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A Decade Later: Inequalities by Neighborhood Poverty Remain for Influenza-related Hospitalizations in Connecticut

Hospitalizations are a costly outcome of influenza infection. To prevent severe influenza infections resulting in hospitalization, interventions must be targeted to populations most affected. Although measures of socioeconomic status (SES) are not typically collected through routine public health surveillance, understanding the relationship between SES and health outcomes allows for targeted interventions. A previous evaluation of New Haven County influenza-related hospitalizations indicated a strong association between increasing incidence of hospitalizations and increasing census tract-level poverty, a proxy for SES, among children <18 years old during 2003-2011 influenza seasons (*1*). The same association was found among adults ≥18 years and older during 2007-2011 (*2*). The objective of the current analysis was to determine whether this inequality persisted following publicity through publication and discussion at local, regional and national meetings, implementation of the Affordable Care Act and, particularly, implementation of a licensed daycare influenza vaccination requirement in 2011 for children 6 months and older.

The Connecticut Department of Public Health/ Yale Emerging Infections Program geocoded addresses for New Haven County laboratory confirmed influenza-associated hospitalizations during the 2013-2014 through 2017-2018 influenza seasons. Geocoded addresses were linked to census tract poverty (CTP) level, defined as the percentage of households in a census tract living below the federal poverty level as determined by the 2013-2017 American Community Survey 5-Year Estimates. Census tracts were categorized into 4 CTP levels: <5%, 5-<10%, 10-<20%, and ≥20%. Age-specific and age-adjusted incidences for the five influenza seasons (2013-2014 through 2017-2018) were determined for each CTP level for all five seasons combined overall and by race/ethnicity and sex and for each influenza season. Trends in incidence by increasing CTP category were measured using chi-square for trend. Incidence rate ratios (IRR) of the ≥20% to <5% CTP groups were used to measure magnitude of trend associations found. Age-specific IRRs from the aggregated 2013-2018 data were compared to those found in the 2003-2010 (children) and 2007-2011 (adult) studies.

During 2013-2018 increasing CTP was significantly (p<0.05 for trend) associated with increased age-adjusted influenza-associated hospitalization incidence for all seasons combined and among each age-group (Figure 1, page 18). This relationship was true within each influenza season, each race/ethnic group, and each sex group. Compared to previous studies, the magnitude of the association was unchanged (IRR for children 0-4 years, 2.82 vs 3.76; for those 5-17 years 2.84 vs 2.91, for those 18-49, 3.82 vs 4.14, for those 50-64, 5.46 vs 4.31; and for senior ≥65adults, 1.55 vs 2.00, p=not significant for all) (Figure 2, page 18).

Reported by

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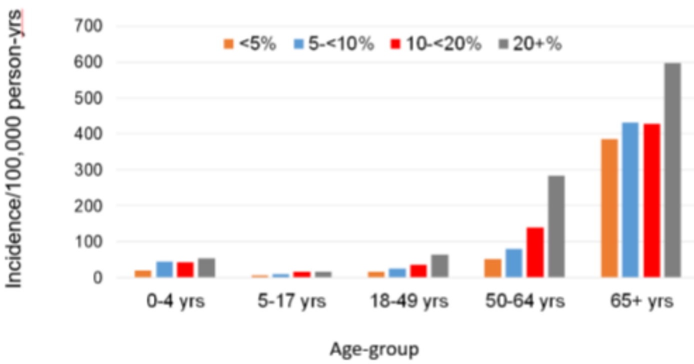
Editorial

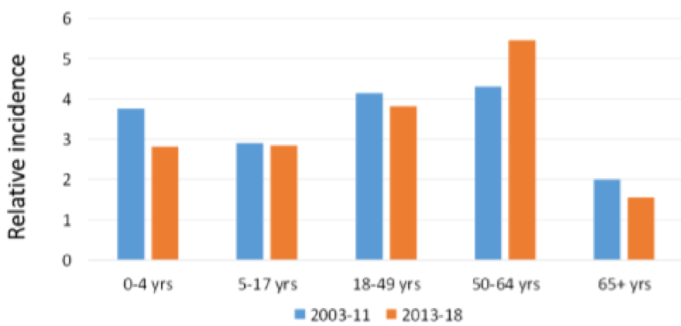
The initial New Haven County studies were the first to examine influenza hospitalization incidence by census tract poverty level. (1,2) Since then, a study using data from the national influenza hospitalization monitoring system, FluSurv-NET (which includes Connecticut), showed similar findings in all 14 FluSurv-NET sites (*3*). The association between hospitalizations and SES can be explained in part by differences influenza vaccination rates by SES, differences in crowding that can promote household influenza transmission (*1-3*), and possibly by less well controlled

Figure 1. Incidence of influenza-related hospitalization by age-group and census tract poverty level, 2013-2018*



*For each age group, there is a statistically significant trend (p<0.01) toward increasing incidence with increasing poverty level.

Figure 2. Comparison of relative incidence high/low poverty* by age-group and time period.



