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ORIGINAL ARTICLE

# Characterization of adult obesity in Florida using the OneFlorida clinical research consortium

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## Summary

### *Introduction*

With obesity rates and obesity-related healthcare costs increasing, policy makers must understand the scope of obesity across populations.

### *Objective*

This study sought to characterize adult obesity using electronic health records (EHRs) available from a statewide clinical data research network, the OneFlorida Clinical Research Consortium, which contains claims and EHR data from over 12 million patients in Florida. The primary aim was to compare EHR-based Florida obesity rates with those rates obtained from the Behavioural Risk Factor Surveillance System (BRFSS).

### *Methods*

Body mass index from OneFlorida patient data (2012–2016) was used to characterize obesity among adults 20–79 years old. Obesity rates from both OneFlorida and BRFSS (2013) were reported by demographics and by county.

### *Results*

Among the 1,344,015 adults in OneFlorida with EHR data and who met inclusion criteria, the obesity rate was 37.1%. Women had higher obesity rates compared with men. Obesity rates varied within racial/ethnic groups, with the highest rate among African–Americans (45.7%). Obesity rates from OneFlorida were consistently higher than those found in BRFSS (overall 27.8%).

### *Conclusions*

Utilizing clinical big data available through hospital system and health partner collaborations provides an important view of the extent of obesity. Although these data are available only from healthcare users, they are large in scope, directly measured and are available sooner than commonly used national data sources.

**Keywords:** Body mass index, databases, demography, electronic health records.

## Introduction

The prevalence of obesity among adults in the USA has increased rapidly between 1980 and 2000 (1). Although trends have slowed in the past two decades, the overall age-adjusted obesity rate remains around 40% for adult men and women (2). Obesity is a risk factor for numerous diseases and conditions, including type 2 diabetes, cardiovascular disease (CVD) and many cancers (3). Researchers have projected 65 million more adults with obesity in the USA in 2030 than in 2010 (4). Even if recent trends showing a reduction in the rate of increase in obesity continue, these researchers project an additional 6 million cases of type 2 diabetes, 5 million cases of

cardiovascular disease and 400,000 cases of cancer by 2030 attributable to obesity (4). Healthcare costs associated with obesity and overweight are estimated to double every decade, accounting for 16–18% of total US healthcare costs by 2030 (5). Utilizing clinical big data to understand the distribution of obesity across a given area and within various demographic groups has potential to guide obesity interventions to areas and individuals of greatest need and to model future healthcare needs.

Publicly available data sources such as the National Health and Nutrition Examination Survey (NHANES) and the Behavioral Risk Factor Surveillance System (BRFSS) are widely used to estimate obesity rates (2,6). NHANES has directly measured height and weight from a nationally representative sample, and those data are often used to describe national prevalence estimates of obesity (2,7). However, NHANES was not designed to describe state or county-level estimates, and even regional-level NHANES data are 'restricted' (8). Popular policy statistics, such as the County Health Rankings, use BRFSS-estimated adult obesity rates (9). However, a primary limitation of BRFSS is the use of self-reported height and weight. Significant bias has been shown in self-reported height and weight (10), and this bias differs by gender, weight status, and other characteristics (11–13). Specifically, weight tends to be underreported and height tends to be over-reported (13). Consequently, BRFSS may underestimate BMI and, thus, obesity rates by nearly 10%, and the underestimation may differ across various demographics (14). While others have attempted to implement correction factors (15), these corrections often are based on national-level data and do not account for potential geographic and other demographic influences on self-reported bias. Furthermore, obesity rates in the BRFSS sample from smaller counties without adequate sampling are model-based estimates and not directly calculated (16,17). Finally, the availability of these national data for a given time period is delayed substantially (18). Given the limitations to these publicly available data, it has been recommended that new data sources, such as from electronic health records (EHRs), be used more prominently, for both research and screening (19,20).

In 2014, the Patient-Centered Outcomes and Research Institute created PCORnet, a national consortium of Clinical Data Research Networks (CDRN) and Patient Powered Research Networks. PCORnet was created to allow for the integration of data from multiple contributing health system networks using a Common Data Model and to focus on patient engagement throughout the research process (21). OneFlorida is one of the PCORnet CDRNs that is composed of 11 health systems, hospitals and affiliated practices across Florida, as well as several statewide insurance programmes and the Florida Agency for Health Care Administration, which oversees Florida Medicaid (22). OneFlorida partners provide clinical or administrative claims data to the OneFlorida Data Trust (23), a secure, centralized data repository maintained at the University of Florida that integrates the data into the PCORnet Common Data Model. Partners provide these data at least quarterly, with some providing data on a monthly basis, and even one partner submitting data daily. As of early 2017, the OneFlorida Data Trust contained EHR and claims data from over 12 million unique patients across Florida, over half of the population of the state. EHR data specifically were available from 6.99 million patients. The OneFlorida Institutional Review Board, located at University of Florida, reviews all research studies using OneFlorida data.

OneFlorida is the only state-based PCORnet CDRN and is thus in a unique position to perform a statewide characterization of obesity. OneFlorida data are detailed and expansive, allowing for estimation of obesity rates across multiple subgroups of healthcare users. The data also allow for the analysis of obesity rates across counties within the state of Florida, both overall and within subpopulations. In contrast to other smaller data sources, OneFlorida provides an alternate approach to obtain direct estimates through analysing large quantities of data. These data mirror the distribution of healthcare users with greater geographic representation.

