Data Resources for Conducting Patient-Centered Outcomes Research at Federally Qualified Health Centers: The National Ambulatory Medical Care Survey

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Abstract

Background: Federally qualified health centers and look-alikes are outpatient care settings that provide primary care and other health services in health professional shortage areas and to their populations. Compiling and disseminating data from these centers that is accessible for patient-centered outcomes research (PCOR) is critical to understanding healthcare provided at these settings.

Objective: To describe the National Ambulatory Medical Care Survey Health Center (NAMCS HC) Component, and how this redesigned survey can be utilized to understand healthcare provided at health centers, improve data capacity, and facilitate PCOR.

Methods: Beginning in 2021, the NAMCS HC Component began collecting visit data through electronic health record (EHR) submission from a nationally representative sample of FQHCs and FQHC look-alikes. Resulting datasets are made available for researchers to analyze, used to produce readily available interactive data visualizations, and linked to external datasets.

Results: The NAMCS HC Component and its resulting data resources are described. Availability of restricted and public datafiles is highlighted, with an example of how these can be used to study visits across different patient characteristics. Interactive dashboards are presented, including how researchers, health centers, and patients can view biannual preliminary visit rates/counts. Finally, linkages between the NAMCS HC Component and external data sources are highlighted, including how these linkages can be used to study health outcomes among different populations.

Conclusions: EHR data collected from FQHCs and look-alikes through the redesigned NAMCS HC Component fills a gap to improve PCOR capacity at these unique settings.

Keywords

Data linkage; FQHC look-alikes; mental health; maternal health

Federally qualified health centers (FQHCs) and FQHC look-alikes (i.e., health centers meeting all Health Resources and Services Administration [HRSA] Health Center Program requirements but not receiving Program funding) are community-based healthcare settings that provide primary care and other health services in health professional shortage areas (HPSAs) and to their populations.[1–3] FQHCs and look-alikes are important sources of healthcare in HPSAs, serve to mitigate differences in health outcomes,[4–6] and allow access to quality healthcare which contributes to reduction in health differences.[7–10] In 2023, FQHCs served 31.3 million patients in the United States.[11] Patients who use FQHCs may differ from the U.S. population; for example, in 2023 67.3% of FQHC patients were in poverty[11] compared to 11.1% of the U.S population.[12]

Because of the uniqueness of populations served by FQHCs and look-alikes, having data to examine the healthcare provided at these settings is critical to understanding their role in achieving improved health across the United States. HRSA oversees and monitors the Health Center Program and currently has a reporting system called the Uniform Data System (UDS) that requires FQHCs and look-alikes to report on selected patient characteristics, services provided, health outcomes, and center staffing.[13] This system is currently expanding to include more patient-level measures.[14] Although the UDS has been an important source of data, the National Ambulatory Medical Care Survey (NAMCS) provides *visit-level* data that can facilitate detailed patient-centered outcomes research (PCOR). In 2021 the NAMCS component that collected data from health centers was redesigned and began collecting all visits from participating health centers for the entire calendar year via electronic health record (EHR) submission. This has led to additional data resources for researchers, healthcare providers, and patients to understand not only what types of care are provided at health centers, but also to explore potential differences that may exist in provision of this care.

This manuscript aims to describe the NAMCS HC Component and how it provides data resources that can be utilized to understand healthcare provided at FQHCs and look-alikes. To demonstrate its ability to facilitate enhanced data capacity for studying PCOR, three empirical examples highlighting the utility of the NAMCS HC Component are provided: (1) visit-level datafiles, (2) interactive data visualizations, and (3) linkage to external data sources.