*No statistically significant differences between time periods.

underlying conditions such as asthma, which are risk factors for hospitalization. However, the differences in incidence by SES cannot be explained by having a lower threshold for admission as the same magnitude of disparity was found for admissions requiring ventilator care and for those resulting in death (*3*).

The magnitude of the previously described inequality in influenza-related hospitalizations by neighborhood poverty remained unchanged during 2003 (children) and 2007 (adults) through 2018. This inequality has remained largely unchanged despite efforts to bring it to public attention, implementation of the Affordable Care Act, and licensed daycare influenza vaccine requirements.

Since the first studies, annual influenza vaccination rates in Connecticut have increased in all age groups but the elderly. Comparing 2010-2012 to 2016-2018 aggregated data from CDC (*4*), vaccination levels increased from 81.3% to 85.0% in 6 month-4 year olds, from 54.9% to 68.0% in 5-17 year olds, and from 36.9% to 41.0% in 18-64 year olds, but showed no significant change (67.8% to 68.3%) in ≥65 year olds. Nonetheless, the increase in vaccination rates as well as efforts to publicize the earlier findings do not appear to have changed the inequalities by neighborhood poverty described previously. Thus, more systematic efforts are needed to increase influenza vaccination rates in poor communities.

Key Messages for Providers

- Providers serving poor communities should systematically offer influenza vaccination during the entire influenza season (October through April) at each medical appointment for all individuals ≥ 6 months of age who are not already vaccinated. In Connecticut, the influenza season usually peaks in mid-late February.
- Practice policies for offering influenza vaccination should be established to minimize the potential for missed opportunities.
- If practice burden makes it impossible to offer vaccination routinely to all at each visit, priority should be given to persons with qualifying underlying conditions, children 6 months to 17 years and those ≥50 years of age.

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Lyme Disease — Connecticut, 2018

Lyme disease (LD) is caused by the bacterium *Borrelia burgdorferi*. In Connecticut, LD is transmitted through the bite of infected blacklegged ticks (*Ixodes scapularis*). Lyme disease became a reportable disease in Connecticut in 1987 and a nationally-notifiable disease in 1991, and is the most commonly reported vector-borne disease in the United States (*1, 2*).

In 2018, Connecticut healthcare providers were required to report all cases of LD to the Connecticut Department of Public Health (DPH) using the Reportable Disease Confidential Case Report Form PD-23. Laboratories with electronic reporting capabilities were required to report positive findings of *Borrelia burgdorferi*. Supplemental Lyme Disease Laboratory Surveillance follow-up forms were generated and mailed by DPH staff to ordering providers for positive laboratory results as defined in the 2017 National Surveillance Case Definition (NSCD) (1). The NSCDs are drafted, considered, and approved by members of the Council of State and Territorial Epidemiologists (CSTE) and used by the Centers for Disease Control and Prevention (CDC) for national surveillance. Completed forms were returned to DPH by mail or confidential fax.

The NSCD, based on both clinical and laboratory criteria, was used to classify patients as confirmed, probable, or suspect cases (*1*). A classification of "case criteria not met" was given to reports that did not meet NSCD laboratory or clinical criteria. When no clinical information was returned, reports were classified as suspect. Confirmed and probable cases were reported to the CDC for inclusion in national surveillance data.

In 2018, DPH received 8,107 LD reports for CT residents. Of these, 7,622 (94%) indicated the reporting source. These included 529 (6.5%) from providers and 7,093 (90%) from laboratories. Of individuals reported by providers, 212 (40%) were also reported by laboratories. Of all laboratory reports, 4859 (67%) met the NSCD criteria for laboratory evidence; 4569 follow-up forms were mailed. Provider reports resulted in identification of 278 (87%) confirmed or probable cases, 32 (10%) suspect cases, and 6 (2%) case criteria not met. Among all laboratory reports meeting the NCSD, there were 1585 (32%) confirmed or probable cases, and 3,274 (67%) suspect cases. Of individuals reported by providers, 212 (40%) were also reported by laboratories, of these there were 154 (74%) confirmed or probable and 55 (26%) suspect cases. Of 483 reports with unknown surveillance method, none were confirmed or probable cases.

Of 1,271 confirmed cases, 549 (43%) had EM only, 661 (52%) one or more systemic manifestations only, and 60 (5%) both EM and systemic manifestations. Of confirmed cases not associated with EM, 567 (86%) had arthritic symptoms, 160 (24%) neurologic manifestations (Bell's palsy, encephalitis, radiculoneuropathy, lymphocytic meningitis), and 4 (1%) 2nd or 3rd degree atrioventricular (AV) block. Cases may have had multiple systemic symptoms.

The statewide incidence rate for confirmed and probable cases combined in 2018 was 51.8 cases per 100,000 population. Of cases with reported county of residence, the highest rate was among residents of New London County (141.2) and the lowest among residents of Hartford County (24.2). Adults aged ≥60 years had the highest incidences (60-69 = 96.4, ≥70 = 97.1) and those aged 40-49 years the lowest (31.4); 56% were male. Children aged 0-9 years had a rate of 42.4 cases per 100,000 population. Of 902 cases with known onset date, 56% occurred during June-August, with 221 (25%) occurring during June.