Others have studied the utilization of EHR-based data in characterizing obesity, and compared to national data such as NHANES (24,25). In order to compare to BRFSS, overall obesity rates among adults was the focus of this study. Recently, Klompas et al. (18) compared rates of various conditions, including obesity, between EHR data from one large Massachusetts health system and BRFSS, as well as comparisons across a number of Massachusetts cities and small-area estimates from the CDCs '500 Cities' project. However, this is arguably the first attempt to (1) characterize adult obesity rates geographically across an entire state using EHR data and (2) directly compare these rates to those from national data (BRFSS). By using a vast CDRN that captures the majority of the population of the third largest state, this study aimed to assess the feasibility and utility of a large clinical data set in making statewide characterizations about adult obesity.

## Methods

### The OneFlorida query

Over 12 million patient records were available from OneFlorida as of early 2017, which included Medicaid claims records. After excluding Medicaid claims-only records (which did not contain height and weight),

approximately 6.99 million EHR-based patient records from 2012 to 2016 remained. While Medicaid claims-only records were excluded, height/weight EHR data from Medicaid members who visited OneFlorida health clinics were eligible for inclusion in this 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. Women were excluded if they were pregnant within the study timeframe; pregnancy status was determined via International Classification of Disease Version 9-10 (ICD-9, ICD-10), and Systemized Nomenclature of Medicine codes. Final requirements were that age must be between 20 and 79 years; adults less than 20 years at first encounter, or 80 years or older at their second encounter were excluded.

### Obesity status (OneFlorida)

The two most recent separate encounters with non-missing height/weight or obesity diagnosis code were used to establish obesity status. Obesity status at a single encounter is determined using a diagnosis code of obesity or calculated BMI; having a BMI $\geq$ 30.0 indicated obesity. The majority of patients' obesity status was determined using calculated BMI, due to diagnoses codes infrequently being recorded. To have obesity in this study, patients must be classified as having obesity (through diagnosis code or calculated BMI) at both encounters, which helps prevent misclassification of obesity status due to measurement or data-entry error, or weight fluctuations.

Data were analysed by age, sex, race and ethnicity. Age used for organization within tables is the patient's age from their birthdate on record at their first encounter. Zip code is maintained in the OneFlorida database as the patient's most recently entered zip code.

### BRFSS data

BRFSS is a comprehensive health-related telephone survey of US residents regarding health-related behaviours, chronic health conditions and use of preventive services (26). Survey participants are contacted via telephone (landlines and cell phones) using random-digit-dialling. All BRFSS data are based on self-report. Data from the 2013 BRFSS survey were used to allow for comparisons with this OneFlorida query (2012–2016). This is the most recent cycle of available data with obesity status at both the individual-level and the county level. Here again, obesity rates were calculated for males and non-pregnant women between 20 and 79 years old, broken down by demographics.

### County-level analysis – OneFlorida versus BRFSS

Using patient-residence zip code, OneFlorida data were aggregated from residential and post office zip codes to Zip Code Tabulation Areas (ZCTAs), and secondarily to county equivalents. Zip codes which were traced to Army/Navy Post Offices or Embassy Post Offices in Miami were not included. Florida ZCTAs (2010) containing residential housing total 985, 90% of which exist completely within one county's boundary. The 41 ZCTAs that are bisected by a county boundary impact only 1% of Florida's population. To account for those populations, population percentage weights (based on 2010 census) were used to construct county level equivalent counts from ZCTAs impacted by county boundaries. County-level obesity rates were calculated and mapped to geographically characterize obesity prevalence. County of residence was not available in the individual-level BRFSS data sets. Rather, county-level obesity rates among all adults 20 and over are available in aggregate (17,27). Three years of data (2012–2014) were used to estimate 2013 BRFSS county rates. County-level estimates in BRFSS were not necessarily derived directly from collected data; estimates across all US counties are derived using modern small-area estimation techniques (16).

### Statistical analysis

Obesity rates and 95% confidence intervals for detailed demographic breakdowns were computed using SAS 9.4. For BRFSS data, survey procedures were used to account for the complex survey design. Rates alone were computed for each county, and data are displayed as choropleth maps; percentages are reported within ranges. All statistics were calculated separately for the two data sources (OneFlorida and BRFSS). The level of agreement of county-level obesity rates between the two data sources was examined via a Bland–Altman plot (28).