METHODOLOGY

The NAMCS HC Component is a nationally representative establishment survey that collects data on ambulatory medical care visits to FQHCs and FQHC look-alikes (henceforth, collectively referred to as health centers) throughout the 50 U.S. states and District of Columbia. The NAMCS HC Component collects EHR visit data on patient characteristics, medical diagnoses and procedures, lab tests and results, and medications. In addition, patient personally identifiable information (PII) is also collected, which allows for linkage to external datasets to expand its analytic capabilities. Its 2021 sampling frame was approximately 1,400 health centers, where a primary sample of 50 health centers was drawn, along with a reserve sample of 100 centers. If one of the 50 centers in the primary sample declined or was unable to participate, a similar center from the reserve sample was then

contacted for participation. Participating health centers were eligible for a one-time, set-up fee to reimburse for any costs of participation.[15] This yielded 29 health centers participating in the 2021 NAMCS HC Component. In 2022, new primary and reserve samples were drawn from which new health centers were recruited. In addition, health centers first participating in 2021 were asked to continue and submit data for 2022. A similar sampling strategy for the survey has continued in proceeding years, yielding over 9 million visits from 95 participating centers in 2023 (Table 1). Additional details on NAMCS HC Component methodology are available elsewhere.[16–18]

Data collection for the NAMCS HC Component occurs in four steps.[15] First, sampled health centers are contacted by the National Center for Health Statistics (NCHS) to gain agreement to participate. If agreeable, the participating center answers a ~45-minute questionnaire with responses used to calculate survey weights that can generate national estimates of health center visits. Next, NCHS works with the health center (and their EHR vendor), to install the HL7 CDA R2 Implementation Guide: National Health Care Surveys, Release 1, DSTU Release 1.2,[19] a "template" for EHR systems that allows a center to submit the data requested for the survey. A testing and validation (T&V) file is then submitted by the health center for basic quality assessment and to ensure the EHR data meet survey requirements. Finally, upon successfully passing T&V, EHR datafiles are then submitted to NCHS, where each record is a single medical encounter. Further details on data collection and other methodological considerations of the NAMCS HC Component are available elsewhere (See Appendix).

DATA RESOURCES FOR PCOR

Visit-level Datafiles

Data from the NAMCS HC Component are made publicly available to researchers. The survey does not focus on surveillance of visits for a specific medical condition or type of care, thus its nationally representative data can be used by researchers to explore and examine any healthcare research topic of their own interest from chronic conditions such as asthma and diabetes, to mental health, substance use, and more.[20]

NAMCS HC Component data are released annually, and each year two different versions of the datafile are available. The first is a restricted use datafile containing millions of records from all participating health centers (Table 1),[21–23] as well as a full set of data elements. These files can be accessed by individuals for their own research through the NCHS Research Data Center (https://www.cdc.gov/rdc/index.html); however, researchers must submit an application and provide a fee for their use. To further enhance accessibility, in 2022 a public use version of the datafile was released. This version contains 5% of total records collected, with weights developed that allow users to generate nationally representative estimates of visits to health centers (methodology of the creation of the 5% sample is detailed elsewhere[18]). Unlike the restricted NAMCS HC Component files, these 5% public use files are accessible with no fee and prevent need for a large amount of computing power being a barrier to PCOR researchers who wish to use these data. These files can be download directly from: https://www.cdc.gov/nchs/namcs/documentation/

index.html. Details on data elements available in these files and accessing restricted datafiles are in the Appendix and Table A1.

To highlight use of these datafiles, 2023 NAMCS HC Component restricted data were used to examine maternal health visits and visits with gestational diabetes to health centers by patient's age. This example was selected given differences in severe maternal morbidity[24–26] and mortality,[27–29] as well as association of gestational diabetes,[30,31] with maternal age. The rate for maternal health visits was significantly higher among women 20–29 (134.6 visits per 1,000 females) and 30–39 (101.0) years compared to women 12–19 (29.7) and 40–55 (20.3) years (Table 2). Among these visits, when examining those with a diagnosis of gestational diabetes, there was a significantly higher rate among visits by women 20–29 (2.6), 30–39 (4.3), and 40–55 (0.8) years compared to those 12–19 (0.1) years. There was also a lower rate of visits by women 40–55 years compared to those by women 20–29 and 30–39 years.

Interactive Data Visualizations

The NAMCS HC Component visit-level datafiles may be used for research on specific topics and to inform evidence-based decision making by patients, families, clinicians, and policymakers.[32] As these stakeholders may not have the statistical knowledge needed to use microdata files, aggregate estimates from the NAMCS HC Component have been placed in an interactive data visualization, or "dashboard" (https://www.cdc.gov/nchs/dhcs/prelim-hc-visits/index.htm) (Figure 1).[33] This makes nationally representative, biannual preliminary estimates of visits to health centers available, prior to the datafiles being released. Users can navigate interactive drop-down menus to examine diagnoses/conditions and other health outcome differences across patient characteristics. Corresponding data tables contain counts, rates, and measures of variance that can be downloaded from the dashboard. With timely updates and no programming knowledge needed to generate estimates, this dashboard further enhances user accessibility for PCOR.