Reported by

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Editorial

Connecticut is considered a high-incidence state by CDC (*3*). All 14 high-incidence states struggle with the burden of clinical follow-up of LD laboratory reports and decreased reporting. In Connecticut, the number of follow-up forms mailed and not returned increased from 42% (2268/5037) in 2010 to 68% (3125/4569) in 2018. Lack of response means potential confirmed or probable cases cannot be classified or included in national case counts. Although the proportion of confirmed and probable cases among provider reports is higher than that of laboratory reports, provider only reports account for 20% or less of confirmed and probable cases (Figure, page 20).

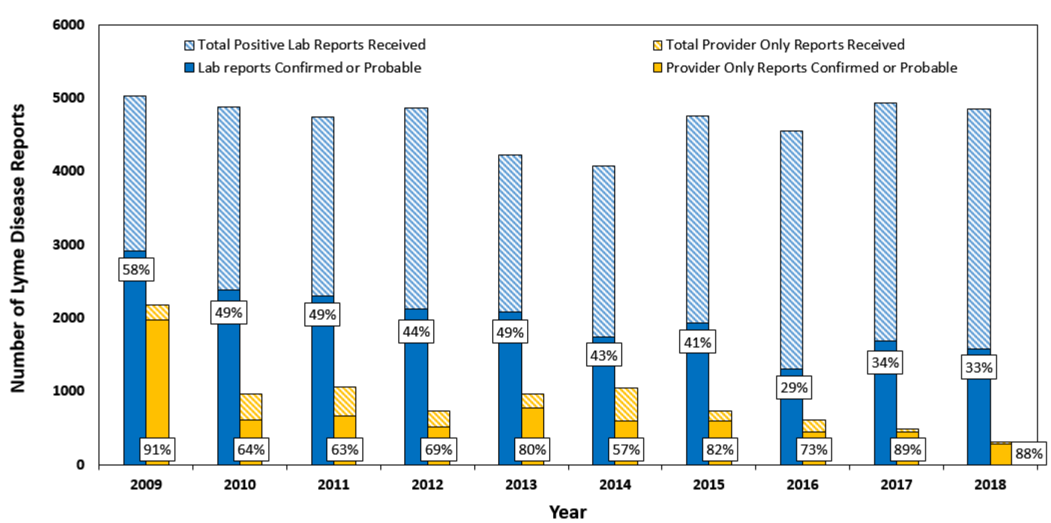
Public health surveillance systems should be periodically evaluated for efficiency, sensitivity, usefulness, and timeliness. Connecticut's follow-up process is labor-intensive, expensive, and reduces resources to respond to emerging or re-emerging conditions such as Powassan virus or Eastern Equine Encephalitis virus; outreach and prevention activities are also limited. Decreased physician reporting and responses to requests for clinical information can obscure whether changes in reported incidence or distribution of illness reflect changing epidemiology or changing reporting patterns (*4*). Finally, the interval between receipt of positive laboratory results and case classification can exceed six months. These factors limit DPH's ability to detect and respond to changes in LD epidemiology.

High incidence states have implemented resource-saving surveillance modifications such as follow-up on a proportion of laboratory reports to estimate incidence or laboratory reporting with no clinical follow-up (laboratory-only). Massachusetts now conducts laboratory-only surveillance; all reports meeting the 2017 NSCD criteria for laboratory evidence are classified as suspect. Currently, however, only cases meeting the NSCD for confirmed or probable are included in national surveillance data. With a revised NSCD allowing laboratory-only reporting, states could conserve resources and be included in national surveillance; in addition, this would standardize reporting and data would be more directly comparable across high-incidence states. A proposal to revise the NCSD is being discussed by high-incidence states for submission to CSTE in 2020. The CDC is participating in these discussions.

In Connecticut, laboratory-only reporting would have resulted in over 3,000 additional LD cases reported to CDC in 2018. Laboratory-only reporting would still allow DPH to monitor trends in LD; basic demographic data is transmitted with laboratory results so high risk groups could still be characterized. Furthermore, a newly validated two-tier laboratory test for LD will make laboratory results more accurate and be included in a revised NSCD. Syndromic surveillance is a supplementary approach. Similar to outpatient influenza-like illness surveillance, surveillance for emergency department and urgent care clinic visits associated with tick bites or LD provides near real-time information to detect temporal and geographic trends.

Current LD surveillance practices have limited sensitivity or timeliness, and are resource intensive. In Connecticut, high-risk groups, clinical presentations, and seasonality of incidence are well characterized and similar to other high-incidence states (*4*). Together, laboratory-only reporting and syndromic surveillance meet the goals of LD surveillance for high-incidence states, which are to detect trends and identify high-risk groups, rather than identify every incident case (*4*). Reducing the burden of LD surveillance will improve DPH's capacity to respond to emerging conditions and efforts can be directed towards improving prevention of this important disease.

Figure. Number of Lyme disease reports received through laboratory or provider reporting and proportion of case classification by year - Connecticut, 2009-2018.



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