## Results

### Primary results – overall sample and rate of obesity within demographics

Among the 6.99 million EHR-based OneFlorida records between 2012 and 2016, 1,344,015 adults 20–79 years of age met the aforementioned inclusion criteria (Figure 1). Approximately 55.7% were women (Table 1). The sample included Non-Hispanic Whites (51.9%), Hispanics (21.1%), Non-Hispanic Blacks (19.6%), Asians

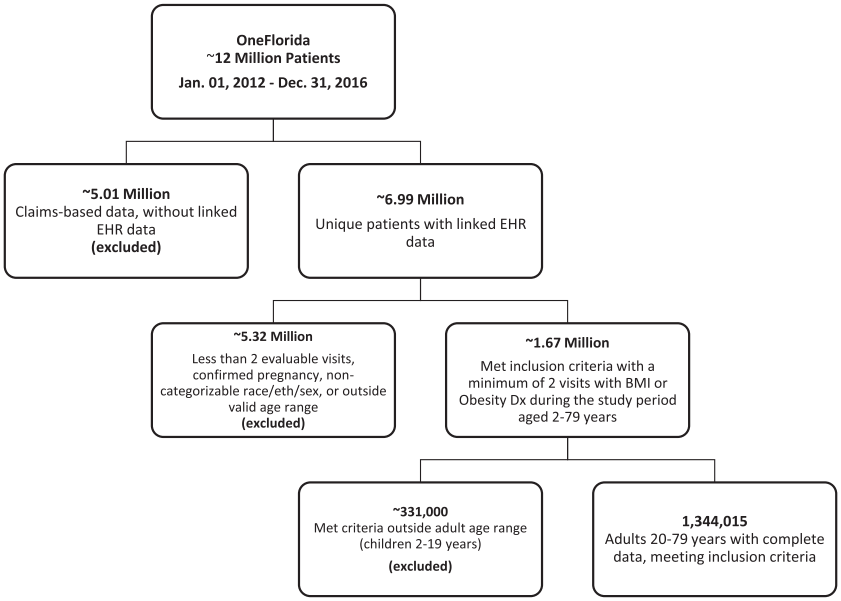


**Figure 1** Flow chart of participants excluded and included from the analysis.

(1.5%) and less than 1% each of other categories. A total of 5.6% had no reported race/ethnic information or reported 'Other' racial/ethnic background. The largest proportion were 40–59 years (40.9%).

The overall obesity rate among adult healthcare users age 20–79 years within OneFlorida is 37.1% (95% CI: [37.1, 37.2]) (Table 2). This overall rate is higher among women compared to men (39.0% vs. 34.7%). Non-Hispanic Whites had an obesity rate of 35.2%. Non-Hispanic Blacks had the highest rate of obesity (45.7%). Those with Hispanic ethnicity had an obesity rate similar to the overall state (37.1%). Obesity rates for other race/ethnicity categories were all similar and below the overall rate, with the lowest rate among Non-Hispanic Asians (12.8%).

After applying survey weights, there was roughly an even distribution of men and women in BRFSS 2013 (Table 1); 32.5% were 20–39 years, 38.5% were 40–59 years and 29.0% were 60–79 years. The racial/ethnic distribution in BRFSS was similar to OneFlorida. The majority were Non-Hispanic White (56.2%), 13.4% were Non-Hispanic Black, 21.8% were Hispanic; 1.3% were Non-Hispanic Asians and less than or equal to 1% each of other race/ethnicity categories. There are 5.4% refused or reported 'Other' racial/ethnic background. Both BRFSS and OneFlorida demographic breakdowns were similar to the Florida racial/ethnic breakdown profile reported by the US Census Bureau, obtained from the 2016 American Community Survey 1-year estimates; these estimates are reflective of the state as a whole and not subset by adults 20–79 years of age (29). However, BRFSS demographics were generally closer in distributions to the US Census Florida estimates than OneFlorida.

Lower than OneFlorida, the 2013 BRFSS overall adult obesity rate was 27.8% (95% CI: [26.6, 28.9]) (Table 3). The obesity rate within racial/ethnic groups is somewhat dissimilar to OneFlorida. Non-Hispanic American Indian/Alaskans in BRFSS had the highest rate of obesity at 37.1%. Non-Hispanic Blacks and Hispanics both had rates above the overall BRFSS rate (35.5% and 35.2%, respectively). Non-Hispanic Asians have the lowest rate of obesity at 15.3% in BRFSS, similar to OneFlorida. The pattern of obesity across age groups is similar, with the highest rate among 40- to 59-year olds. Within racial/ethnic groups, the obesity rate varied by sex and age group. The sample sizes within demographic cross-sections were very small in some instances, and 95% CIs were large.

## Geographical results

Overall, the geographic distribution of highest and lowest obesity rates is relatively similar between OneFlorida query and 2013 BRFSS (Figure 2a). The majority of the counties in the northwest part of the state have the highest obesity rates, along with the more rural counties in the mid-south-west. Although the distribution of higher obesity rates is similar across counties, OneFlorida rates are consistently higher than BRFSS rates. Obesity rates are lowest in southern Florida, especially in the densely

**Table 1** Demographic distribution within the OneFlorida obesity query and BRFSS 2013: non-pregnant adults 20–79 years old

