Obesity Research & Clinical Practice 13 (2019) 12–15

Contents lists available at ScienceDirect

Obesity Research & Clinical Practice

journal homepage: www.elsevier.com/locate/orcp

Short Report

Objectively measured pediatric obesity prevalence using the OneFlorida Clinical Research Consortium

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ARTICLE INFO

Article history:
Received 11 May 2018
Received in revised form
26 September 2018
Accepted 18 October 2018

Keywords:
Severe obesity
Electronic health records
Childhood obesity
NHANES

ABSTRACT

We characterized the prevalence of obesity among Florida children 2–19 years old using electronic health records (EHRs). The obesity prevalence for 331,641 children was 16.9%. Obesity prevalence at 6–11 years (19.5%) and 12–19 years (18.9%) were approximately double the prevalence of obesity among children 2–5 years (9.9%). The highest prevalence of severe obesity occurred in rural Florida (21.7%) and non-Hispanic children with multiple races had the highest obesity prevalence (21.1%) across all racial/ethnic groups. Our results highlight EHR as a low-cost alternative to estimate the prevalence of obesity and severe obesity in Florida children, both overall and within subpopulations.

Introduction

Pediatric overweight and obesity affect over 1 in 3 children in the US and represent a public health crisis [1]. The state of Florida is the 3rd most populated state in the US [2] and according to reported height and weight data, ranks 37th for obesity among 15-to-19-year-olds (10.9%) and 4th for combined overweight and obesity rates (36.6%) for 10–17 years old [3]. Among 2-to-4-year-olds, Florida ranks 41st for obesity (12.7%) using measured height and weight data [3]. However information on the geographic and demographic distribution of obesity and severe obesity in Florida remains limited. Electronic health records (EHRs) have emerged as a large-scale data source with low error rates [4] that can be leveraged to track population trends in obesity [5]. In this study, we characterize the prevalence of obesity and severe obesity among children 2–19 years of age according to self-identified race and ethnicity in urban and rural Florida children. Our study is among the first to leverage EHRs available through OneFlorida [6,7] as a low-cost alternative to objectively evaluate the prevalence of obesity and severe obesity among Florida children from diverse geographic regions and racial/ethnic backgrounds.

Methods

The OneFlorida query

Over 12 million unique patient records were available from OneFlorida as of early 2017, which included Medicaid claims records. Previous work has demonstrated the OneFlorida Data Trust demographics are similar to estimates reported by the US Census Bureau [8,9]. In addition, participation in the OneFlorida Data Trust is voluntary, and is comprised of thousands of providers, clinics, practices, and multiple hospital systems throughout the state. Patients

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https://doi.org/10.1016/j.orcp.2018.10.002
1871-403X/

Table 1
Demographic breakdown of obesity among Florida children.