The following empirical example uses the NAMCS HC Component dashboard to examine differences in rates for health center visits with diagnosis of lung/breathing-related disease by race/ethnicity in the United States from January 2022-June 2024 (Table 3). This topic was selected as respiratory health differences by racial/ethnic groups have long been documented,[34–36] and certain racial/ethnic groups may experience difficulties with management of respiratory disease[37] and complications surrounding the task of addressing respiratory health problems.[38]

Using preliminary estimates from the NAMCS HC Component dashboard, there was a rate of 18.0 visits (per 1,000 people) to health centers with a diagnosis of lung/breathing-related disease in January-June 2022, and a rate of 23.9 visits in January-June 2024 (difference not significant). In July-December 2022 the rate for visits to health centers with a diagnosis of lung/breathing-related disease among non-Hispanic White people (12.2) was significantly lower than for Hispanic people (26.8). This difference remained in January-June 2023 (12.9 vs. 28.5, respectively). In July-December 2023, the rate for visits to health centers with a diagnosis of lung/breathing-related disease was significantly lower among non-Hispanic White people (10.3) compared to Hispanic people (27.0), and non-Hispanic Black people (24.1). These same differences were also found in January-June 2024. For each

racial/ethnicity group, the highest observed rate was in January-June 2024. This example shows how not only researchers but patients, clinicians, and others can conduct their own interactive PCOR using this dashboard.

Linkage to External Data Sources

The NAMCS HC Component facilitates additional PCOR as it allows for linkage to external data sources. An example of this is linkage at the patient-level of 2021 NAMCS HC Component data with 2020–2022 housing assistance program data from the U.S. Department of Housing and Urban Development (HUD). Through this linkage, the resulting data resource can support public health research and policy evaluation studies focused on housing assistance program participation and its relation to health outcomes.

Linkage of the NAMCS HC Component and HUD data focuses on HUD's three largest housing assistance programs: Housing Choice Vouchers (HCV), Public Housing (PH), and assisted Multifamily (MF) programs. The HCV program is the largest program, allowing families with lower incomes, older adults, and persons with disabilities to choose/lease safe and affordable housing on the private market. The PH program provides safe housing through assigning eligible low-income families, elderly, and persons with disabilities to specific, subsidized units, buildings, or developments. The MF program encompasses several HUD programs where subsidies are paid directly to private property owners who provide a percentage of their housing units at affordable rates for qualifying low-income persons. A summary of specific HUD programs, and their relation to the NAMCS HC Component, is provided elsewhere.[39]

Linkage was attempted only for NAMCS HC Component patient records that met linkage eligibility criteria. Linkage eligibility is distinct from HUD program eligibility and includes presence of at least two of three valid identifiers on the patient record: social security number, date of birth (month, day, and year), and name (first, middle initial, and last). Nearly all patients in the 2021 NAMCS HC Component (i.e., 726,384, or 99.9%) were eligible for linkage with HUD data. This high level of linkage eligibility was consistent across non-missing patient age group and sex categories suggesting minimal bias in linkage eligibility. Linkage was conducted using both deterministic and probabilistic approaches. For the probabilistic linkage process, scoring was conducted according to Fellegi-Sunter methodology.[40]

Table 4 presents total number of 2021 NAMCS HC Component patients by age and sex, number eligible for linkage, number linked to HUD program data, and percentage of all patients and those eligible for linkage who were linked to HUD data. A total of 3.6% of the 2021 NAMCS HC Component linkage-eligible patients linked to HUD data, indicating that they had a record in the HUD administrative datafiles between 2020–2022. Regarding patient's age, 4.4% of those 0–17, 3.0% of those 18–44, 3.1% of those 45–64, and 4.7% of those 65 who were linkage-eligible linked to HUD data. As for sex, 2.9% of linkage-eligible males and 4.1% of linkage-eligible females linked to HUD data. These linked HUD datafiles, as well as further linkages to the NAMCS HC Component, can allow for researchers to perform additional PCOR that may not be otherwise facilitated by any one

data source alone. Access to these restricted linked files can be requested through the NCHS Research Data Center (https://www.cdc.gov/rdc/index.html).