| | OneFlorida obesity query | | BRFSS 2013 (Florida) | | State of Florida[2] |
|---|---|---|---|---|---|
| | *N* | Percent | *N* | Percent[1] | Percent |
| Overall | 1,344,015 | | 28,519 | | |
| Sex | | | | | |
| Male | 595,000 | 44.3 | 11,644 | 50.1 | 48.9 |
| Female | 749,015 | 55.7 | 16,875 | 49.9 | 51.1 |
| Age categorization | | | | | |
| 20–39 | 362,904 | 27.0 | 4,590 | 32.5 | |
| 40–59 | 549,164 | 40.9 | 9,769 | 38.5 | |
| 60–79 | 431,947 | 32.1 | 14,160 | 29.0 | |
| Race–Ethnicity and sex | | | | | |
| **Non-Hispanic (NH) White** | **697,712** | **51.9** | **21,973** | **56.2** | **54.7** |
| M | 321,162 | 46.0 | 8,900 | 50.4 | |
| F | 376,550 | 54.0 | 13,073 | 49.6 | |
| **NH Black** | **263,400** | **19.6** | **2,479** | **13.4** | **15.3** |
| M | 110,902 | 42.1 | 890 | 49.3 | |
| F | 152,498 | 57.9 | 1,589 | 50.7 | |
| **NH Asian** | **20,083** | **1.5** | **257** | **1.3** | **2.7** |
| M | 8,182 | 40.7 | 141 | 55.2 | |
| F | 11,901 | 59.3 | 116 | 44.8 | |
| **NH American Indian/Alaskan** | **1,869** | **0.1** | **314** | **0.6** | **0.2** |
| M | 904 | 48.4 | 142 | 43.0 | |
| F | 965 | 51.6 | 172 | 57.0 | |
| **NH Hawaiian/ Pacific Islander** | **1,497** | **0.1** | **53** | **0.3** | **0.1** |
| M | 679 | 45.4 | 24 | 33.1 | |
| F | 818 | 54.6 | 29 | 66.9 | |
| **Hispanic** | **282,957** | **21.1** | **2,154** | **21.8** | **24.9** |
| M | 117,357 | 41.5 | 915 | 49.3 | |
| F | 165,600 | 58.5 | 1,239 | 50.7 | |
| **NH multiple race** | **1,269** | **0.1** | **428** | **1.0** | **1.9** |
| M | 555 | 43.7 | 200 | 41.9 | |
| F | 714 | 56.3 | 228 | 58.1 | |
| **Other, unknown, refused** | **75,228** | **5.6** | **861** | **5.4** | **0.3** |
| M | 35,259 | 46.9 | 432 | 54.5 | |
| F | 39,969 | 53.1 | 429 | 45.5 | |

*American Community Survey 1-year estimates*. Retrieved from *Census Reporter Profile page for Florida* <https://censusreporter.org/profiles/04000US12-florida/%3e>. This demographic profile is reflective of the state as a whole, and not subset to adults 20–79 years of age.

[1]Percentages are presented weighted.

[2]US Census Bureau (2016).

populated Dade and Broward counties and retirement destinations of Collier and Monroe counties. Large portions of these four counties encompass the Greater Florida Everglades Ecosystem, which is sparsely populated. Figure 2b,c highlights obesity rates by sex. Again, there is similarity in the geographic distribution of obesity rates between OneFlorida and BRFSS; however, these rates are consistently higher in OneFlorida. Female obesity rates were higher than male obesity rates in almost all subpopulations; this difference between males and females is most prominently observed in the northern portion of the state where rates are quite high on the county level. BRFSS does not show any counties with rates as high as 45%, whereas OneFlorida indicates multiple counties with rates well above 45%; this is especially true for female obesity. The Bland–Altman plot (Figure 3) summarizes the level of disagreement in county-level obesity rates; the magnitude of the difference in rates between the two data sources tends to increase for higher obesity rates.

## Discussion

This study characterized adult obesity in the third most populated state in the USA using a large-scale network of health-system data. Compared to BRFSS, OneFlorida adult obesity rates were higher: overall, by various demographic subgroups, and by county. This overall difference (nearly 10% higher, 37.1% vs. 27.8% in BRFSS) is significant from a clinical and public health perspective and has healthcare and policy implications. This study was limited to overall obesity rates among adults in order to compare to BRFSS, which does not survey children and does not report severe obesity rates at the county level. Future studies will explore obesity among Florida youth and examine severe obesity across the state.

In this study of adult obesity, the major difference between OneFlorida and BRFSS is the method of data collection. OneFlorida utilized measures of height and weight obtained during an in-person clinic or hospital encounter and extracted from the EHR. This presents a real advantage over self-reported height/weight in BRFSS, which research has demonstrated to be biased (11–13). It is unknown if a widely accepted correction for bias induced by using self-reported data exists. While EHR data integrity can be a concern, this was addressed in the OneFlorida analysis by classifying a patient as having obesity only if the patient had obesity on two separate encounters. Further, the CDRNs data integrity is strong, as there are high standards mandated for data characterization of the OneFlorida Data Trust, which then goes through rigorous testing before being approved by a separate entity (Patient-Centered Outcomes and Research Institute).

Others have performed a similar comparison of Massachusetts EHR data versus BRFSS and found no major differences in obesity rates (22.8% vs. 23.8%, respectively) (18). However, Massachusetts is a smaller state (population roughly a third the size of Florida) with less racial/ethnic diversity and whose residents have greater

