Published in final edited form as:

Acad Pediatr. 2017 April ; 17(3): 267–274. doi:10.1016/j.acap.2016.10.017.

Identifying Local Hotspots of Pediatric Chronic Diseases Using Emergency Department Surveillance

David C. Lee, MD, MS^{a,b}, Stella S. Yi, PhD, MPH^b, Hiu-Fai Fong, MD, MS^{c,d}, Jessica K. Athens, PhD, MS^b, Joseph E. Ravenell, MD, MS^b, Mary Ann Sevick, ScD, RN^b, Stephen P. Wall, MD, MSc, MAEd^a, and Brian Elbel, PhD, MPH^{b,e}

^aRonald O. Perelman Department of Emergency Medicine, NYU School of Medicine, 462 First Avenue, Room A345, New York, NY 10016

^bDepartment of Population Health, NYU School of Medicine, 227 East 30th Street, New York, NY 10016

^cDivision of General Pediatrics, Department of Medicine, Boston Children's Hospital, 300 Longwood Avenue, Boston, MA 02115

^dDepartment of Pediatrics, Harvard Medical School, 25 Shattuck Street; Boston, MA 02115

^eWagner Graduate School of Public Service, New York University, 295 Lafayette Street, New York, NY 10012

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 pre-specified geographic levels. Strongest correlations were found for asthma and mental health conditions by county among younger children (0.88, $p=0.05$ and 0.99, $p<0.01$, respectively). Moderate correlations by neighborhood were identified for obesity and cancer (0.53 and 0.54, $p<0.01$). Among adolescents, correlations by health districts were strong for

Corresponding Author: David C. Lee, MD, MS, 462 First Avenue, Room A345, New York, NY 10016, david.lee@nyumc.org, Phone: 212-562-6561, Fax: 212-562-3001.

Conflicts of Interest: The authors have no conflicts of interest relevant to this article to disclose.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

obesity (0.95, $p=0.05$), and depression estimates had a non-significant, but strong negative correlation with suicide attempts (-0.88 , $p=0.12$). Using SaTScan, we also identified local hotspots 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.

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 hotspots of pediatric chronic diseases.

Keywords

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

INTRODUCTION

Though children account for a quarter of the U.S. 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 hotspots where children are at high risk for poor health outcomes, e.g., 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

Since 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 since 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 hotspots 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 five 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 (e.g., preschool 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 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 3,002 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 was 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 (DOE). 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 $\geq 25 \text{ kg/m}^2$ or 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 meets standards for completeness and quality.

NYC Youth Risk Behavior Survey—The Youth Risk Behavior Survey (YRBS) is performed through a collaboration between the DOHMH, DOE, 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 in selected District Public Health Office (DPHO) areas to locally investigate three NYC areas (South Bronx, North and Central Brooklyn, and East and Central Harlem) known to have the highest premature mortality rates in NYC.

Participants

We analyzed administrative claims data from children 0 to 17 years old who had visited an ED in 2009 and had a residential address in NYC based on geocoded home address or ZIP code. We excluded any newborns admitted through the ED based on flags in the SPARCS database since they would otherwise inflate the denominator in prevalence calculations. To account for repeated ED visits by the same child, we used SPARCS enhanced unique personal identifiers to assess only unique children in the ED records.

Main Outcome

Our main study outcome was the correlation of pediatric chronic disease prevalence based on ED surveillance with traditional health surveys and registry data at the pre-specified geographic levels. We first determined what proportion of unique children in the ED population had ever received a primary or secondary diagnosis code for asthma, diabetes, obesity, cancer, or mental health conditions (included ICD-9 codes are listed in Supplemental Table 1). We then divided the number of unique children who had each of these conditions by the total number of unique children in the ED population. Conditions

were chosen a priori based on the most common pediatric chronic diseases and availability of a comparable health survey or registry data source for geographic analysis.

