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PCORnet Antibiotics and Childhood Growth Study: Process for Cohort Creation and Cohort Description



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ABSTRACT

OBJECTIVES: The National Patient-Centered Clinical Research Network (PCORnet) supports observational and clinical research using health care data. The PCORnet Antibiotics and Childhood Growth Study is one of PCORnet's inaugural observational studies. We sought to describe the processes used to integrate and analyze data from children across 35 participating institutions, the cohort characteristics, and prevalence of antibiotic use.

METHODS: We included children in the cohort if they had at least one same-day height and weight measured in each of 3 age periods: 1) before 12 months, 2) 12 to 30 months, and 3) after 24 months. We distributed statistical queries that each institution ran on its local version of the PCORnet Common Data Model, with aggregate data returned for analysis. We defined overweight or obesity as age- and sex-specific body mass index ≥ 85 th percentile, obesity ≥ 95 th percentile, and severe obesity ≥ 120 % of the 95th percentile.

RESULTS: A total of 681,739 children met the cohort inclusion criteria, and participants were racially/ethnically diverse (24.9% black, 17.5% Hispanic). Before 24 months of age, 55.2% of children received at least one antibiotic prescription; 21.3% received a single antibiotic prescription; 14.3% received 4 or more; and 33.3% received a broad-spectrum antibiotic. Overweight and obesity prevalence was 27.6% at age 4 to <6 years ($n = 362,044$) and 36.2% at 9 to <11 years ($n = 58,344$).

CONCLUSIONS: The PCORnet Antibiotics and Childhood Growth Study is a large national longitudinal observational study in a diverse population that will examine the relationship between early antibiotic use and subsequent growth patterns in children.

KEYWORDS: antibiotics; body mass index; childhood growth; childhood obesity; electronic health records; research infrastructure

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WHAT'S NEW

The National Patient-Centered Clinical Research Network (PCORnet) provides an unprecedented opportunity to conduct research using health care data. In 35 health care institutions, we assembled a large cohort to examine antibiotics and childhood growth. More than half of children received an antibiotic prescription before 2 years of age.

THE WIDESPREAD AVAILABILITY of health care data through electronic health records (EHRs) and other data sources provide unique opportunities to conduct pragmatic clinical trials and observational studies on a large scale. The National Patient-Centered Clinical Research Network (PCORnet) is a distributed research network that uses health care data to facilitate multisite clinical trials and observational research studies.^{1–3} PCORnet has 13 clinical data research

networks (CDRNs) that contribute health information for over 128 million patients. Within the CDRNs, data are organized in a Common Data Model (CDM) that allows for standardization across institutions and the development of efficient and reusable tools to capture and analyze data.⁴

This type of data infrastructure is essential for patient-centered research that requires large sample sizes, such as studies of rare diseases or studies that require assessments of heterogeneity of treatment effects, with various types of exposures among specific subgroups. To help develop infrastructure for observational research in PCORnet, the Patient-Centered Outcomes Research Institute (PCORI) funded 2 initial observational studies to explore diverse research questions and launch PCORnet into a research-ready data system.^{3,5} One of these studies, the PCORnet Antibiotics and Childhood Growth Study, was the first effort in PCORnet to establish a large pediatric cohort across the network, and the first study in PCORnet to actively characterize prescribing data. Having access to a large pediatric cohort also will enable assessments of different types, timing, and doses of antibiotics on weight outcomes, which has been difficult to do with smaller studies.

Our objective was to evaluate the utility of this cohort for conducting comparative effectiveness research on medications and growth in young children. Here we describe the processes used to integrate, synchronize, and analyze data from children across 35 health care institutions organized in 10 CDRNs, and we describe the cohort characteristics, including antibiotic use before 24 months of age and prevalence of overweight and obesity from early to midchildhood.

METHODS

PARTICIPATING INSTITUTIONS AND THE PCORNET CDM

PCORI, created by the Affordable Care Act of 2010, is a funding agency that supports patient-centered comparative effectiveness research within 5 priority areas: “evaluating prevention, diagnosis, and treatment options; improving health systems; enhancing communication and dissemination of evidence; addressing disparities in health and health care; and improving comparative effectiveness research methods and data infrastructure.”⁶ PCORI created PCORnet to expand the data infrastructure available for comparative effectiveness research in a manner that incorporates the input of stakeholders.² In addition to the 13 participating CDRNs including data from nearly 100 health care systems, PCORnet has 20 Patient-Powered Research Networks that are focused on specific diseases or populations (contributing to both stakeholder engagement efforts and data) and 2 Health Plan Research Networks that are working to link health insurance claims data to PCORnet EHR data.