**Table 2** Detailed demographic breakdown of obesity among adults (OneFlorida obesity query)

| | | Adults 20–79 years | | | 20–39 years | | | 40–59 years | | | 60–79 years | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *N* | Rate | 95 CI | *N* | Rate | 95 CI | *N* | Rate | 95 CI | *N* | Rate | 95 CI |
| Overall | | 1,344,015 | 37.1 | (37.1, 37.2) | 362,904 | 32.3 | (32.1, 32.4) | 549,164 | 41.6 | (41.5, 41.8) | 431,947 | 35.5 | (35.4, 35.7) |
| Sex | | | | | | | | | | | | | |
| Male | | 595,000 | 34.7 | (34.6, 34.9) | 159,913 | 28.9 | (28.7,29.1) | 234,617 | 40.1 | (39.9, 40.3) | 200,470 | 33.1 | (32.9, 33.3) |
| Female | | 749,015 | 39.0 | (38.9, 39.2) | 202,991 | 34.9 | (34.7, 35.1) | 314,547 | 42.8 | (42.6, 42.9) | 231,477 | 37.6 | (37.4, 37.8) |
| Race–Ethnicity | | | | | | | | | | | | | |
| Non-Hispanic (NH) White | | 697,712 | 35.2 | (35.1, 35.3) | 161,849 | 28.9 | (28.7, 29.2) | 271,330 | 39.2 | (39.0, 39.4) | 264,533 | 34.9 | (34.7, 35.0) |
| NH Black | | 263,400 | 45.7 | (45.5, 45.9) | 87,333 | 40.9 | (0.5, 41.2) | 112,615 | 51.4 | (51.1, 51.7) | 63,452 | 42.2 | (41.9, 42.6) |
| NH Asian | | 20,083 | 12.8 | (12.3, 13.2) | 6,144 | 13.4 | (12.5, 14.2) | 8,456 | 13.4 | (12.7, 14.1) | 5,483 | 11.1 | (10.3, 12.0) |
| NH American Indian/Alaskan | | 1,869 | 32.6 | (30.5, 34.7) | 480 | 25.4 | (21.5, 29.3) | 758 | 37.5 | (34.0, 40.9) | 631 | 32.2 | (28.5, 35.8) |
| NH Hawaiian/ Pacific Islander | | 1,497 | 30.3 | (27.9, 32.6) | 454 | 28.9 | (24.7, 33.0) | 627 | 34.3 | (30.6, 38.0) | 416 | 25.7 | (21.5, 29.9) |
| Hispanic | | 282,957 | 37.1 | (36.9, 37.3) | 83,624 | 32.5 | (32.2, 32.8) | 126,240 | 41.3 | (41.0, 41.6) | 73,093 | 35.0 | (34.7, 35.4) |
| NH multiple race | | 1,269 | 33.9 | (31.3, 36.5) | 536 | 31.5 | (37.6, 35.5) | 477 | 35.8 | (31.5, 40.2) | 256 | 35.2 | (29.3, 41.0) |
| Other, unknown, refused | | 75,228 | 32.4 | (32.1, 32.7) | 22,484 | 27.5 | (27.0, 28.1) | 28,661 | 36.1 | (35.5, 36.6) | 24,083 | 32.6 | (32.0, 33.2) |
| Race–Ethnicity and sex | | | | | | | | | | | | | |
| Non-Hispanic (NH) White | M | 321,162 | 35.1 | (34.9, 35.3) | 72,630 | 27.2 | (26.9, 27.6) | 121,458 | 40.1 | (39.8, 40.4) | 127,074 | 34.8 | (34.5, 35.0) |
| | F | 376,550 | 35.2 | (35.1, 35.4) | 89,219 | 30.3 | (30.0, 30.6) | 149,872 | 38.4 | (38.2, 38.7) | 137,459 | 34.9 | (34.7, 35.2) |
| NH Black | M | 110,902 | 34.3 | (34.0, 34.6) | 37,672 | 30.0 | (29.5, 30.5) | 46,293 | 40.4 | (40.0, 40.9) | 26,937 | 29.9 | (29.3, 30.4) |
| | F | 152,498 | 54.0 | (53.8, 54.3) | 49,661 | 49.1 | (48.7, 49.6) | 66,322 | 59.1 | (58.8, 59.5) | 36,515 | 51.4 | (50.8, 51.9) |
| NH Asian | M | 8,182 | 13.6 | (12.9, 14.4) | 2,597 | 15.4 | (14.0, 16.8) | 3,303 | 14.6 | (13.4, 15.8) | 2,282 | 10.2 | (90.0, 11.5) |
| | F | 11,901 | 12.2 | (11.6, 12.8) | 3,547 | 11.9 | (10.9, 13.0) | 5,153 | 12.7 | (11.8, 13.6) | 3,201 | 11.8 | (10.7, 12.9) |
| NH American Indian/Alaskan | M | 904 | 30.9 | (27.9, 33.9) | 214 | 23.4 | (17.7, 29.0) | 345 | 37.4 | (32.3, 42.5) | 345 | 29.0 | (24.2, 33.8) |
| | F | 965 | 34.2 | (31.2, 37.2) | 266 | 27.1 | (21.7, 32.4) | 413 | 37.5 | (32.9, 42.2) | 286 | 36.0 | (30.5, 41.6) |
| NH Hawaiian/ Pacific Islander | M | 679 | 30.0 | (26.6, 33.5) | 210 | 26.2 | (20.2, 32.1) | 276 | 36.6 | (30.9, 42.3) | 193 | 24.9 | (18.8, 31.0) |
| | F | 818 | 30.4 | (27.3, 33.6) | 244 | 31.1 | (25.3, 37.0) | 351 | 32.5 | (27.6, 37.4) | 223 | 26.5 | (20.7, 32.2) |
| Hispanic | M | 117,357 | 36.6 | (36.3, 36.9) | 36,317 | 32.8 | (32.3, 33.2) | 49,789 | 42.4 | (42.0, 42.8) | 31,251 | 31.8 | (31.3, 32.4) |
| | F | 165,600 | 37.4 | (37.2, 37.7) | 47,307 | 32.3 | (31.9, 32.8) | 76,451 | 40.6 | (40.3, 40.9) | 41,842 | 37.4 | (36.9, 37.9) |
| NH multiple race | M | 555 | 28.3 | (24.5, 32.0) | 234 | 26.5 | (20.8, 32.2) | 208 | 30.8 | (24.5, 37.0) | 113 | 27.4 | (19.2, 35.7) |
| | F | 714 | 38.2 | (34.7, 41.8) | 302 | 35.4 | (30.0, 40.8) | 269 | 39.8 | (33.9, 45.6) | 143 | 41.3 | (33.2, 49.3) |
| Other, unknown, refused | M | 35,259 | 31.9 | (31.4, 32.4) | 10,039 | 2.7 | (26.0, 27.7) | 12,945 | 36.6 | (35.8, 37.5) | 12,275 | 31.0 | (30.2, 31.8) |
| | F | 39,969 | 32.8 | (32.4, 33.3) | 12,445 | 28.1 | (27.3, 28.9) | 15,716 | 35.6 | (34.8, 36.3) | 11,808 | 34.2 | (33.3, 35.1) |