Statistical Analysis

Given that SPARCS has home addresses, we also studied the prevalence of pediatric chronic diseases using ED surveillance at a more geographically granular level. In addition to the county- and neighborhood-levels, we also analyzed estimates at the ZIP code level and Census tract level based on geocoded home addresses. In New York City, Census tracts generally have around 4,000 residents including children and adults. ZIP codes have around 40,000 residents, UHF neighborhoods have around 200,000 residents, and NYC Counties have an average of 1.6 million residents. In these analyses, we excluded geographic areas that did not have at least 30 observations to limit the bias of small samples. We also required that the standard deviation of the prevalence estimate did not exceed the mean prevalence estimate at a given geographic level.¹⁸ For instance, if the standard deviation for prevalence measured at the Census tract level exceeded the mean prevalence among Census tracts, then we moved to a higher geographic level of analysis to avoid generating maps with substantial over-dispersion of prevalence estimates (i.e., frequent zero prevalence observations due to the geographic unit of analysis).

To compare our estimates using ED surveillance to traditional health surveys and registry data, we analyzed age subgroups corresponding to each data source (CCHS: 0 to 12; FITNESSGRAM: 5 to 14; NYS Cancer Registry: 0 to 19; YRBS: 14 to 17). Analyses were performed at the most geographically granular level available, which was at the county level representing the five NYC boroughs (CCHS), among the 42 UHF Neighborhoods (FITNESSGRAM and NYS Cancer Registry), or by selected DPHO areas (YRBS). A correlation coefficient with its corresponding p-value was calculated for each childhood condition comparing the two methods, and estimates were plotted against each other by geographic region to assess the quality of the correlation.

To find hot and cold spots of pediatric chronic disease, we used the Bernoulli spatial scan statistic to identify statistically significant clusters of high and low disease prevalence.¹⁹ To perform this analysis, we used counts of children with and without any diagnosis code for each chronic disease based on the ED surveillance data. These counts were performed by Census tract and the maximum spatial cluster size was set at 10% of the total population at risk. Maps of hot and cold spots were generated based on the relative risk of disease for statistically significant clusters based on a p-value less than 0.05.

Statistical analyses were performed in Stata 12.1 (StataCorp: College Station, TX. 2011). Geographic analysis was performed using SaTScan 9.4 (Martin Kulldorff, the National Cancer Institute, and the NYC DOHMH) and ArcGIS Desktop 10.2 (ESRI: Redlands, CA. 2013). Shapefiles and ACS data were obtained from the National Historical Geographic Information System (Minnesota Population Center: Minneapolis, MN. 2011). Our study was approved by the Institutional Review Board at the NYU School of Medicine.

RESULTS

Participants

We identified 549,547 unique NYC children aged 0 to 17 who visited an ED at least once in 2009. This ED population accounts for 29.3% of the estimated 1.87 million NYC children, which is similar to the 30.3% of children 0 to 12 years old surveyed by the CCHS who reported having visited an ED in the past 12 months.²⁰

The demographic distribution of children in the ED population were generally similar to ACS Census data (Table 1). However, the ED population proportionately had more 0 to 5 year olds (48.8% in SPARCS; 36.4% in ACS), more publicly insured children (61.0% in SPARCS; 43.3% in ACS) and uninsured children (14.7% in SPARCS; 4.5% in ACS).

Prevalence Estimates Using ED Surveillance

Using ED surveillance among children and adolescents 0 to 17 years old, we found the prevalence of asthma was 10.6%, diabetes was 0.25%, cancer was 0.12%, obesity was 0.25%, and any mental health condition at 2.34% based on ICD-9 diagnosis codes (Supplemental Table 2). Asthma was most prevalent among children aged 6 to 12 years old. The prevalence of diabetes, cancer, obesity, and mental health conditions all increased with age and were highest among adolescents aged 13 to 17 years old.

Correlation with Health Surveys and Registry Data (Table 2 and Figure 1)

NYC Child Community Health Survey—The CCHS estimated the prevalence of current asthma at 6.1% and current mental health conditions at 5.0% among 0 to 12 year olds. In this age group, ED surveillance identified a citywide prevalence of asthma of 11.1% and mental health conditions of 1.2%. Despite the differences in absolute prevalence, when analyzed by county, correlation between ED surveillance and the CCHS was strong at 0.88 for asthma and 0.99 for mental health conditions (p-values 0.05 and < 0.001).

