224</td>
</tr>
<tr>
<td>ED visits</td>
<td>1,130</td>
<td>880, 1,370</td>
<td>41</td>
<td>1:117</td>
</tr>
<tr>
<td>ILI in the community</td>
<td>132,110</td>
<td>101,450, 162,770</td>
<td>4,792</td>
<td>1:1</td>
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<tr>
<td>Children and adults</td>
<td></td>
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<tr>
<td>combined</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deaths</td>
<td>67</td>
<td>51, 83</td>
<td>1.8</td>
<td>1:14,177</td>
</tr>
<tr>
<td>ICU admissions</td>
<td>190</td>
<td>150, 230</td>
<td>5.1</td>
<td>1:1,472</td>
</tr>
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<td>Hospitalizations</td>
<td>780</td>
<td>630, 920</td>
<td>21</td>
<td>1:358</td>
</tr>
<tr>
<td>ED visits</td>
<td>5,690</td>
<td>4,430, 6,950</td>
<td>152</td>
<td>1:49</td>
</tr>
<tr>
<td>ILI in the community</td>
<td>279,610</td>
<td>202,930, 325,580</td>
<td>7,451</td>
<td>1:1</td>
</tr>
</tbody>
</table>

Abbreviations: ED, emergency department; ICU, intensive care unit; ILI, influenza-like illness.

a Rounding may affect sums.

b Symptomatic case fatality proportion.

c Symptomatic case hospitalization proportion.

d Symptomatic case ICU admission proportion.

e Age-adjusted estimates.

We estimated correction factors of 3.5 (90/26) and 2.6 (167/65) for adult and pediatric hospitalizations, respectively (Table 3). Applying the correction factors to Georgia EIP hospitalization data for all metro-Atlanta hospitals, we estimated that there were 590 adult and 190 pediatric pH1N1 hospitalizations in metro-Atlanta during the investigation time frame. By combining the adult and pediatric data, we estimated that every pH1N1 hospitalization reported to Georgia EIP represented 3.2 total pH1N1 hospitalizations in metro-Atlanta (Table 3).
admission proportion (the proportion admitted to an ICU), and case hospitalization proportion (the proportion hospitalized) were 0.024%, 0.069%, and 0.281%, respectively.

DISCUSSION

We produced estimates of the influenza burden at 5 different levels of severity by combining existing local surveillance data, hospital records, and a community survey. We estimated that the pH1N1 virus was associated with 279,610 (7.5%) symptomatic infections among approximately 3,752,600 residents of the 8-county metro-Atlanta area during 6 weeks in the late summer/early fall of 2009. Children were more likely to become ill from pH1N1 virus infection, but infected adults were more likely to have severe illness resulting in hospitalization, ICU admission, or death. Our overall severity estimates, including case fatality proportion and case hospitalization proportion, were similar to those of US estimates for the spring (2–5). In contrast to the 1918 influenza pandemic, the second wave of the 2009 influenza pandemic was not more severe than the first in metro-Atlanta. Nevertheless, the numbers of ED visits, hospitalizations, and deaths occurring during the second wave were substantial.

We estimated that approximately 1 out of every 21 adults (4.8%) and 1 out of every 8 children (13.3%) in metro-Atlanta had symptomatic pH1N1 virus infection during the 6-week study period. Our results are similar to results from a supplementary module to the national Behavioral Risk Factor Surveillance System (BRFSS) phone survey (6). The BRFSS is a large, ongoing telephone health survey system that has been tracking health conditions and risk behaviors in the United States yearly since 1984. The BRFSS found that the average monthly percentage of respondents reporting ILI during the 30 days preceding the interview was 8.1% among adults (range: 5.5% for September interviews to 9.5% for November) and 28.4% among children (range: 20.4% for September interviews to 35.9% for November). Our results reflect only 1 community in Georgia, unlike the BRFSS. Higher attack rates of pH1N1 illness among younger persons were also observed during the spring wave in New York City (14) and in other national estimates (4).

The high incidence of symptomatic pH1N1 virus infection in children resulted in a considerable number of ED visits; we estimated that 1 out of every 218 children in the metro-Atlanta area visited an ED with pH1N1 virus infection, which is consistent with the surge in ED visits noted by the media (13). However, relatively few of the pH1N1 virus infections in children resulted in death in comparison with adults. The rate of death associated with pH1N1 was more than 5 times greater in adults, despite the lower overall rate of illness in adults. An estimate from the spring also found a greater proportion of severe outcomes in adults than in children (3).

Two models from the spring pH1N1 wave estimated common markers of severity and accounted for underascertainment of cases within the United States; those estimates were 0.45%–1.44% for case hospitalization proportion, 0.24% for case ICU admission proportion, and 0.026%–0.048% for case fatality proportion (3, 4). We estimated a symptomatic case hospitalization proportion of 0.28%, a symptomatic case ICU admission proportion of 0.07%, and a symptomatic case fatality proportion of 0.024% during the second wave in metro-Atlanta. These comparisons provide additional evidence that the severity of illness associated with pH1N1 virus infection did not increase from the first wave to the second in metro-Atlanta, as opposed to previous pandemics when subsequent waves reportedly had higher morbidity and mortality. In addition, they substantiate our methods of using data from a local survey as well as surveillance and hospital data as an approach to estimate severity.