access to healthcare services (30,31). Given the results here show an increasing level of disagreement between EHR and BRFSS data as mean obesity rates increase, the lack of disagreement for the relatively low obesity rates in Massachusetts is not surprising. The differences between the two states highlights the need to study obesity rates using various data sources geographically.

Given that OneFlorida only includes healthcare users, results may not be generalizable to all of Florida. OneFlorida does encompass millions of healthcare users adults in Florida. According to the 2015 National Health Interview Survey, 82.8% of US adults have had contact with a doctor or healthcare professional within the last year (relative to the time of the survey); 91.1% of adults have had contact within the past 2 years (32). Among those areas served by OneFlorida health systems, OneFlorida should capture a sizeable proportion of the population. From a public health perspective, healthcare users are the most likely to benefit from interventions implemented within a healthcare system, and thus, the lack of generalizability to the entire population is not a limitation in all contexts.

From the perspective of outreach to the underserved, data were not available from those unable to access care

**Table 3** Detailed demographic breakdown of obesity among adults (BRFSS 2013)

| | | Adults 20–79 years | | | 20–39 years | | | 40–59 years | | | 60–79 years | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *N* | Rate | 95 CI | *N* | Rate | 95 CI | *N* | Rate | 95 CI | *N* | Rate | 95 CI |
| Overall | | 28,519 | 27.8 | (26.6, 28.9) | 4,590 | 23.1 | (21.0, 25.2) | 9,769 | 31.7 | (29.7, 33.7) | 14,160 | 27.8 | (26.2, 29.4) |
| Sex | | | | | | | | | | | | | |
| Male | | 11,644 | 28.8 | (27.1, 30.5) | 1,995 | 22.0 | (19.2, 24.8) | 4,043 | 35.9 | (32.8, 39.0) | 5,606 | 27.3 | (25.0, 29.7) |
| Female | | 16,875 | 26.7 | (25.2, 28.2) | 2,595 | 24.4 | (21.3, 27.5) | 5,726 | 27.4 | (24.8, 29.9) | 8,554 | 28.2 | (26.0, 30.4) |
| Race–Ethnicity | | | | | | | | | | | | | |
| Non-Hispanic (NH) White | | 21,973 | 26.5 | (25.4, 27.7) | 2,852 | 21.5 | (19.00, 23.9) | 7,163 | 29.3 | (27.2, 31.5) | 11,958 | 27.2 | (25.7, 28.7) |
| NH Black | | 2,479 | 35.2 | (31.3, 39.0) | 590 | 30.6 | (24.4, 36.7) | 985 | 41.9 | (35.6, 48.1) | 904 | 32.7 | (26.4, 39.0) |
| NH Asian | | 257 | 15.3 | (8.3, 22.3) | 98 | 17.2 | (5.1, 29.3) | 110 | 12.8 | (5.1, 20.4) | 49 | 17.6 | (0.0, 37.9) |
| NH American Indian/Alaskan | | 314 | 37.1 | (27.4, 46.8) | 41 | 23.2 | (5.3, 41.2) | 134 | 51.1 | (36.5, 65.8) | 139 | 28.7 | (15.3, 42.1) |
| NH Hawaiian/ Pacific Islander | | 53 | 27.0 | (6.9, 47.0) | 18 | 45.2 | (14.4, 76.0) | 24 | 6.0 | (0.0, 14.1) | 11 | 50.8 | (0.7, 100.0) |
| Hispanic | | 2,154 | 28.0 | (24.8, 31.2) | 702 | 21.5 | (16.9, 26.2) | 899 | 33.8 | (28.4, 39.3) | 553 | 29.4 | (22.4, 36.4) |
| NH multiple race | | 428 | 35.5 | (26.1, 44.9) | 86 | 38.4 | (22.4, 54.4) | 159 | 33.0 | (16.1, 49.9) | 183 | 34.1 | (19.0, 49.2) |
