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Influenza-Related Hospitalizations and Poverty Levels — United States, 2010–2012

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Annual influenza vaccine is recommended for all persons aged ≥6 months in the United States, with recognition that some persons are at risk for more severe disease (*1*). However, there might be previously unrecognized demographic groups that also experience higher rates of serious influenza-related disease that could benefit from enhanced vaccination efforts. Socioeconomic status (SES) measures that are area-based can be used to define demographic groups when individual SES data are not available (*2*). Previous surveillance data analyses in limited geographic areas indicated that influenza-related hospitalization incidence was higher for persons residing in census tracts that included a higher percentage of persons living below the federal poverty level (*3–5*). To determine whether this association occurs elsewhere, influenza hospitalization data collected in 14 FluSurv-NET sites covering 27 million persons during the 2010–11 and 2011–12 influenza seasons were analyzed. The age-adjusted incidence of influenza-related hospitalizations per 100,000 person-years in high poverty (≥20% of persons living below the federal poverty level) census tracts was 21.5 (95% confidence interval [CI]: 20.7–22.4), nearly twice the incidence in low poverty (<5% of persons living below the federal poverty level) census tracts (10.9, 95% CI: 10.3–11.4). This relationship was observed in each surveillance site, among children and adults, and across racial/ethnic groups. These findings suggest that persons living in poorer census tracts should be targeted for enhanced influenza vaccination outreach and clinicians serving these persons should be made aware of current recommendations for use of antiviral agents to treat influenza (*6*).

Influenza causes annual epidemics in the United States resulting in an estimated 4,900–27,000 deaths and 114,000–624,000 hospitalizations per year (*7*). Influenza vaccination recommendations have evolved from focusing on persons at higher risk for severe disease and influenza-associated complications to a recommendation for vaccination of all persons aged ≥6 months (*1*). In addition to the recommendation for universal influenza vaccination, enhancing vaccination efforts in specific demographic groups that experience higher rates of serious influenza-related disease can reduce their vulnerability and minimize disparities.

Influenza surveillance data have generally not included individual measures of SES. Thus, any potential association

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between influenza, particularly severe disease, and SES was unmeasured until area-based SES measures began to be used. During 1998–2005, the Public Health Disparities Geocoding Project recognized the potential for using area-based SES measures to describe and monitor the association between SES and reportable disease incidence. After comparing numerous possible area-based SES measures to describe SES disparities for selected health outcomes, the census tract poverty level of case residence was recommended to be used as a variable in addition to age, sex, and race/ethnicity in routine surveillance data analyses (*2*). During 2003–2005, the 10 Emerging Infections Programs (EIP)* established active surveillance for influenza-related hospitalizations. Analyses of data from New Haven County, Connecticut, and eight counties in Tennessee indicated that, during multiple influenza seasons, including those when influenza A(H1N1)pdm09 predominated, influenza-related hospitalization incidence was consistently higher for children and adults residing in census tracts with higher percentages of persons living below the federal poverty level (*3*–*5*).

To assess the association between census tract-level poverty and influenza hospitalization at a national level, participating sites in the Influenza Hospitalization Surveillance Network (FluSurv-NET), including all 10 EIP sites, participated in a multisite analysis. FluSurv-NET is a national sentinel surveillance system established in 2009 that conducts population-based surveillance for laboratory-confirmed influenza-associated hospitalizations annually during October–April. For this analysis, data were gathered from 78 counties in 14 FluSurv-NET states† representing approximately 9% of the U.S. population. Each site geocoded the residential address of all influenza-associated hospitalizations for the 2010–11 and 2011–12 influenza seasons. Geocoded addresses were assigned to census tracts. Census tract poverty level, defined as the percentage of households in the census tract living below the federal poverty level, was determined from the 2008–2012 American Community Survey 5-Year Estimates.§ Census tracts were categorized by their percentage of households living below the poverty level (<5%, 5%–9%, 10%–19%, ≥20%), and age-adjusted (2000 U.S. Standard Population) influenza-related hospitalization incidence overall and for each FluSurv-NET site was calculated, stratified by census tract poverty status. County and census tract-specific denominators were determined from the 2010 U.S. Census.

In total, 7,936 (96%) of 8,304 influenza-related hospitalizations were coded to census tract, including 5,624 in 2010–2011 and 2,312 in 2011–2012. For both seasons combined, the age-adjusted incidence of influenza-related hospitalizations per 100,000 person-years in high poverty (≥20% of persons

* California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New Mexico, New York, Oregon, and Tennessee. http://www.cdc.gov/ncezid/dpei/eip/index.html.