NYC FITNESSGRAM Assessments—Based on a DOHMH analysis of FITNESSGRAM Assessments, NYC children 5 to 14 years old had an obesity prevalence of 20.9%. In this age group, ED surveillance only estimated a citywide prevalence of obesity at 0.35% based on ICD-9 codes. Despite this substantial underestimation, when analyzed by UHF neighborhood, correlation between ED surveillance and FITNESSGRAM Assessments was still moderate with a coefficient of 0.53 (p-value < 0.001).

NYS Cancer Registry—The NYS Cancer Registry estimates the incidence of invasive malignant cancers among children 0 to 19 years old at 189 cases per million children. In this age group, ED surveillance identified a citywide cancer prevalence of 1,183 cases per million children. When analyzed by UHF neighborhood, correlation between registry incidence rates and ED surveillance prevalence estimates were moderately correlated with a coefficient of 0.54 (p-value < 0.001), though it should be noted that incidence and prevalence are not equivalent measures. When prevalence is low, incidence and prevalence may be similar. But for specific cancers with long survival rates, the comparison of prevalence with incidence may be very tenuous.

NYC Youth Risk Behavior Survey—The YRBS estimates that NYC public high school students had a prevalence of current asthma of 13.2%, obesity of 10.4%, and attempted suicide of 9.9%.²⁰ Among adolescents 13 to 17 years old, ED surveillance estimated a citywide prevalence of asthma at 8.5%, obesity at 0.58%, and depression at 2.1%. When analyzed among selected DPHO areas, correlation between ED surveillance and the YRBS was strong at 0.72 for asthma and 0.92 for obesity (p-values 0.28 and 0.05). But there was a non-significant but strong negative correlation of −0.88 between depression estimated by diagnosis codes from ED visits and suicide attempts identified by health surveys (p-value 0.12). Significance of these correlations was limited by the few number of observations as there were only three selected districts compared to the rest of NYC.

Local Pediatric Chronic Disease Prevalence

We also analyzed these childhood conditions at a more granular geographic level given the larger sample obtained using emergency claims data and the availability of home addresses. Only the standard deviation for pediatric asthma prevalence by Census tract (4.1%) did not exceed its average prevalence (9.3%). Figure 2 maps pediatric asthma prevalence by Census tract and shows the subsequent hotspot analysis using Census tract level data. In contrast, pediatric cancer cases were so infrequent, that the standard deviation for prevalence exceeded the average prevalence at both the Census tract and ZIP code levels, thus maps are only shown by UHF Neighborhood. Otherwise, all other pediatric conditions were depicted at the ZIP code level (See Appendix for maps for other pediatric chronic diseases). For the subsequent analysis that identified statistically significant clusters of high and low prevalence, we used the count data by Census tract to identify hot and cold spots of each pediatric chronic disease throughout NYC. These clusters are quantified by the relative risk of these areas having higher versus lower pediatric chronic disease prevalence compared to NYC overall.

DISCUSSION

Despite the importance of pediatric chronic disease surveillance, existing methods for estimating childhood conditions are limited by the difficulty of data collection and the need for large sample sizes.⁵ The absence of reliable estimates of childhood conditions at a highly granular geographic level means that local hotspots of disease burden among children may be missed by gross averages analyzed over large geographic regions.²¹ These hotspots are clusters where disease demonstrates significant geographic disparities, which may point to an underlying social or environmental cause. Our findings suggest that surveillance of pediatric chronic disease using ED surveillance and geospatial analysis may provide an alternative means of identifying the local geographic distribution of both medical and psychiatric conditions among children.²²