We estimated that 24% of patients hospitalized with pH1N1 required ICU admission. While high, this proportion was within the range of 19%–31% found in studies from the first pandemic wave (3, 15, 16). Indeed, according to Georgia EIP data, 25% of persons with laboratory-confirmed pH1N1 hospitalizations in metro-Atlanta during our time frame were admitted to an ICU. Our investigation differed from these previous estimates because we aimed to estimate pH1N1 burden and severity while accounting for undiagnosed and unreported cases during the second wave of the pandemic. If we assumed an overestimation of pH1N1 ICU admissions, our corrected symptomatic case ICU admission ratio would have been even lower than estimates from the first pandemic wave.

Our estimates were based on a number of assumptions and carry certain limitations. Previous pandemics have displayed considerable geographic variation (8), so our results may not be generalizable to the rest of the United States. The Georgia Public Health Laboratory data were mostly from hospitalized patients; we applied these laboratory estimates to all levels of illness severity and age groups. In addition, the demographic characteristics of our community survey area were not representative of metro-Atlanta. In order to complete the in-person survey in a timely fashion, we decided that a simple random sample of 1 metro-Atlanta

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### Table 3. Comparison Between Reported and Estimated Numbers of Hospitalizations Due to 2009 Influenza A H1N1 From Selected Pediatric and Adult Hospitals,a Metropolitan Atlanta, Georgia, August 16, 2009–September 26, 2009b

<table>
<thead>
<tr>
<th></th>
<th>Children</th>
<th>Adults</th>
<th>All Ages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated no. of pH1N1 admissions to selected hospitals</td>
<td>167</td>
<td>91c</td>
<td>258</td>
</tr>
<tr>
<td>Reported no. of pH1N1 admissions to selected hospitals</td>
<td>65</td>
<td>26d</td>
<td>91</td>
</tr>
<tr>
<td>Correction factor (estimated number/report number)</td>
<td>2.6</td>
<td>3.5</td>
<td>3.2</td>
</tr>
<tr>
<td>Total reported no. of metropolitan Atlanta pH1N1 hospitalizationsa</td>
<td>75</td>
<td>169</td>
<td>244</td>
</tr>
<tr>
<td>Total calculated no. of metropolitan Atlanta pH1N1 hospitalizations</td>
<td>190</td>
<td>590</td>
<td>780</td>
</tr>
</tbody>
</table>

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a Selected to determine a correction factor for testing practices.
b Totals have been rounded.
c Excluding persons aged ≥65 years.
d pH1N1, pandemic 2009 influenza A H1N1.
e Emerging Infections Program surveillance for laboratory-confirmed influenza hospitalization.
community was more feasible than a stratified random sample of the entire metro-Atlanta area. Focusing on 1 area allowed us to achieve a response rate of 68%, which was higher than similar door-to-door surveys (17) and telephone surveys (6) done during the first wave. Moreover, we did not find significant differences in ILI proportions by race and ethnicity in the survey data (data not shown), suggesting that metro-Atlanta areas with different demographic characteristics may have had similar ILI proportions. We relied on several syndromic case definitions, depending on the data source. In particular, our case definition for pneumonia and influenza hospitalizations was nonspecific. However, we chose ICD-9 codes that have been used to identify potential influenza hospitalizations in previous estimates (18), and these codes would have captured 85% of laboratory-confirmed influenza hospitalizations reported to Georgia EIP during the pandemic.

The proportion of adults aged ≥65 years with laboratory-confirmed influenza hospitalization reported to Georgia EIP was substantially lower than the proportion in our estimate of pneumonia and influenza hospitalizations among the 5 selected hospitals. This disparity may have occurred because most of the pneumonia and influenza hospitalizations among elderly persons were not associated with pH1N1. Serologic evidence suggested that elderly adults were more likely to have preexisting immunity to pH1N1 (19). We thus excluded adults aged ≥65 years from the correction factor calculation. This may have led to an underestimation of adult pH1N1 hospitalizations. However, our estimated correction factor of 3.5 was similar to the 2.7 correction factor estimated by Reed et al. (4). If we had included adults aged ≥65 years in the correction factor calculation, our adult hospitalization correction factor and estimate would have been 6.6 and 1,120, respectively. Using this higher estimate, we would arrive at a symptomatic case hospitalization proportion of 0.85%, which is still within the range of estimates from the spring of 2009.

Using existing surveillance systems and local surveys, we estimated high rates of pH1N1-associated community illness and ED visits but relatively fewer pH1N1-associated hospitalizations, ICU admissions, and deaths during the second wave of the pandemic in metro-Atlanta. Although we estimated a higher case fatality proportion for adults (0.05%) than for children (0.003%), the adult estimate is still in the range for seasonal influenza and would classify the pandemic as category 1 (least severe) in the Pandemic Severity Index (20). By contrast, the 1918 influenza pandemic, considered the most severe pandemic of the 20th century, is estimated to have had a case fatality proportion between 2% and 3% (21). Our estimates are consistent with those of other investigations conducted during the spring of 2009. Similar models could be used locally to estimate severity during subsequent influenza seasons.

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The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the CDC.

Conflict of interest: none declared.

REFERENCES