In PCORnet, data are organized by Network Partners. These Network Partners include data from either one contributing health care institution or, in the case of centralized Network Partners, from multiple institutions. In this study, 28 Network Partners participated, and these partners held data for 35 institutions across 10 CDRNs, including integrated delivery systems, freestanding children’s hospitals, and federally qualified health centers (Supplemental Table 1).

To participate in the study, Network Partners had to meet data quality standards that were set forth by the PCORnet Coordinating Center. These included assessments of data model conformance, missing data in required tables and variables, and data plausibility in date and vital measure fields.⁷ Required tables included enrollment, encounters, demographics, vital findings, diagnoses, and procedures. The study team additionally required that Network Partners had the capacity to create a pediatric cohort that met the study’s inclusion criteria and that could identify antibiotic prescriptions. Of the 44 institutions initially planned for inclusion, we removed 8 from the study for the following reasons: did not meet Coordinating Center data quality standards ($n = 1$) or did not meet them by February 1, 2017 ($n = 1$); did not have access to outpatient prescription medications in their CDM ($n = 2$); were unable to map their prescribing data to RxNorm codes needed for the study by February 1, 2017 ($n = 1$); were unwilling to share individual-level data ($n = 2$); or chose not to participate because the site had a small pediatric population available in their CDM ($n = 1$). A team of stakeholders from participating CDRNs and 2 of the Patient-Powered Research Networks, including parents, providers, health system representatives, and patient advocates, closely informed the study conception and design, and provided ongoing feedback throughout the study.

The PCORnet CDM consists of 15 tables and over 100 variables available for research.⁴ An in-depth assessment of data usability and consistency was necessary before conducting statistical analyses, a process called study-specific data characterization. For the PCORnet Antibiotics and Childhood Growth Study, this process included capturing site-level aggregate data on study-specific variables (eg, demographics, diagnoses, medications, vital signs). The study team analyzed this data to determine which sites met data quality eligibility requirements, while providing initial information on the cohort of interest.

DISTRIBUTED STATISTICAL NETWORK QUERIES

Sites extract data from their local EHR systems and other health care data repositories, such as insurance claims, and transform those data to meet CDM standards. The PCORnet distributed research network model addresses governance and privacy concerns by allowing institutions to maintain data locally, rather than create a network-wide centralized database. Queries written to conform to the CDM standards are distributed to Network Partners for local execution, resulting in the return of standardized output that can be aggregated with other partners. To produce statistical query packages for distribution, either for data characterization or study analyses, PCORnet follows a standard workflow, informed by the setup of the US Food and Drug Administration’s Sentinel program.⁸ The Sentinel program utilizes claims data from health insurers to examine drug safety across the United States. The workflow begins with the development of scientific specifications that describe the purpose of the query and the intended analyses, which serves as a blueprint for the programming team. The programmers then develop a SAS statistical query to capture relevant data from

Network Partners or to conduct analyses (SAS Institute, Cary, NC). Study teams are also responsible for generating and reviewing codes for relevant variables used for the query. This study used International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM), and SNOMED-CT codes for diagnoses, and RxNorm and National Drug Code (NDC) codes for medications.

After query program development has been completed and tested with simulated data at the PCORnet Coordinating Center and at sites for beta testing, the program is distributed to the network via the PopMedNet Query Tool.⁹ Once results are returned from all responding sites, responses are collapsed into a single summary report for review and analysis by the study team (Supplemental Fig. 1) in the case of aggregated data, and into analytic files for other types of data, such as patient-level data.

STUDY COHORT

The PCORnet Antibiotics and Childhood Growth study cohort included children from birth to <11 years of age. Inclusion criteria were one or more encounters with same-day length/height and weight measured in each of the following intervals: 0 to 12 months, 12 to < 30 months, and 24+ months of age. The latter 2 age periods overlapped to allow for the possibility that children had their 2-year-old well-child visit soon after their second birthday. Thus, children with only 2 measures were eligible for inclusion if the second was between 24 and 30 months of age. Less than 1% of the children met the cohort criteria with only 2 measures. Children were excluded from the cohort if they did not have a male or female designation for sex. Most Network Partners had data available from 2009 or 2010 until mid-to late 2016, with a few exceptions. Only one had data that began before 2000; another Network Partner's data availability ended in 2015.