Even with a single year of data, we show that nearly one-third of NYC children can be identified. Though younger children, publicly insured and uninsured children make up a higher proportion of the ED population, our disease prevalence estimates correlated well with traditionally performed health surveys and registry data at both county- and neighborhood-levels. In addition, given the large sample of children in the ED population,

geospatial analysis can identify local hotspots of pediatric chronic diseases and also asthma prevalence by Census tract.²³ Prior studies have identified hotspots of pediatric asthma by Census tract using hospitalization rates, but in this study, we expand the analysis to estimate prevalence of asthma using data from all ED visits.²⁴

Furthermore, ED data may be useful for capturing children not well-represented in national or citywide surveys such as very young children or socioeconomically disadvantaged subgroups. Our study sample had a higher proportion of minority and publicly insured children. But this sampling bias is counter-balanced by analyzing prevalence in small geographic units. Local neighborhoods are more demographically and socioeconomically homogenous. These over-represented populations are disproportionately attributed to Census tracts where they actually live using geocoded home addresses.

Some administrative diagnosis codes are known to be particularly poor at identifying individuals with certain conditions. Obesity diagnosis codes are known to have very limited sensitivity but high specificity.²⁵ Though our method of ED surveillance severely underestimates obesity at an absolute level, the relative prevalence between different geographic regions still demonstrated reasonable correlation with traditional methods of determining pediatric obesity rates. But obesity surveillance would probably be better served using other methods that do not rely on administrative data, such as obtaining body-mass-index data from school surveys.

However, diagnosis codes that are more likely to be present in ED claims data may be good candidates for performing ED based chronic disease surveillance.²⁶ For example, in at least one study of adults, a diagnosis code of diabetes was shown to have a sensitivity of 95% and specificity of 99% in the ED population, which was better than identification based on outpatient, inpatient, pharmacy, or even laboratory data.²⁷ Among children, some of the most common chronic diagnosis codes we found in our ED claims data were asthma, allergic rhinitis, mood disorders, and ADHD.

With the large sample of children in the ED population, chronic disease surveillance can be expanded to include important diseases that are not regularly included in traditional health surveys, such as diabetes.²⁸ In fact, our pediatric diabetes prevalence estimate of 0.25% in NYC was similar to estimates of 0.24% based on national studies of pediatric diabetes prevalence.²⁹ Our methods also have the potential to expand surveillance of mental health conditions given that we found strong correlations of our estimates with survey data among younger children. However, caution is warranted based on our findings.

Among adolescents aged 14 to 17 years old, the prevalence estimates for depression based on diagnosis codes demonstrated a strong negative correlation with the prevalence of suicide attempts among high school students. These results may speak to the lack of mental health care accessed by adolescents living in neighborhoods with the highest rates of suicide attempts.¹⁷ We hypothesize that the low prevalence of depression diagnoses codes may paradoxically identify areas where adolescents are at high risk for suicide as infrequent coding of depression may be a sign of lower detection rates. If so, then these findings

highlight the need for better mental health screening, potentially in areas where ED surveillance estimates a low prevalence of depression.

Limitations

There are several important limitations in our methods. First, administrative claims data can contain coding errors by the institutions providing data.³⁰ The infrequency of diagnosis codes may also be attributable to low detection rates rather than low disease prevalence. Hospitals can also have substantial differences in how accurately they assign diagnoses codes, which can lead to heterogeneity in the distribution of prevalence estimates.³¹ In addition, inherent sampling bias skewed observations towards patients more likely to come to an ED for care, which we found to be younger children and populations with high rates of public insurance or uninsurance.³² These populations with low socioeconomic status may also experience higher residential mobility, which may contribute bias in neighborhood-level prevalence estimates. Comparison health survey and registry data were also limited by their sample size and did not always allow for comparison at a highly geographically granular area. This method of ED surveillance may also not be useful for many other prevalent childhood conditions that may not be frequently listed as diagnosis codes in ED data (e.g., learning disabilities). Finally, our study was limited to NYC, a unique, heterogeneous, and dense environment, therefore, our findings may not be generalizable to other settings.