		Children 2–19 years		Children 2–5 years		Children 6–11 years		Children 12–19 years	
		N	Prevalence (95 CI)	N	Prevalence (95 CI)	N	Prevalence (95 CI)	N	Prevalence (95 CI)
Overall		331,641	16.9 (16.8, 17.0)	80,759	9.9 (9.7, 10.1)	110,047	19.5 (19.3, 19.8)	140,835	18.9 (18.7, 19.1)
Sex									
Male		170,527	17.5 (17.3, 17.7)	43,594	10.7 (10.4, 11.0)	57,648	20.4 (20.1, 20.7)	69,285	19.4 (19.1, 19.7)
Female		161,114	16.3 (16.1, 16.4)	37,165	8.9 (8.6, 9.2)	52,399	18.5 (18.2, 18.9)	71,550	18.4 (18.1, 18.7)
Race-ethnicity									
Non-Hispanic (NH) white		101,677	14.8 (14.5, 15.0)	19,199	7.8 (7.4, 8.2)	29,486	15.4 (14.9, 15.8)	52,992	17.0 (16.6, 17.3)
NH black		58,815	18.3 (18.0, 18.6)	13,824	9.1 (8.6, 9.6)	18,871	19.5 (19.0, 20.1)	26,120	22.3 (21.8, 22.8)
NH Asian		3139	9.9 (8.8, 10.9)	717	7.9 (6.0, 9.9)	950	11.5 (9.4, 13.5)	1472	9.8 (8.3, 11.3)
NH American Indian/Alaskan		315	15.6 (11.6, 19.6)	71	4.2 (0.0, 8.9)	101	18.8 (11.2, 26.4)	143	18.9 (12.5, 25.3)
NH Hawaiian/Pacific Islander		175	20.0 (14.1, 25.9)	30	6.7 (0.0, 15.6)	56	26.8 (15.2, 38.4)	89	20.2 (11.9, 28.6)
Hispanic		147,747	18.1 (17.9, 18.3)	42,267	11.3 (11.0, 11.6)	54,268	22.0 (21.7, 22.4)	51,212	19.5 (19.1, 19.8)
NH multiple race		969	21.1 (18.5, 23.6)	234	12.8 (8.5, 17.1)	353	21.5 (17.2, 25.8)	382	25.7 (21.3, 30.0)
Other, unknown, refused		18,804	15.9 (15.3, 16.4)	4417	8.2 (7.4, 9.0)	5962	18.3 (17.3, 19.3)	8425	18.2 (17.3, 19.0)
Race-ethnicity & sex									
Non-Hispanic (NH) white	M	51,906	15.5 (15.2, 15.8)	10,401	8.5 (8.0, 9.1)	15,643	15.8 (15.2, 16.3)	25,862	18.1 (17.7, 18.6)
	F	49,771	14.0 (13.7, 14.3)	8798	6.9 (6.4, 7.4)	13,843	14.9 (14.3, 15.5)	27,130	15.8 (15.4, 16.3)
NH black	M	30,534	16.1 (15.7, 16.5)	7557	9.1 (8.5, 9.8)	9969	17.6 (16.8, 18.3)	13,008	18.9 (18.2, 19.6)
	F	28,281	20.8 (20.3, 21.2)	6267	9.0 (8.3, 9.7)	8902	21.7 (20.9, 22.6)	13,112	25.7 (25.0, 26.5)
NH Asian	M	1582	13.8 (12.1, 15.5)	398	10.3 (7.3, 13.3)	493	15.8 (12.6, 19.0)	691	14.5 (11.8, 17.1)
	F	1557	5.8 (4.7, 7.0)	319	5.0 (2.6, 7.4)	457	6.8 (4.5, 9.1)	781	5.6 (4.0, 7.3)
NH American	M	159	13.8 (8.5, 19.2)	39	5.1 (0.0, 12.1)	55	20.0 (9.4, 30.6)	65	13.8 (5.4, 22.2)
Indian/Alaskan	F	156	17.3 (11.4, 23.2)	32	3.1 (0.0, 9.2)	46	17.4 (6.4, 28.3)	78	23.1 (13.7, 32.4)
NH Hawaiian/Pacific	M	98	20.4 (12.4, 28.4)	20	10.0 (0.0, 23.1)	33	21.2 (7.3, 35.2)	45	24.4 (1.9, 37.0)
Islander	F	77	19.5 (10.6, 28.3)	10	0.0 (0.0, 0.0)	23	34.8 (15.3, 54.2)	44	20.5 (8.5, 32.4)
Hispanic	M	76,081	19.7 (19.4, 20.0)	22,651	12.4 (12.0, 12.9)	28,158	24.2 (23.7, 24.7)	25,272	21.2 (20.7, 21.7)
	F	71,666	16.4 (16.1, 16.6)	19,616	10.0 (9.6, 10.4)	26,110	19.7 (19.2, 20.2)	25,940	17.8 (17.3, 18.3)
NH multiple race	M	493	20.1 (16.5, 23.6)	126	11.1 (5.6, 16.6)	189	22.2 (16.3, 28.1)	178	24.2 (17.9, 30.4)
	F	476	22.1 (18.3, 25.8)	108	14.8 (8.1, 21.5)	164	20.7 (14.5, 26.9)	204	27.0 (20.9, 33.1)
Other, unknown, refused	M	9674	16.5 (15.7, 17.2)	2402	8.9 (7.7, 10.0)	3108	19.4 (18.0, 20.8)	4164	18.7 (17.5, 19.9)
	F	9130	15.2 (14.5, 16.0)	2015	7.4 (6.3, 8.5)	2854	17.1 (15.7, 18.5)	4261	17.7 (16.5, 18.8)