VARIABLES AND DATA ANALYSIS

All data presented here were from descriptive analyses of all participating institutions. We presented some descriptive data anonymously at the Network Partner level for those 23 Network Partners that had at least 5000 children in the cohort. Demographics were defined according to the PCORnet CDM standards. Drug codes for antibiotics were identified using a two-pronged approach. First, we captured NDC codes for antibiotics using the functional classification system from First Databank.¹⁰ Crosswalks available from the National Library of Medicine were used to convert the NDC code list into RxNorm codes,¹¹ the prescription classification system used for this study. Second, to identify additional systemic antibiotic codes in RxNorm, we separately captured RxNorm semantic clinical drug form (SCDF) terms using the Anatomic Therapeutic Classification system.¹² Under the RxNorm hierarchy, we also collected all less specific codes that were related to the SCDF terms to maximize capture of antibiotics; these included drug component, ingredient, brand name, multi-ingredient, and precise ingredient codes. We further captured more specific codes related to the SCDF terms, including semantic clinical drug

or pack and semantic branded drug or pack codes. During manual review of these lists, we excluded antiprotozoal medications, antibiotics not available in the United States, veterinary medicines, and most intravenous medications. This led to a final antibiotic list of oral medications and intravenous or intramuscular ceftriaxone and penicillin, medications likely to be prescribed in the outpatient or emergency department setting. This restriction ensured consistency across the network—several did not have inpatient medications—and allowed this study to focus on antibiotics whose use we believed could be potentially more modifiable than most intravenous medications.

Network Partners did not routinely have *days supplied* available for prescriptions. Thus, we defined exposure to antibiotics by the number of episodes of antibiotics prescribed. The time window for an antibiotic episode was 7 days, such that any antibiotic prescriptions within a 7-day period of another prescription were joined together into a single episode. Narrow-spectrum antibiotics included amoxicillin, penicillin, and dicloxacillin; broad-spectrum antibiotics included all others, including penicillin combinations, such as amoxicillin/clavulanic acid. To define whether the episode was for a broad- or narrow-spectrum antibiotic, we used the highest spectrum antibiotic prescribed within the episode.

Diagnostic codes were identified for potential confounders or effect modifiers, such as asthma and prematurity, as well as diagnoses for chronic conditions. For complex chronic conditions, we used the list of ICD-9-CM code clusters developed by Feudtner et al.¹³ Using these diagnoses, we added to the list by searching an Optum database to ensure that we captured all relevant codes for these diagnoses. For those sites that used only SNOMED-CT codes for diagnoses, we translated the final ICD-9-CM code list to SNOMED-CT using an established crosswalk.¹⁴

Computation of body mass index (BMI) *z* scores utilized the World Health Organization (WHO) growth standards for children <24 months of age: underweight if age- and sex-specific BMI was <2.3rd percentile, normal weight if 2.3rd to <97.7th percentile, and overweight/obesity if ≥97.7th percentile.¹⁵ We used the US Centers for Disease Control and Prevention National Health and Nutrition Examination Survey (NHANES) 2000 growth charts to classify weight status of children ≥24 months of age: underweight if <5th percentile, normal weight 5th to <85th, overweight 85th to <95th percentile, obesity ≥95th percentile, and severe obesity ≥120% of the 95th percentile.¹⁶ We removed implausible values of BMI *z* scores less than −5 and greater than 8, accounting for the recommended bounds for both the WHO (−5, +5) and Centers for Disease Control and Prevention (−4, +8). We utilized a SAS-based summary program to aggregate data across responding Network Partners and format into a readable Excel (Microsoft, Redmond, Wash) report for analyses and characterization.