Conclusions

In summary, we found that ED surveillance may be an alternative method for identifying the distribution of childhood conditions at a local geographic level. By obtaining a large proportion of the entire pediatric population with a single year of ED data, we found that estimates of pediatric chronic diseases based on administrative diagnosis codes had moderate to strong correlations with traditional health surveys and registry data. By identifying local hotspots of pediatric chronic diseases, physical and social factors in the local environment can be better assessed to identify local influences which are associated with poor health among children.^{33,34} 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 the limitations of these methods and assess the reliability of local disease estimates.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This study was supported in part by two grants K23-DK110316 and R01-DK097347 from National Institute of Diabetes and Digestive and Kidney Disease at the National Institutes of Health. This sponsor did not have any role in the study design, the collection, analysis or interpretation of data, the writing of the report, or the decision to submit the article for publication. Authors have no conflicts of interest to disclose.

References

1. Blumberg SJ, Foster EB, Frasier AM, et al. Design and operation of the National Survey of Children's Health, 2007. Vital and health statistics. Ser. 1, Programs and collection procedures. 2012;1–149.
2. Liese AD, Lawson A, Song HR, et al. Evaluating geographic variation in type 1 and type 2 diabetes mellitus incidence in youth in four US regions. Health & place. 2010; 16:547–556. [PubMed: 20129809]
3. Liu, GC., Cunningham, C., Downs, SM., Marrero, DG., Fineberg, N. A spatial analysis of obesogenic environments for children. Proceedings /AMIA ... Annual Symposium. AMIA Symposium; 2002. p. 459-463.
4. Roberts EM, English PB, Wong M, et al. Progress in pediatric asthma surveillance II: geospatial patterns of asthma in Alameda County, California. Preventing chronic disease. 2006; 3:A92. [PubMed: 16776893]
5. Skalland BJ, Blumberg SJ. Nonresponse in the National Survey of Children's Health, 2007. Vital and health statistics. Series 2, Data evaluation and methods research. 2012;1–22.
6. Reznik M, Bauman LJ, Okelo SO, Halterman JS. Asthma identification and medication administration forms in New York City schools. Annals of allergy, asthma & immunology : official publication of the American College of Allergy, Asthma, & Immunology. 2015; 114:67–68. e61.
7. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011–2012. JAMA : the journal of the American Medical Association. 2014; 311:806–814. [PubMed: 24570244]
8. Boyle MH, Offord DR, Hofmann HG, et al. Ontario Child Health Study. I. Methodology. Archives of general psychiatry. 1987; 44:826–831. [PubMed: 3632257]
9. Lee DC, Long JA, Wall SP, et al. Determining Chronic Disease Prevalence in Local Populations Using Emergency Department Surveillance. American journal of public health. 2015 Sep.105:e67–74. [PubMed: 26180983]
10. Rasooly IR, Mullins PM, Alpern ER, Pines JM. US emergency department use by children, 2001–2010. Pediatric emergency care. 2014; 30:602–607. [PubMed: 25162688]
11. Sequist TD, Taveras EM. Clinic-community linkages for high-value care. The New England journal of medicine. 2014; 371:2148–2150. [PubMed: 25470692]
12. Quan JM. SPARCS: the New York State health care data system. Journal of clinical computing. 1980; 8:255–263. [PubMed: 10249760]
13. Spielman SE, Folch DC. Reducing uncertainty in the american community survey through data-driven regionalization. PloS one. 2015; 10:e0115626. [PubMed: 25723176]
14. Child Community Health Survey Methods Summary. New York, NY: New York City Department of Health and Mental Hygiene; 2009.
15. Rundle A, Richards C, Bader MD, et al. Individual- and school-level sociodemographic predictors of obesity among New York City public school children. American journal of epidemiology. 2012; 176:986–994. [PubMed: 23132672]
16. Kato I, Toniolo P, Koenig KL, Kahn A, Schymura M, Zeleniuch-Jacquotte A. Comparison of active and cancer registry-based follow-up for breast cancer in a prospective cohort study. American journal of epidemiology. 1999; 149:372–378. [PubMed: 10025481]
17. LeVasseur MT, Kelvin EA, Grosskopf NA. Intersecting identities and the association between bullying and suicide attempt among New York city youths: results from the 2009 New York city youth risk behavior survey. American journal of public health. 2013; 103:1082–1089. [PubMed: 23597376]
18. Song HR, Lawson A, D'Agostino RB Jr, Liese AD. Modeling type 1 and type 2 diabetes mellitus incidence in youth: an application of Bayesian hierarchical regression for sparse small area data. Spatial and spatio-temporal epidemiology. 2011; 2:23–33. [PubMed: 21505641]
19. Kulldorff M. A Spatial Scan Statistic: Bernoulli, Discrete Poisson and Continuous Poisson Models. Communications in Statistics: Theory and Methods. 1997; 26:1481–1496.