in the OneFlorida Data Trust had the option to select a single racial and ethnic group that included: American Indian or Alaska Native; Asian; Black or African American; Native Hawaiian or Other Pacific Islander; White; Multiple race; Refuse to answer; Unknown; and Other. Records from Medicaid members who visited OneFlorida health clinics that retain height/weight EHR data were included in our analysis; however, Medicaid claims-only records did not contain height and weight and were not included. After excluding Medicaid claims-only records, approximately 6.99 million EHR-based patient records from 2012 to 2016 remained for our analysis. Additional inclusion criteria were a recorded sex, race/ethnicity, birth date, a 5-digit zip code between '32003' and '34997' (Florida zip codes), and non-missing height/weight data for a minimum of two separate medical encounters. If more than two encounters existed for a patient, the two most recent encounters with height/weight were used. Final requirements were that age must be between 2–19 years; individuals 20 years or older at either encounter were excluded. Supplementary Fig. 1 outlines selection of 331,641 individuals between 2–19 years that were included in the final analysis. This study was approved by OneFlorida's institutional review board at the University of Florida.

Obesity status

The two most recent separate encounters with non-missing height/weight were used to establish obesity status. Obesity status at a single encounter was determined using a diagnosis code of obesity or calculated BMI; BMI value $\geq$ 95th percentile for the child's sex and age at the time of encounter. Severe obesity was defined as a BMI $\geq$ 99th percentile. To have obesity in this study, patients must be classified as having obesity at both encounters. Data were analyzed by age and sex as well as self-reported race and ethnicity. Age was calculated from the patient's birthdate on record at their first encounter. Zip code is maintained in the OneFlorida database as the patient's most recently entered zip code.

County-level analysis

County-level obesity prevalence were calculated and mapped to geographically characterize obesity prevalence. We aggregated OneFlorida patients from residential and post office zip codes to Zip Code Tabulation Areas (ZCTAs 2010), and secondarily to county equivalents, excluding Foreign Service overseas zip codes. To account for the few ZCTAs impacted by county boundaries, population percentage weights (based on 2010 census) were used to construct county level equivalent counts. Rural-urban classifications were based on criteria from the National Center for Health Statistics (NCHS) [10].

Statistical analysis

We computed prevalence and 95% confidence intervals for detailed demographic breakdowns of obesity prevalence using SAS 9.4. Prevalence alone were computed for each county, and data are displayed as choropleth maps; percentages are reported within ranges.

Results

The OneFlorida pediatric obesity prevalence for 331,641 children (2–19 years) was 16.9% (Table 1). Obesity prevalence at 6–11 years (19.5%) and 12–19 years (18.9%) were approximately double those of individuals 2–5 years (9.9%). Boys had a significantly higher prevalence of obesity compared to girls across all age groups. Within most racial ethnic groups boys had higher prevalence of obesity, though the magnitude of sex disparity varied.

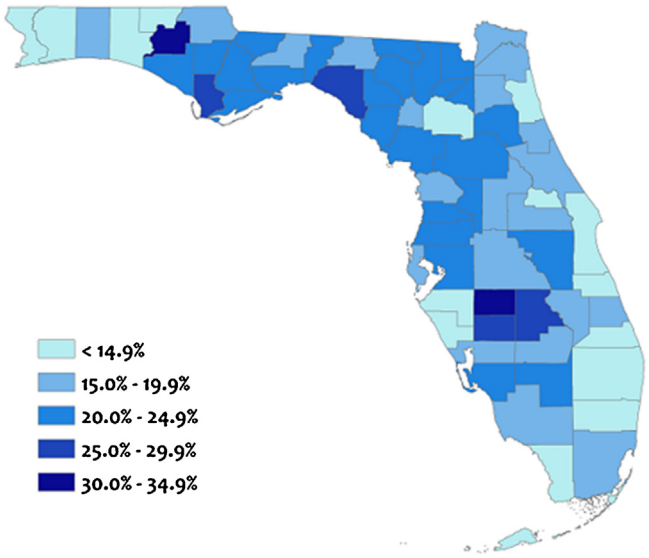

Fig. 1. OneFlorida Pediatric Obesity Prevalence by County. Geographic distribution of obesity prevalence at the county-level in Florida children by quintile among pediatric patients with two separate non-missing height and weight encounters recorded in the OneFlorida Data Trust between January 1, 2012 through December 31, 2016.

Table 2
Childhood obesity prevalence by urban and rural classifications.

	Child	
	Obesity	Severe obesity
Metropolitan	16.5	4.1
Micropolitian (i.e., Small Metro)	17.9	5.2
Rural and small town	21.7	7.1

National Center for Health Statistics: code 1–2 as metropolitan, codes 3–4 as micropolitan, and 5–6 as rural and small town.