RESULTS

The final study cohort included 681,739 children, which was 38% of all children who had at least one same-day height/weight measurement at <12 months of age and 71% of children who also had at least one additional same-day

Table 1. Descriptive Characteristics of Study Cohort

Characteristic	n (%)
Sex	
Male	356,875 (52.3%)
Female	324,864 (47.7%)
Race	
White	363,759 (53.4%)
Black, African American	170,007 (24.9%)
Asian	28,356 (4.2%)
Multiple race	14,184 (2.1%)
Native Hawaiian, other Pacific Islander	2,930 (0.4%)
American Indian, Alaska Native	2,862 (0.4%)
Other	39,885 (5.9%)
Refused/unknown/no information	59,684 (8.8%)
Hispanic	
Yes	119,059 (17.5%)
No	445,878 (65.4%)
Other	2,125 (0.3%)
Refused/unknown/no information	114,660 (16.8%)
Birth-related diagnoses	
Prematurity	52,752 (7.7%)
Heavy for gestational age newborn	9,907 (1.5%)
Low birth weight	5,828 (0.9%)
Macrosomia	425 (0.06%)
Chronic conditions/categories	
Asthma	94,399 (13.8%)
Cardiovascular	46,862 (6.9%)
Other congenital defect	42,094 (6.2%)
Respiratory	21,455 (3.1%)
Metabolic	17,005 (2.5%)
Neuromuscular	16,906 (2.5%)
Renal	16,397 (2.4%)
Hematological/immunological	14,547 (2.1%)
Endocrine	6,602 (1.0%)
Malignant neoplasms	6,593 (1.0%)
Gastrointestinal	6,015 (0.9%)

height and weight measurement at 12 to <30 months of age (Supplemental Fig. 2). Slightly more than half were boys (52.3%), and the cohort was racially diverse, with 53.4% white, 24.9% black or African American, 5.9% other race, and 4.2% Asian (Table 1). Although there were substantial missing data on Hispanic ethnicity, 17.5% of the cohort was identified as Hispanic. All 28 Network Partners contributed to the cohort; the largest CDRN contributors were PEDSnet (46% of the cohort), PORTAL (22%), ADVANCE (9%), and Mid-South (8%).

Birth-related diagnoses were rarely documented in the EHRs, except for prematurity, with 7.7% of children having a code for prematurity (Table 1). By comparison, the prevalence of US preterm births in 2014 was 9.5%.¹⁷ Because several of the participating health systems were referral centers, the rate of chronic conditions was high, including 13.8% who had at least one diagnostic code documented for asthma, and 6.9%, 6.2%, and 3.1% for cardiovascular, other defects (mostly congenital defects), and respiratory diagnoses, respectively, at <5 years of age.

Among all children in the cohort, 55.2% received at least one prescription for an antibiotic at <24 months of age (Table 2). Among the 23 Network Partners with at least 5000 children in the cohort, the fraction of children prescribed at least one antibiotic ranged from 19% to 77%; 16 of the 23 Network Partners, including most of the larger ones, had

Table 2. Exposure to Antibiotics and Other Medications Before Age 2 Years

Antibiotics	n (%)
No antibiotics	305,489 (44.8%)
Any antibiotic	376,250 (55.2%)
All antibiotics	
1	144,949 (21.3%)
2	83,157 (12.2%)
3	50,870 (7.5%)
4+	97,267 (14.3%)
Narrow spectrum	
1	159,295 (23.4%)
2	76,486 (11.2%)
3	34,326 (5.0%)
4+	23,512 (3.4%)
Broad spectrum	
1	114,830 (16.8%)
2	47,440 (7.0%)
3	24,848 (3.6%)
4+	39,926 (5.9%)
Amoxicillin	
1	159,083 (23.3%)
2	76,096 (11.2%)
3	34,068 (5.0%)
4+	22,793 (3.3%)
Amoxicillin/clavulanic acid	
1	67,435 (9.9%)
2	19,121 (2.8%)
3	6,797 (1.0%)
4+	4,280 (0.6%)
Azithromycin	
1	46,191 (6.8%)
2	10,836 (1.6%)
3	3,719 (0.5%)
4+	2,371 (0.3%)

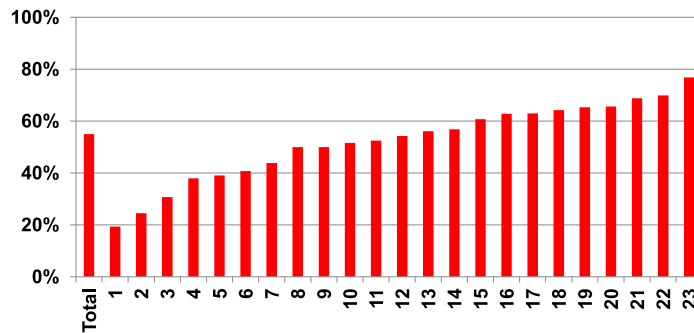
prescribing rates above 50% (Fig. 1A). For all children in the cohort, 21.3% had 1 prescription episode and 14.3% had 4+ prescription episodes <24 months (Table 2).