20. New York City Department of Health and Mental Hygiene. Epiquery: Child Community Health Survey. Vol. 2016. New York City: New York City Department of Health and Mental Hygiene; 2009.
21. Tomayko EJ, Weinert BA, Godfrey L, Adams AK, Hanrahan LP. Using Electronic Health Records to Examine Disease Risk in Small Populations: Obesity Among American Indian Children, Wisconsin, 2007–2012. *Preventing chronic disease*. 2016; 13:E29. [PubMed: 26916900]
22. Block WM, Putzer GJ, Jaramillo JR. Children with type 2 diabetes mellitus and the prevalence of psychiatric disorders. *Southern medical journal*. 2010; 103:1214–1218. [PubMed: 20935593]
23. Musa GJ, Chiang PH, Sylk T, et al. Use of GIS Mapping as a Public Health Tool-From Cholera to Cancer. *Health services insights*. 2013; 6:111–116. [PubMed: 25114567]
24. Corburn J, Osleeb J, Porter M. Urban asthma and the neighbourhood environment in New York City. *Health & place*. 2006; 12:167–179. [PubMed: 16338632]
25. Golinvaux NS, Bohl DD, Basques BA, Fu MC, Gardner EC, Grauer JN. Limitations of administrative databases in spine research: a study in obesity. *The spine journal : official journal of the North American Spine Society*. 2014; 14:2923–2928. [PubMed: 24780248]
26. Robinson JR, Young TK, Roos LL, Gelskey DE. Estimating the burden of disease. Comparing administrative data and self-reports. *Medical care*. 1997; 35:932–947. [PubMed: 9298082]
27. Zgibor JC, Orchard TJ, Saul M, et al. Developing and validating a diabetes database in a large health system. *Diabetes research and clinical practice*. 2007; 75:313–319. [PubMed: 16934906]
28. Lipman TH, Ratcliffe SJ, Cooper R, Levitt Katz LE. Population-based survey of the prevalence of type 1 and type 2 diabetes in school children in Philadelphia. *Journal of diabetes*. 2013; 5:456–461. [PubMed: 23480262]
29. Dabelea D, Mayer-Davis EJ, Saydah S, et al. Prevalence of type 1 and type 2 diabetes among children and adolescents from 2001 to 2009. *JAMA : the journal of the American Medical Association*. 2014; 311:1778–1786. [PubMed: 24794371]
30. Kim, M., Berger, D., Matte, T. Diabetes in New York City: Public Health Burden and Disparities. New York: New York City Department of Health and Mental Hygiene; 2006.
31. Leong A, Dasgupta K, Bernatsky S, Lacaille D, Avina-Zubieta A, Rahme E. Systematic review and meta-analysis of validation studies on a diabetes case definition from health administrative records. *PloS one*. 2013; 8:e75256. [PubMed: 24130696]
32. Malhotra K, Baltrus P, Zhang S, McRoy L, Immergluck LC, Rust G. Geographic and racial variation in asthma prevalence and emergency department use among Medicaid-enrolled children in 14 southern states. *The Journal of asthma : official journal of the Association for the Care of Asthma*. 2014; 51:913–921. [PubMed: 24915006]
33. Adler NE, Stead WW. Patients in context--EHR capture of social and behavioral determinants of health. *The New England journal of medicine*. 2015; 372:698–701. [PubMed: 25693009]
34. Sage WM, Balthazar M, Kelder S, Millea S, Pont S, Rao M. Mapping data shape community responses to childhood obesity. *Health affairs (Project Hope)*. 2010; 29:498–502. [PubMed: 20194992]

