

Estimating Hospital Admissions for Influenza Using Emergency Department (ED) Syndromic Surveillance Data, New York City

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Objective: To evaluate whether trends in influenza hospitalizations can be monitored using ED syndromic surveillance data.

Background: An important goal of influenza surveillance is to provide public health decision-makers with timely estimates of the severity of community-wide influenza. One potential indicator is the number of influenza hospitalizations. In New York City (NYC) methods for estimating influenza hospitalizations include asking hospitals to self-report, sending field staff to review medical records, and analyzing electronic hospital discharge data available months after influenza season is over. Given the limitations of each of these approaches, we evaluated whether electronic ED data, received daily for syndromic surveillance, could be used to monitor hospitalizations during influenza epidemics.

Methods: Three community-wide influenza A periods (12/16/01-2/23/02, 12/21/02-3/8/03, 11/15/03-1/17/04) were identified based on influenza isolate data. Using hospital discharge data, weekly counts of hospitalizations with primary or secondary ICD9 code 480-487 were generated for four age-groups. Serfling regression was used to estimate expected counts, and the excess (observed – model expected) during influenza A periods was calculated as our gold standard estimate of influenza A hospitalizations. ED data are received daily for approximately 90% of NYC ED visits, and include patient's age, gender and chief complaint. ED ILI visits were defined as any visit whose chief complaint indicated fever-flu or respiratory syndrome. Weekly excess ED ILI visits were estimated as above using Serfling regression.

Results: During three influenza A seasons a total of 315,271 ED ILI visits and 48,791 hospitalizations with ICD9 480-487 were identified. During influenza A periods, 60% of ED ILI patients were under age 18, vs. only 17% of patients hospitalized with ICD9 480-487. The ratio of excess ED ILI visits to excess ICD9 480-487 hospitalizations varied by season and age-group. During the moderate 2001-2002 influenza A period, we estimated 18,853 excess ED ILI visits and 2,616 excess ICD9 480-487 hospitalizations (ratio 7:1), vs. 2,737 excess ED ILI visits and fewer than expected ICD9 480-487 hospitalizations (ratio undefined) during the mild 2002-2003 season, and 51,724 and 3,463 respectively (ratio 15:1) during the more severe 2003-2004 season. Significant age differences were observed. During 2001-2002 the

ratio of ED ILI to ICD9 480-487 hospitalizations was 102:1 in young children ages 0-4 and 0.3:1 in adults age 60+. Weekly excess ED ILI visits and weekly excess ICD9 480-487 hospitalizations increased, peaked and declined simultaneously during influenza A periods in 2001-2002 and 2003-2004 (see figure). Excess estimates were highly correlated ($r^2 > 0.90$) among young children and adults during these seasons, but not among children age 5-17 ($r^2 = 0.54$). The correlation between ED visits and hospitalizations was weakest during the mild 2002-2003 season. Examination of age-specific trends identified several periods of discordance between ED visits and hospitalizations, including an influenza B epidemic in February 2002 that caused a dramatic spike in ED ILI visits among children ages 5-17 but no increase in hospitalizations.

Conclusions: The easy availability of ED data and the high proportion (83%) of ICD9 480-487 hospitalizations admitted through the ED make surveillance in EDs attractive for monitoring trends in influenza hospitalizations. Correlation between ED visits and hospitalizations was highest during more severe influenza seasons, but varied considerably by season and age. The relationship between ED visits and hospitalizations depends on many factors, including the virulence of circulating influenza strains, previous immunological exposure of the population, and the sensitivity and specificity of chief complaint-based case ascertainment. To be useful, prospective estimation of influenza hospitalizations based on ED visits may require more specific data, including discharge disposition, physician diagnoses, and patient's temperature.