Among patient groups with at least 1000 included records, non-Hispanic children with multiple self-reported races had the highest obesity prevalence (21.1%) and Non-Hispanic Asian children had the lowest (9.9%) across all racial/ethnic groups. The highest prevalence of obesity observed in our analysis occurred in rural and small towns (21.7%), which was 25% higher than observed in metropolitan areas (Fig. 1). Further, rural-small town areas had a roughly 75% higher prevalence of severe obesity relative to metropolitan areas (Table 2).

Discussion

Our study is the largest cross-sectional investigation of pediatric obesity in Florida children (2–19 years), and among the first to characterize the geographic distribution of both obesity and severe obesity, using state-wide EHRs. The prevalence of pediatric obesity in 331,641 Florida children (2–19 years) included in the analysis was 16.9% and replicates estimates of national obesity prevalence (16.9%) data available through the National Health and Nutrition Examination Survey (NHANES) among US children the same age during the same time period (2012–2016) [1]. We also found the prevalence of obesity at 6–11 years (19.5%) and 12–19 years (18.9%) was approximately double those children 2–5 years (9.9%). The highest prevalence of obesity seems to occur in the north central, as well as a small pocket in the central, regions of the state. This was corroborated by the analysis showing that rural-small town areas had roughly a 75% higher rate of severe obesity relative to metropolitan and micropolitan areas. Previous studies have reported high rates of childhood obesity in rural areas [11]; however our study extends these observations by also reporting on severe obesity. Severe obesity afflicts nearly 6% of all US children [12] where approximately 90% of individuals with severe obesity will grow up to be adults with at least class 2 obesity (BMI $\geq$ 35 kg/m^2) [13]. Our results are highlighted by recent analysis of NHANES data from 2015 to 2016 that reports a sharp increase in severe obesity among children 2–5 years [1]. With the use of EHR data, a strength of this study is the large sample size that incorporates a full range of demographic information that allowed for subgroup analysis within the state of Florida, whereas state-based subgroup analysis is not possible with NHANES data [14]. The primary limitation of this study is that participants in our analysis must be seen for routine clinical care and thus were unable to include children who do not seek medical care. Previous work evaluating children's access to health care demonstrates that racial/ethnic minorities, older children, children from low-income families and individuals without insurance are less likely to seek medical care [15], therefore we may have an underrepresentation of these individuals in our sample. Nevertheless, data analyzed in this study (height and weight) are traditionally collected as standard care at well-child visits. Well-child visits are recommended annually, and research suggests that 92.7% of children have had contact with a health care professional in the past year [16]. Together, these data suggest the number of children excluded from our data, is likely very small and would not be predicted to significantly bias our analysis. Given that racial/ethnic minorities, older children, and those without insurance are likely to have increased rates of obesity [1], if our sample is biased, then our data likely underreports the prevalence of obesity among Florida's youth. Our analysis implicates EHRs from Florida health-systems as a low-cost alternative to more traditional data collection methods for surveillance of obesity and severe obesity prevention, treatment and health inequalities among diverse groups of children [6].

Acknowledgments

Research reported in this publication was supported in part by the OneFlorida Clinical Data Network, funded by the Patient-Centered Outcomes Research Institute#CDRN-1501-26692, in part by the OneFlorida Cancer Control Alliance, funded by the Florida Department of Health's James and Esther King Biomedical Research Program#4KB16, and in part by the University of Florida Clinical and Translational Science Institute, which is supported in part by the NIH National Center for Advancing Translational Sciences under award number UL1TR001427. The content of this study solely the responsibility of the authors and does not necessarily represent the official views of the Patient-Centered Outcomes Research Institute (PCORI), *its Board of Governors or Methodology*, the Oneflorida Clinical Research Consortium, the University of Florida's Clinical and Translational Science Institute, the Florida Department of Health, or the National Institutes of Health." All authors — designed research (project conception, development of overall research plan, and study oversight); SLP, MJG, JH analyzed data or performed statistical analysis; DJL, MIC, JH, SRS, RZE, JN, TD, BS, DN, MJG, DMJ — interpreted data findings; DJL, MIC, DMJ wrote paper; DJL and DMJ had primary responsibility for final content. All authors have read and approved the final manuscript and there is no conflict of interest.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.orcp.2018.10.002.

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