Figure 1. Correlation of Pediatric Chronic Disease Prevalence Estimated by Emergency Department Surveillance versus Health Surveys and Registry Data
 Legend: Pediatric chronic disease prevalence estimates using Emergency Department Surveillance of diagnosis codes versus estimates from traditional health surveys and registry data. Correlations shown for a) asthma, b) obesity, c) cancer, and d) mental health conditions for relevant pediatric subgroups at the most granular geographic level available for comparison data.

Figure 2. Local Prevalence and Hotspots of Pediatric Asthma Using Emergency Department Surveillance in New York City

Legend: Maps of pediatric asthma in New York City using Emergency Department Surveillance to identify a) local prevalence of asthma among children stratified into quintiles by Census tract, and b) statistically significant hotspots and coldspots of asthma among children quantified by relative risk. Maps of other pediatric conditions available in the Online Supplement.

Table 1

Comparison of Study Populations - New York City Children in 2009

Population Characteristics	American Community Survey Estimates	Emergency Department Surveillance Estimates
Children in New York City	1,878,174	549,547
Age		
0 to 5 Years Old	36.4%	48.8%
6 to 12 Years Old	36.9%	29.6%
13 to 17 Years Old	26.7%	21.6%
Gender		
Male	50.8%	53.0%
Female	49.2%	47.0%
Race & Ethnicity		
White	26.4%	23.2%
Black /Other *	27.9%	39.3%
Hispanic	34.1%	32.1%
Asian	11.6%	5.4%
Insurance		
Private	52.2%	24.3%
Public	43.3%	61.0%
Uninsured	4.5%	14.7%

* Non-Hispanic black and non-Hispanic other populations are collapsed to match availability of Census estimates from the American Community Survey.

Table 2

Correlation of Pediatric Chronic Disease Prevalence Estimated by Emergency Department Surveillance versus Health Surveys and Registry Data

Diseases & Conditions	Comparison Data Source	Age Group	Geographic Level of Analysis	Correlation Coefficient	Confidence Interval	P-value
Asthma	Child Community Health Survey	0 to 12 Years	County	0.88	(-0.02 to 0.99)	0.05
	Youth Risk Behavior Survey	13 to 17 Years	Selected District Public Health Offices	0.72	(-0.78 to 0.99)	0.28
Diabetes	No Comparison Available	---	---	---	---	---
Obesity	FITNESSGRAM Assessments	5 to 14 Years	United Hospital Fund Neighborhoods	0.53	(0.27 to 0.72)	<0.01
	Youth Risk Behavior Survey	13 to 17 Years	Selected District Public Health Offices	0.92	(-0.15 to 1.00)	0.05
Cancer	New York State Cancer Registry	0 to 19 Years	United Hospital Fund Neighborhoods	0.54	(0.29 to 0.73)	<0.01
Any Mental Health Condition	Child Community Health Survey	0 to 12 Years	County	0.99	(0.85 to 1.00)	<0.01
Behavioral Disorder *	Child Community Health Survey	0 to 12 Years	County	0.98	(0.78 to 1.00)	<0.01
Attention Disorder	Child Community Health Survey	0 to 12 Years	County	0.93	(0.29 to 1.00)	0.02
Anxiety Disorder *	Child Community Health Survey	0 to 12 Years	County	0.70	(-0.48 to 0.98)	0.19
Bipolar Disorder	No Comparison Available	---	---	---	---	---
Depressive Disorder **	Youth Risk Behavior Survey	13 to 17 Years	Selected District Public Health Offices	-0.88	(-1.00 to 0.53)	0.12

* Subcategories of certain mental health disorders based on any history of these conditions rather than current diagnosis given data limitations of the Child Community Health Survey

** Prevalence of depression based on ICD-9 diagnosis codes compared to self-reported suicide attempts from the Youth Risk Behavior Survey