| Other, unknown, refused | | 861 | 21.8 | (16.6, 26.9) | 203 | 17.8 | (11.0, 24.6) | 295 | 26.9 | (17.2, 36.6) | 363 | 19.1 | (12.0, 26.1) |
| Race–Ethnicity and sex | | | | | | | | | | | | | |
| Non-Hispanic (NH) White | M | 8,900 | 28.9 | (27.1, 30.8) | 1206 | 21.8 | (18.3, 25.3) | 2960 | 33.9 | (30.5, 37.3) | 4734 | 28.8 | (26.5, 31.0) |
| | F | 13,073 | 24.1 | (22.7, 25.6) | 1646 | 21.1 | (17.7, 24.6) | 4203 | 24.4 | (21.9, 26.8) | 7224 | 25.8 | (23.9, 27.7) |
| NH Black | M | 890 | 30.3 | (24.7, 35.9) | 220 | 19.6 | (12.9, 26.4) | 349 | 44.1 | (34.3, 53.9) | 321 | 25.3 | (16.7, 34.0) |
| | F | 1,589 | 39.9 | (34.8, 45.0) | 370 | 40.8 | (31.8, 49.7) | 636 | 39.4 | (32.1, 46.7) | 583 | 38.9 | (30.0, 47.7) |
| NH Asian | M | 141 | 17.8 | (7.0, 28.6) | 55 | 22.6 | (4.0, 41.2) | 59 | 9.6 | (2.0, 17.1) | 27 | 26.0 | (0.0, 57.2) |
| | F | 116 | 12.3 | (4.6,20.0) | 43 | 9.7 | (0.2, 19.2) | 51 | 16.1 | (2.3, 29.9) | 22 | 5.8 | (0.0, 17.0) |
| NH American Indian/Alaskan | M | 142 | 35.8 | (23.2, 48.4) | 19 | 4.9 | (0.0, 12.1) | 74 | 51.3 | (32.8, 69.9) | 49 | 33.8 | (9.8, 57.9) |
| | F | 172 | 38.2 | (24.1, 52.3) | 22 | 36.7 | (6.8, 66.7) | 60 | 50.9 | (27.6, 74.1) | 90 | 26.9 | (11.4, 42.4) |
| NH Hawaiian/ Pacific Islander | M | 24 | 24.3 | (0.1, 48.5) | 8 | -- | (0.0, 80.0) | 13 | 11.9 | (0.0, 30.3) | 3 | -- | (0.0, 100.0) |
| | F | 29 | 28.3 | (0.8, 55.7) | 10 | -- | (14.9, 92.5) | 11 | 2.9 | (0.0, 8.9) | 8 | -- | (0.0, 100.0) |
| Hispanic | M | 915 | 29.8 | (25.1, 34.6) | 337 | 24.7 | (18.1, 31.3) | 371 | 39.2 | (30.8, 47.6) | 207 | 23.0 | (13.4, 32.5) |
| | F | 1,239 | 26.2 | (21.9, 30.6) | 365 | 17.6 | (11.3, 23.9) | 528 | 29.2 | (22.1, 36.3) | 346 | 34.3 | (24.7, 43.8) |
| NH multiple race | M | 200 | 40.2 | (26.8, 53.6) | 35 | 54.1 | (31.8, 76.3) | 82 | 27.6 | (9.9, 45.3) | 83 | 34.2 | (10.0, 58.5) |
| | F | 228 | 32.1 | (19.2, 45.1) | 51 | 27.4 | (7.1, 47.7) | 77 | 36.8 | (11.6, 61.9) | 100 | 34.0 | (14.8, 53.3) |
| Other, unknown, refused | M | 432 | 21.7 | (14.7, 28.7) | 115 | 14.2 | (6.1, 22.3) | 135 | 31.9 | (17.8, 45.9) | 182 | 19.1 | (9.6, 28.6) |
| | F | 429 | 21.8 | (14.3, 29.4) | 88 | 23.1 | (11.7, 34.6) | 160 | 22.0 | (8.8, 35.3) | 181 | 19.1 | (8.5, 29.6) |

and from those persons with strictly Medicaid claims-only records. However, Medicaid members who sought care at OneFlorida-associated health clinics and who had height/weight EHR data were included in this study. Individuals who have obesity may access healthcare differently than those who do not have obesity, with research showing both greater (33,34) as well as less (35–37) utilization of care, which could potentially bias OneFlorida obesity estimates in either direction. Despite its limitations, the size and reach of OneFlorida allows for relatively precise characterizations of a sizable population in Florida. Further, the fact that EHR data from OneFlorida is available in nearly real-time is a major advantage from the perspective of both surveillance and the ability to monitor changes over short time periods at the group and patient level (20).