† Ten EIP states plus Michigan, Ohio, Rhode Island, and Utah.

§ http://www.census.gov/programs-surveys/acs.

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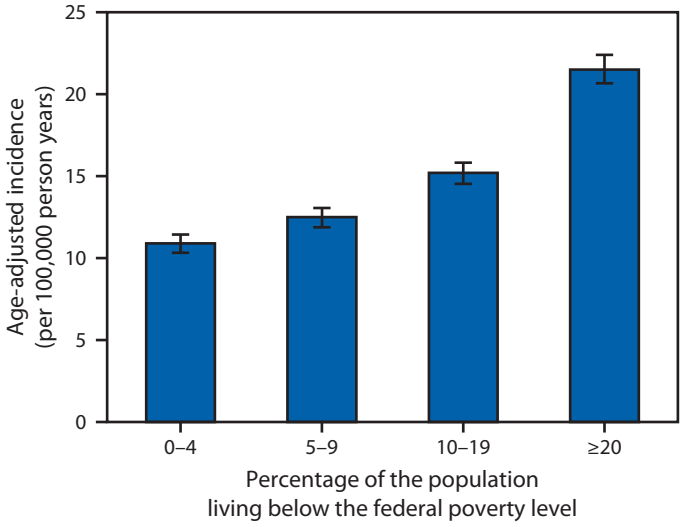
living below the federal poverty level) neighborhoods was 21.5 (95% CI: 20.7–22.4), nearly twice the incidence in low poverty (<5% of persons living below the federal poverty level) neighborhoods (10.9, 95% CI: 10.3–11.4), with a gradient of increasing incidence as census tract poverty category increased (Figure 1). This relationship was observed in all 14 surveillance sites (Table), within groups defined by age (0–4 years, 5–17 years, 18–49 years, 50–64 years, and ≥65 years), within each racial/ethnic group (Figure 2) and during each influenza season. The relationship also was observed for age-adjusted rates for hospitalizations requiring intensive care, for those requiring mechanical ventilation, and for deaths during or within 30 days of hospitalization. The incidence rate ratios for census tracts with ≥20% versus <5% of households living below the federal poverty level were 1.96 [95% CI: 1.7–2.3] for hospitalizations requiring intensive care; 2.03 [95% CI: 1.6–2.5] for hospitalizations requiring mechanical ventilation; and 1.82 [95%CI: 1.3–2.7] for deaths occurring within 30 days of hospitalization. The overall percentage of hospitalized influenza patients who were vaccinated was inversely associated with census tract poverty level, from a high of 48% in the census tracts with the lowest poverty levels to a low of 35% in the census tracts with the highest poverty levels, a finding driven by differences in vaccination rates among persons aged ≥65 years, who accounted for 94% of hospitalized cases in the lowest poverty census tracts compared with 80% in the highest.

FIGURE 1. Age-adjusted incidence of influenza-related hospitalizations per 100,000 person-years,* by census tract poverty level — FluSurv-NET, 14 states, 2010-2012



* With 95% confidence intervals.

Discussion

The association of higher census tract-level poverty with higher influenza-related hospitalization rates appears to be robust, occurring across counties in 14 states, within pediatric and adult age groups, and across racial/ethnic groups. Possible contributing factors are lower vaccination rates in residents of poorer census tracts, poverty-related crowding with higher rates of influenza transmission, and higher prevalence of medical conditions predisposing persons to influenza complications in poorer areas. However, differences in vaccination rates cannot fully explain all the age-specific differences by census tract poverty observed: only hospitalized influenza patients aged ≥65 years had a large enough difference in vaccination rates to fully explain the findings. Regardless of the causes, to reduce poverty-associated disparities in influenza-related hospitalizations, there is a need to increase influenza vaccination levels in higher poverty neighborhoods and to more fully implement recommendations on the use of antivirals in the outpatient setting (*6*). This will require enhanced efforts by public health agencies and health care providers to address missed opportunities for vaccination and system barriers (*8*), as well as a better understanding of personal barriers (*9*) to influenza vaccination in these neighborhoods. In addition, it will require evaluation of use of antivirals and efforts to improve them.

Healthy People 2020 includes a public health infrastructure objective (PHI 7.3) to increase the percentage of population-based health objectives for which national data are available by socioeconomic status (*10*). Public heath surveillance data often lack information on the SES of individual persons, making it difficult to describe and monitor health disparities based on SES. When residential address data are available, it is possible to geocode the address, link it to census tract SES data and conduct analyses. The EIP, recognizing the potential to use geocoded addresses to examine possible SES-related disparities at a broad interstate level, formed a health equity workgroup to explore standardizing its use in all EIP states (*11*). This analysis demonstrates that multisite analyses using census tract SES can provide national-level data that are relevant to prevention efforts.