Narrow-spectrum antibiotics—nearly all amoxicillin—were more commonly prescribed, with 43.0% of all children in the cohort (over three quarters of children who received any antibiotics) receiving at least one prescription for a narrow-spectrum antibiotic at <24 months of age and 33.3% receiving at least one broad-spectrum antibiotic (Table 2). Across the 23 Network Partners with at least 5000 children, 16 had higher rates of prescribing for narrow-spectrum antibiotics (Fig. 1B).

Nearly a quarter of children (23.4%) received 1 narrow-spectrum antibiotic, and 3.4% received 4+ compared to 16.8% and 5.9% for broad-spectrum antibiotics (Table 2). Amoxicillin/clavulanic acid and azithromycin were prescribed at least once for 14.3% and 9.2% of children, respectively.

Mean BMI *z* score was −0.30 (WHO, SD 1.31) at 0 to <6 months of age, rising to 0.59 (NHANES, SD 1.18) at 9 to 11 years of age (Supplemental Table 2). The prevalence of overweight and obesity across age groups was 3.7% among 0- to 6-month-olds, 27.6% among 4- to <6-year-olds, and 36.2% among 9- to <11-year-olds (Fig. 2, Supplemental Tables 3 and 4). The prevalence of severe obesity was 2.5% and 6.8%, respectively, for 4- to <6-year-olds and 9- to <11-year-olds. There was a range in prevalence of overweight

A. Percent of Children with Any Antibiotic Prescription before 24 Months of Age, By Network Partner



B. Among Children Receiving Any Antibiotic, Percent Receiving Broad or Narrow Spectrum Antibiotics, By Network Partner

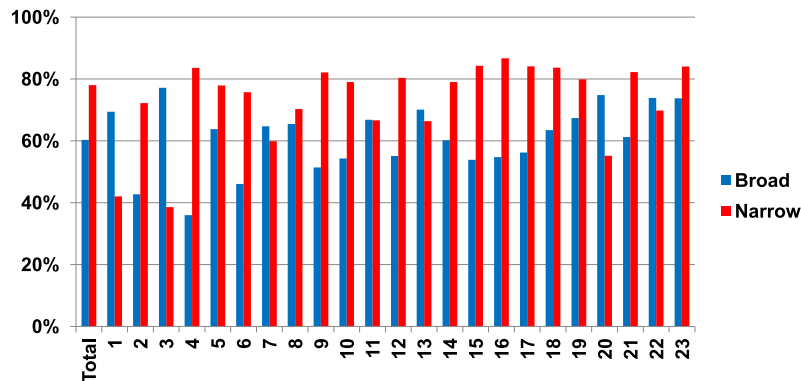


Figure 1. PCORnet Antibiotics and Childhood Growth Study, prescribing rate and breakdown of antibiotic spectrum by Network Partner. Shown is the percentage of children who received an antibiotic prescription before 24 months of age overall for the cohort and by Network Partner for those contributing at least 5000 children to the cohort (A) and the percentage of children receiving any narrow- and broad-spectrum antibiotic before 24 months of age overall and by Network Partner (B). Denominator for (A) includes all children in the cohort and for (B) includes all children who received at least one antibiotic prescription before 24 months of age. Among the 23 Network Partners presented, 16 had antibiotic prescribing rates of >50% and had higher narrow-spectrum antibiotic prescribing rates than broad. PCORnet indicates National Patient-Centered Clinical Research Network.

and obesity across the 23 Network Partners with at least 5000 children in the cohort (Supplemental Fig. 3). For example, prevalence of obesity among 4- to 6-year-olds had a range of 5% to 22%.

DISCUSSION

Using the PCORnet data network infrastructure, we assembled a study cohort of 681,739 children with multiple measures of height and weight captured in EHRs across 35 health care institutions. More than half of these children had height and weight data at ages 4 to <6 years and 9% at ages 9 to <11 years. The cohort has broad diversity in geography, demographics, and care settings, and provides a rich data source for the longitudinal study of childhood growth.