OneFlorida has much higher penetration over some regions of the state than others. Not all health systems in the state contribute data to the consortium at this time, and not all adults have sought healthcare during the study period. However, even in Florida's least-populated counties, OneFlorida frequencies are still on the scale of

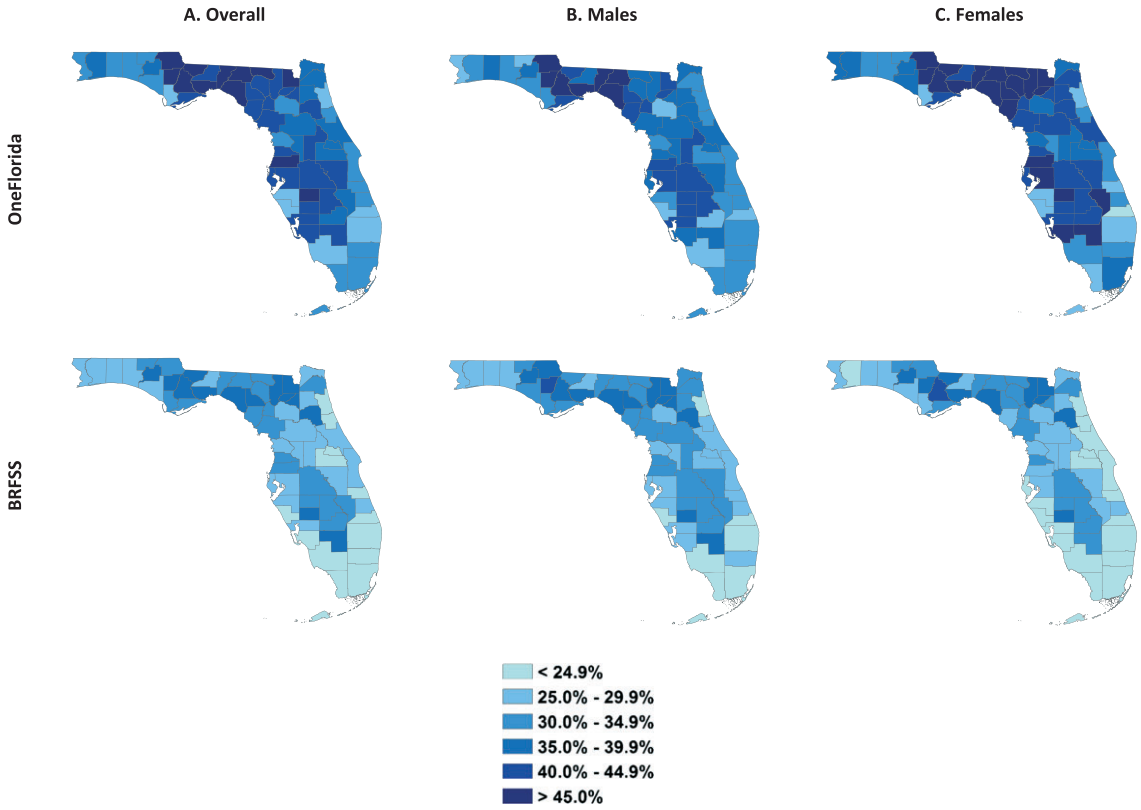


**Figure 2** County obesity rates among adults, OneFlorida and 2013 BRFSS (overall and by sex).

hundreds at a minimum and are considerably greater than those from national sampling efforts such as BRFSS, which uses spatial analyses to estimate county-level rates due to small sample sizes.

Both national surveillance systems such as BRFSS as well as 'big data' EHR options have advantages and limitations. This study presents a detailed perspective on obesity among adult healthcare users in Florida. Among this sizeable population, knowledge that obesity rates are considerably higher than previous estimates is important for healthcare administrators and public health practitioners when targeting obesity in this population.

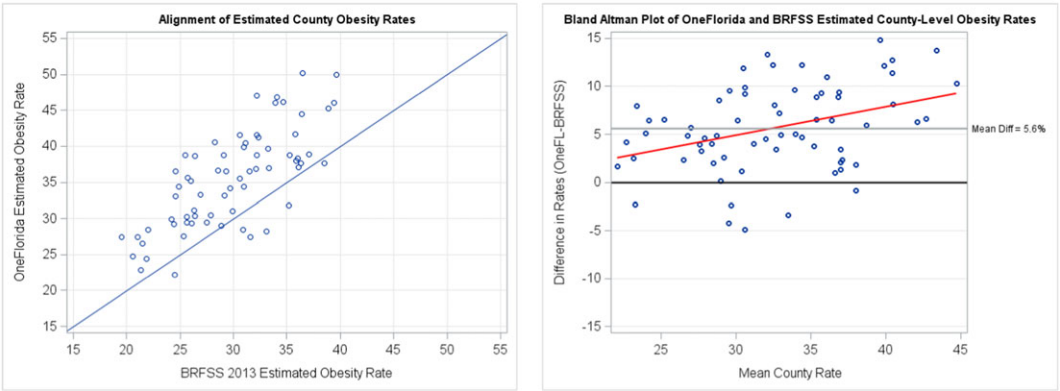


**Figure 3** Agreement of county adult obesity rate estimates – OneFlorida versus BRFSS. The left panel is a scatter plot of BRFSS county obesity rates versus OneFlorida county obesity rates. The right panel is a Bland–Altman plot of the difference in county rates versus mean county obesity rates between the two data sources (mean difference = 5.6%).

Utilization of EHR data from a large health system network can be feasible in characterizing and monitoring obesity rates. A CDRN, thus, has the ability to be a powerful surveillance tool for obesity and potentially other chronic conditions.

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## Conflict of Interest Statement

No conflict of interest was declared.

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