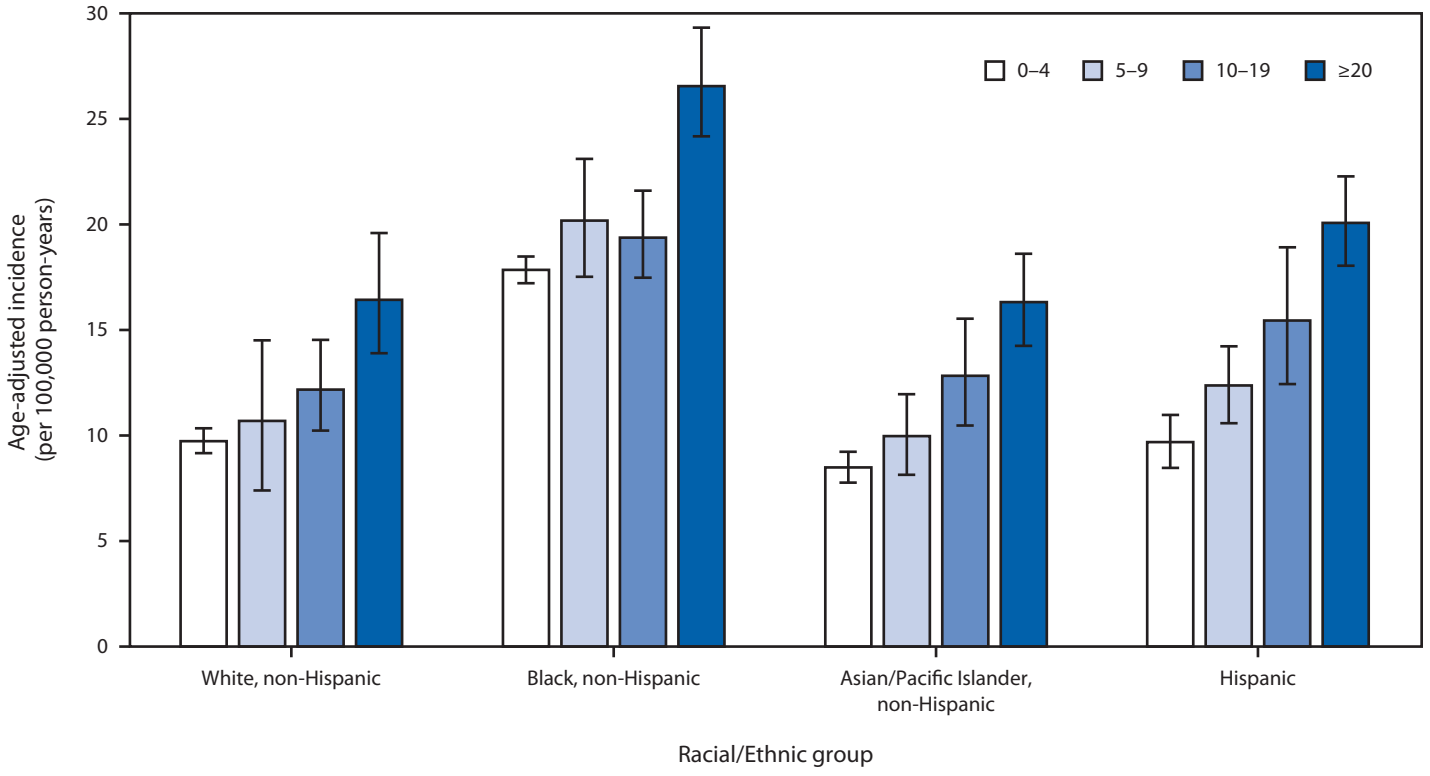
The findings in this report are subject to at least two limitations. First, a total of 4% of cases were unable to be geocoded and thus were not included in the analysis. Second, the data in the report were from two influenza seasons during which influenza A(H3N2) viruses predominated. The findings could be different during an A(H1N1) season or during an influenza pandemic. However, in the single site studies that stimulated this analysis (*3*–*5*), the association of higher census tract poverty with higher influenza-related hospitalization incidence was consistent throughout all seasons examined, regardless of the dominant circulating strain.