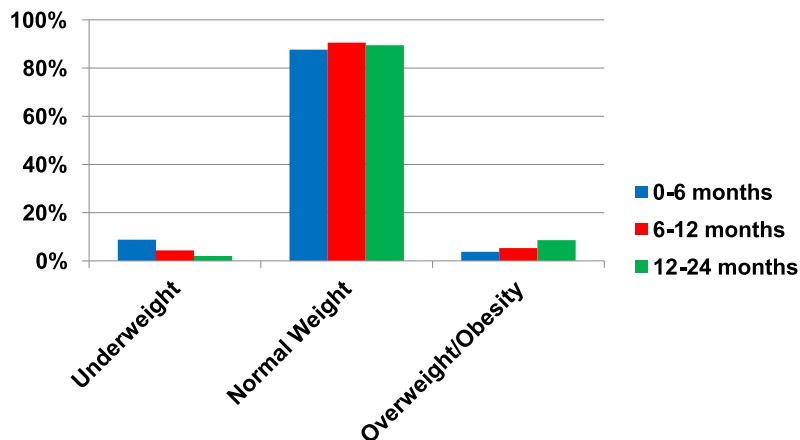
PCORnet's architecture strikes a balance between facilitating large-scale collaborative research and managing institutional risks. The PCORnet Antibiotics and Childhood Growth Study, engaging 28 (34%) of 82 Network Partners, provides an early test of the network, including valuable information about network governance and operations, patient engagement, use of prescribing and anthropometric data, and population characteristics. Most

contributing health care institutions in the network are anchored by large hospitals in urban or suburban areas, which may explain the high rates of complex chronic conditions. Overall, however, the clinical data collected align well with expectations for pediatric populations.

Results from this descriptive study demonstrate that PCORnet is well suited for pediatrics observational epidemiologic research, with the capacity to create large cohorts for the study of health care exposures and outcomes. PCORnet can also provide meaningful national surveillance data on health care utilization and outcomes. In this cohort, over half of included children received at least one prescription for antibiotics by their second birthday. While recommended first-line antibiotics were most common, one third of children received at least one broad-spectrum antibiotic, and 1 in 7 received 4+ courses. This results in a significant exposed group for both antibiotics overall and for subset analyses by type and extent of exposure. The rate of antibiotic exposure is comparable to prior studies.^{18–20}

Anthropometric measures for this cohort are similar to national survey estimates. For most age categories, the median BMI z score is slightly positive. Prevalence of obesity in our cohort was 13.1% from ages 4 to <6 years and 20.0% from

A. 0 to 24 Months of Age, WHO Classification System



B. 2 to 10.9 Years of Age, CDC Classification System

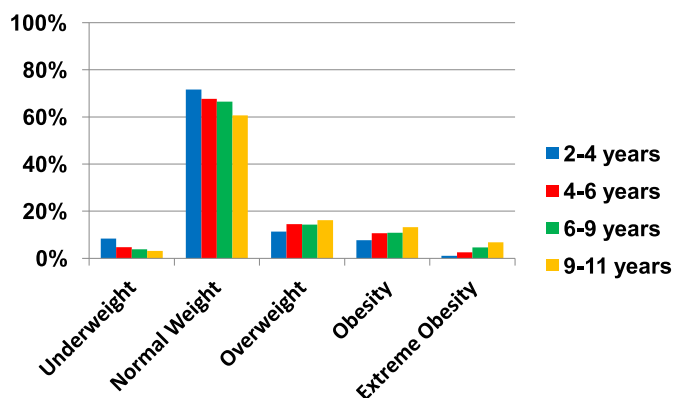


Figure 2. PCORnet Antibiotics and Childhood Growth Study, cohort weight class. Study calculated age- and sex- specific BMI (BMI z score) for children at each age period. World Health Organization growth standards for children were utilized before 24 months of age: underweight if BMI z score was <2.3rd percentile, normal weight if 2.3rd to <97.7th percentile, and overweight/obesity if ≥ 97.7 th percentile (A). CDC NHANES 2000 growth charts for children were utilized for children aged 2 to 10.9 years: underweight if BMI z score <5th percentile, normal weight 5th to <85th percentile, overweight 85th to <95th percentile, obesity ≥ 95 th percentile, and severe obesity $\geq 120\%$ of 95th percentile (B). Rates of overweight, obesity, and severe obesity were higher for older children. BMI indicates body mass index; CDC, US Centers for Disease Control and Prevention; NHANES, National Health and Nutrition Examination Survey; and PCORnet, National Patient-Centered Clinical Research Network.

