Identifying Local Hot Spots of Pediatric Chronic Diseases Using Emergency Department Surveillance

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Conflict of Interest: The authors declare that they have no conflict of interest.
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Received for publication June 24, 2016; accepted October 28, 2016.

Abstract

Objective: To use novel geographic methods and large-scale claims data to identify the local distribution of pediatric chronic diseases in New York City.

Methods: Using a 2009 all-payer emergency claims database, we identified the proportion of unique children aged 0 to 17 with diagnosis codes for specific medical and psychiatric conditions. As a proof of concept, we compared these prevalence estimates to traditional health surveys and registry data using the most geographically granular data available. In addition, we used home addresses to map local variation in pediatric disease burden.

Results: We identified 549,547 New York City children who visited an emergency department at least once in 2009. Though our sample included more publicly insured and uninsured children, we found moderate to strong correlations of prevalence estimates when compared to health surveys and registry data at prespecified geographic levels. Strongest correlations were found for asthma and mental health conditions by county among younger children (0.88, $P = .05$ and 0.99, $P < .01$, respectively). Moderate correlations by neighborhood were identified for obesity and cancer (0.53 and 0.54, $P < .01$). Among adolescents, correlations by health districts were strong for obesity (0.95, $P = .05$), and depression estimates had a nonsignificant, but strong negative correlation with suicide attempts (−0.88, $P = .12$). Using SaTScan, we also identified local hot spots of pediatric chronic disease.

Conclusions: For conditions easily identified in claims data, emergency department surveillance may help estimate pediatric chronic disease prevalence with higher geographic resolution. More studies are needed to investigate limitations of these methods and assess reliability of local disease estimates.

Keywords: emergency department surveillance; geographic information systems; pediatric chronic disease; population health

Academic Pediatrics 2017;17:267–274

What's New

This study demonstrated how emergency department surveillance may improve estimates of pediatric disease prevalence with higher geographic resolution. We identified 29% of New York City children with a single year of data and identified local hot spots of pediatric chronic diseases.

THOUGH CHILDREN ACCOUNT for a quarter of the US population, health surveillance is disproportionately focused on adults.[1] However, adverse health behaviors and conditions like obesity and diabetes can begin in childhood and influence health outcomes for a lifetime.[2,3] Determining the local prevalence of childhood diseases is critical for identifying hot spots where children are at high risk for poor health outcomes—for example, childhood asthma.[4]

Several factors make identifying pediatric chronic disease prevalence difficult. Logistically, it is challenging to administer traditional health surveys to children due to the need for parental consent and the quality of reported data.[5] In addition, most chronic conditions, except for asthma and obesity, are relatively infrequent among children.[6,7] These low prevalence rates can make detailed geographic surveillance more difficult and dramatically increase the sample sizes required to obtain accurate estimates, which makes surveillance more costly and difficult to perform.[8]

Because it can be difficult to obtain a population sample large enough to identify local disease prevalence, alternative methods may be needed to determine the precise geographic distribution of pediatric chronic diseases.[9] In our studies among adults, we have used emergency department (ED) surveillance as a strategy for obtaining a large proportion of the population and used diagnosis codes to determine chronic disease prevalence.[9] In New York City

(NYC), this method reliably estimated neighborhood-level hypertension, diabetes, and asthma prevalence among adults at a highly granular geographic level.[9] This approach enables the identification of local physical and social environmental factors that impact health through detailed geographic research.

There are distinct differences in ED use between adults and children, especially because most children do not have the long standing chronic diseases that many adults have. However, the number of children who access the ED for care each year is as high as adults. Over 30% of NYC children reported having visited an ED in 2009. With multiple years of ED data, we can identify a majority of all children in a given region. In most areas in the United States, comprehensive all-payer ED claims databases are already collected and ready for analysis unlike other claims data such as pediatrics outpatient visits. Therefore, we investigated the use of ED surveillance for identifying the local geographic distribution of pediatric chronic diseases.[10] As a proof of concept, we compared county- and neighborhood-level estimates for asthma, obesity, cancer and mental health conditions to estimates from traditional health surveys and registry data. By identifying hot spots of these childhood conditions, health interventions can be geographically targeted to regions with the highest disease burden among children.[11]

METHODS

STUDY DESIGN AND SETTING

We used ED data from New York State (NYS) in 2009 to estimate pediatric chronic disease prevalence among children aged 0 to 17 years old and compared estimates with traditional health surveys and registry data based on matching age subgroups. Correlations between estimates were performed at geographic levels that matched available comparison data. Depending on the data source, traditional health surveys and registry estimates were available at either the county-level among the 5 NYC boroughs, among the 42 United Hospital Fund (UHF) Neighborhoods, or by selected District Public Health Office (DPHO) areas. We analyzed data from 2009 as it was when the most recent citywide child health survey was performed in NYC. We also used several comparative data sources to provide the best standard for comparing our pediatric chronic disease estimates and to assess prevalence by various pediatric age groups (eg, preschool-age children, adolescents).

DATA SOURCES

SPARCS DATABASE

The Statewide Planning and Research Cooperative System (SPARCS) was established by the NYS Department of Health to collect all-payer data for hospital utilization, including patient characteristics, and diagnoses for hospital discharges and ED visits.[12] It also includes unique identifiers for tracking individuals among hospitals and home addresses, which were geocoded to locate a patient's exact residence.

AMERICAN COMMUNITY SURVEY CENSUS DATA

To assess how well ED data represented the NYC pediatric population, we used data from the American Community Survey (ACS) 2009.[13] We compared the age, gender, race/ethnicity and insurance status of children in our ED population versus census estimates.

NYC CHILD COMMUNITY HEALTH SURVEY

In 2009, the NYC Department of Health and Mental Hygiene (DOHMH) conducted the Child Community Health Survey (CCHS) among 3002 households with children between 0 and 12 years old. Representative county-level samples of children were identified by random digit dialing with responses provided by an adult who knew the child well enough to answer health questions.[14] From the CCHS, we included whether a child currently had a diagnosis of asthma or any mental health condition including depressive, bipolar, anxiety, behavioral (primarily conduct and oppositional), or attention deficit disorders. For individual mental health conditions, data were only available for a current and/or prior history of anxiety or behavioral disorders. Comparison estimates from the CCHS were available at the county-level due to sample size limitations.

NYC FITNESSGRAM ASSESSMENTS

FITNESSGRAM is a citywide fitness assessment of public school students performed by the NYC Department of Education. It teaches about fitness and assesses fitness-related measures including body mass index (BMI).[15] The NYC DOHMH has analyzed data by UHF Neighborhood to determine obesity rates (BMI $\geq$25 kg/m^2 or $\geq$95th percentile for age) among elementary and middle school students 5 to 14 years old in 2009.

NYS CANCER REGISTRY

The NYS Department of Health collects reports of newly diagnosed, invasive malignant cancers from hospitals and health care providers for patients of all ages.[16] Incident rates for childhood cancers are reported for 0 to 19 year olds by UHF neighborhood in NYC for 2008–2012. The registry is annually reviewed by the North American Association of Central Cancer Registries to ensure data meet standards for completeness and quality.

NYC YOUTH RISK BEHAVIOR SURVEY

The Youth Risk Behavior Survey (YRBS) is performed through a collaboration between the DOHMH, the Department of Education, and the Centers for Disease Control and Prevention. It monitors priority risk behaviors that contribute to the leading causes of death among public high school students using a written, anonymous questionnaire.[17] In this study, we analyzed whether adolescents currently had a diagnosis of asthma, a BMI greater than the 95th percentile, or had attempted suicide in the past 12 months. The YRBS currently oversamples adolescents