TABLE. Age-adjusted incidence of influenza-related hospitalizations per 100,000 person-years, by census tract poverty level and state — FluSurv-NET, 14 states, 2010–2012

	Census tract poverty level*			
	0%–4%	5%–9%	10%–19%	≥20%
State	Incidence (95% CI)	Incidence (95% CI)	Incidence (95% CI)	Incidence (95% CI)
California	11.5 (10.0–13.2)	14.5 (13.0–16.3)	15.9 (14.0–18.0)	21.4 (18.8–24.4)
Colorado	13.6 (12.8–17.0)	16.5 (14.1–19.1)	22.8 (20.1–25.8)	25.0 (21.9–28.3)
Connecticut	13.0 (11.4–14.8)	16.1 (13.7–18.7)	24.6 (21.1–28.4)	33.5 (29.0–38.6)
Georgia	9.1 (7.3–11.1)	7.9 (6.5–9.5)	10.3 (9.0–11.7)	12.9 (11.2–14.7)
Maryland	9.3 (8.0–10.7)	14.0 (12.1–16.1)	18.6 (16.1–21.3)	26.0 (22.7–29.6)
Michigan	8.5 (3.9–16.0)	11.9 (7.9–17.3)	14.9 (10.7–20.2)	20.5 (14.8–27.7)
Minnesota	7.3 (6.1–8.7)	9.7 (8.2–11.4)	15.1 (13.1–17.4)	24.1 (20.6–28.1)
New Mexico	7.5 (4.7–11.5)	10.1 (7.1–14.0)	14.6 (12.1–17.5)	15.9 (13.6–18.5)
New York	9.9 (8.1–11.9)	10.1 (8.5–11.9)	10.8 (9.0–12.8)	28.6 (24.9–32.7)
Ohio	7.8 (6.1–10.0)	10.0 (7.9–12.5)	11.2 (9.3–13.5)	21.5 (18.6–24.7)
Oregon	10.7 (7.9–14.2)	9.6 (7.7–11.9)	13.5 (11.4–15.8)	18.4 (15.2–22.0)
Tennessee	6.4 (4.5–8.7)	7.3 (5.5–9.5)	7.3 (5.6–9.5)	12.4 (9.9–15.3)
Utah	23.5 (19.0–28.7)	26.5 (22.2–31.3)	30.9 (26.4–36.1)	38.9 (32.8–45.7)
Rhode Island	14.1 (10.2–19.1)	14.6 (10.9–19.0)	14.4 (10.2–19.6)	26.0 (21.1–31.6)

Abbreviation: CI = confidence interval.
* Percentage of population living below the federal poverty level.

FIGURE 2. Age-adjusted incidence of influenza-related hospitalizations per 100,000 person-years,* by racial/ethnic group and census tract poverty level,† — FluSurv-NET, 14 states, 2010–2012



* With 95% confidence intervals.
† Percentage of population living below the federal poverty level.

Using census tract-based SES measures as variables for surveillance data analysis can contribute to achieving the Healthy People 2020 public health infrastructure goal of having national population-based data available by SES. It is important from an influenza control perspective that local vaccination efforts be emphasized in demographic groups found to have a higher incidence of more severe and costly complications of influenza, including hospitalization, intensive care and mechanical

Summary

What is already known on this topic?

Measures of socioeconomic status are infrequently used in public health surveillance. Several studies in small U.S. geographic areas found that higher census tract-level poverty is associated with higher population-level rates of influenza-related hospitalization, a finding with possible implications for influenza control efforts.

What is added by this report?

A collaborative initiative among 14 states that examined the association between census tract-level poverty and incidence of influenza-related hospitalization found increasing rates of influenza-related hospitalization with increasing census tract poverty. This finding was present during two influenza seasons, among all 14 sites, all age and racial/ethnic groups, and for more severe outcomes of hospitalization (intensive care, respiratory support, and death).

What are the implications for public health practice?

Persons who live in high poverty census tracts represent a demographic group at higher risk for severe influenza outcomes. Persons in poorer neighborhoods should be a focus for enhanced influenza vaccination outreach and early use of antiviral treatment. Analysis of surveillance data using census tract-level measures of socioeconomic status can provide new perspectives and directions for prevention of diseases of public health importance.

ventilation. Based on the consistency of the findings in this study across FluSurv-NET sites, persons who live in high poverty census tracts are one such demographic group. Enhanced influenza outreach to improve influenza vaccination coverage for persons living in poorer neighborhoods and efforts to increase use of antivirals by clinicians serving these neighborhoods could reduce poverty-related disparities in severe influenza outcomes.

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