ages 9 to <11 years, compared to 9% among 2- to <6-year-olds and 18% among 6- to <12-year-olds in NHANES data spanning 2011 to 2014.²¹ Prevalence of severe obesity was 2.5% for 4- to <6-year-olds and 6.8% for 9- to <11-year-olds, compared to 1.7% for 2- to <6-year-olds and 4.3% for 6- to <12-year-olds in NHANES 2011–2014. The slightly higher prevalence in our cohort may reflect differences in age ranges, given the higher prevalence of childhood obesity as age increases or differences in patient mix between those children continuously enrolled in PCORnet health systems versus the US population.^{21,22} It may also reflect characteristics of the cohort, which includes a larger proportion of African American children and children living in urban settings than the US population.²¹

The objective of the PCORnet Antibiotics and Childhood Growth Study is to better characterize the relationship between antibiotics and childhood obesity in the United States. This study is powered to examine multiple potential associations of antibiotics and weight, including the effects of types, timing, and frequency of antibiotic use in

the first 2 years of life on BMI, obesity, and growth. Quantifying the precise effect size of this association will provide pertinent information to patients and clinicians regarding potential obesogenic risks of antibiotic prescriptions. Compared to prior studies that have examined the relationship between antibiotic use and growth in children, this cohort provides the largest and most diverse population for study. Prior reports have included single health system or single region studies in the United States, including children in Northern California (260,556 children) or central Pennsylvania (142,824 children), as well as smaller European national studies such as in England (11,532 children) or Denmark (28,354 children).^{23–26} Representation of African American children in this cohort is higher than the entire US population (25% vs 12%); the proportion of patients identifying as Hispanic is similar to the US population. This cohort demonstrates a modest overrepresentation of several chronic conditions, which may be due to the inclusion of several large health systems providing tertiary care. Also, the prevalence of chronic disease could have been higher solely

because the cohort includes children who have received health care services.

In addition to the overrepresentation of urban environments and chronic conditions, it is important to note several other limitations. Most significantly, available data did not include other variables that influence the risk of childhood obesity, including maternal health or gestational factors, as well as environmental, social, behavioral, and dietary factors. The PCORnet study will address the absence of gestational data by linking maternal and child health records for a subset of the cohort, allowing inclusion of maternal BMI, child birth weight, and maternal weight gain. Another limitation was that antibiotic exposure was measured using prescribing records, which may overestimate exposure in cases where children do not complete prescribed courses of antibiotics. Prescribing records also may underestimate exposure because some prescribing may occur in health care settings not covered by a contributing institution and would therefore be missed. Similarly, our identification of chronic conditions relies on one or more occurrences of diagnosis codes recorded during clinical encounters and may overestimate prevalence due to use of these codes to rule out diagnoses. When we capture and analyze individual-level data on participants, rather than aggregate data only (as used herein), we will be able to compensate for this by requiring repeated presence of codes, consistent with the chronic nature of the conditions.

More generally, the use of routine clinical data for the study may result in missingness (eg, patients with race or Hispanic ethnicity not recorded), misestimation (eg, higher use of diagnostic codes when ruling out conditions), or loss of detail (eg, use of ICD-9-CM in billing data, losing specificity of diagnoses primarily recorded in the EHR). These limitations are common to studies using EHR and administrative data.

CONCLUSIONS

The PCORnet Antibiotics and Childhood Growth cohort demonstrates the capacity of PCORnet to facilitate capture of data on large pediatric populations for research, including early childhood growth, chronic conditions, infectious diagnoses, and antibiotic usage. This study provides valuable surveillance information on antibiotic utilization and weight, and it is the largest study to date to examine the relationship between antibiotic use in early life on weight outcomes in childhood. The large sample size and detailed clinical data will allow us to examine relationships among the type, timing, and level of antibiotic exposure to determine whether these factors are related to weight outcomes. PCORnet can provide significant opportunities to explore precise research inquiries in pediatrics.

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the views of PCORI, its Board of Governors, or Methodology Committee. The PCORnet Childhood Antibiotic Study Team includes a diverse group of investigators, research staff, clinicians, community members, and parent caregivers. All members of the team including the study's Executive Antibiotic Stakeholder Advisory Group contributed to the study design, data acquisition, and interpretation of results. The Study Team thanks the leaders of the participating PCORnet CDRNs, Patient Powered Research Networks, and PCORnet Coordinating Center, as well as members of the PCORI team, for their support and commitment to this project.

SUPPLEMENTARY DATA

Supplementary data related to this article can be found online at <https://doi.org/10.1016/j.acap.2018.02.008>.

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