DISCUSSION

FQHCs and look-alikes have a unique role as community-based settings that provide services to persons living in HPSAs.[1–3] With its 2021 redesign, the NAMCS HC Component now provides novel and accessible data resources on health center visits to health researchers, as well as patients, families, clinicians, and policymakers. Restricted and public use datafiles allow multiple options for researchers to use visit-level data and conduct their own PCOR on a variety of healthcare topics by various patient characteristics. The NAMCS HC Component has also been used to create interactive data visualizations that are readily accessible by anyone to display nationally representative preliminary estimates of visits to health centers. Finally, with collection of PII, the NAMCS HC Component also has ability to link to external data sources further enhancing its analytic utility. These linkages allow additional data important to understanding health differences[41,42] to be used in further studying healthcare provided at these centers.

Some limitations of the NAMCS HC Component exist. First, although a primary/reserve sampling strategy[16] and a set-up fee[15] are used to maximize the response rate, it remains lower than desired (e.g., 42.2% year-specific response rate and 30.2% overall rate in 2023).[18,23] However, retention of recruited centers remains high (98.4% in 2023),[18,23] and a new sample each year continues to increase the number of participating centers. Second, not all data elements collected from EHRs are readily-available in the NAMCS HC Component public use files. However, exploration of adding additional data elements (e.g., lab tests ordered/performed) to future years' public use files, as well as integrating additional health topics into data visualizations, is underway. Third, EHR data from some health centers also has missingness for certain data elements. Normalization techniques can be used to address this (see Appendix). Finally, linkage to external data sources is currently only available for the 2021 NAMCS HC Component.

Even with limitations, the NAMCS HC Component resulted in a new resource for conducting PCOR, with plans to continue expanding its data capacity. Annual data collection is ongoing, and 2024 restricted and public use datafiles are forthcoming. In addition, exploration of including additional data elements on these public use files is underway. Data visualization modules on mental and respiratory health were recently added to the survey's dashboard, and timeliness of preliminary estimates has improved, such that these estimates are available within six months of a visit occurring. Finally, additional data linkages are scheduled. Linkage of the 2021 NAMCS HC Component to the 2021–2022 National Death Index[43] and 2020–2022 HUD administrative data[39] are complete and linkage of NAMCS to the 2020–2021 Transformed Medicaid Statistical Information System is underway. With these future plans, not only will the NAMCS HC Component continue to provide data for studying PCOR at FQHCs and look-alikes, but its accessibility and expanding infrastructure will allow it to be a reliable resource in future years.

Figure 1 is a visual example from the *Preliminary Estimates of Visits to Health Centers in the United States* Interactive Dashboard, displaying the visit rate (per 1,000 people) of health center visits for lung/breathing-related diseases, by race/ethnicity.

APPENDIX.: ADDITIONAL DETAILS AND INFORMATION ON THE NAMCS HC COMPONENT

Data Elements in the NAMCS HC Component Restricted and Public Use Datafiles

As detailed in the main text of the manuscript, in 2022 the National Ambulatory Medical Care Survey Health Center (NAMCS HC) Component begun having public use datafiles made available in addition to its restricted files. Details on the number of health centers participating and the number of visit records available for analyses in the NAMCS HC Component restricted and public use data files are listed in Table 1. The public use versions of the NAMCS HC Component datafiles differ from the restricted files as they: (a) contain 5% of the total number of health center records collected and include public use versions of the weights that allow these data to be used for generating nationally representative estimates of visits to health centers, (b) are accessible with no fee, and (c) prevent the need for a large amount computing power being a barrier to researchers when analyzing these data. However, there are also differences in the specific variables included in these datafiles. The restricted use files have more variables available to researchers than the public use files, with the main reason of exclusion of variables from the public use files being related to confidentiality. To help researchers know when they should request the restricted data as opposed to using the public use data, Table A1 (located at the end of this Appendix) provides a list of the types of variables available in each of these versions of the NAMCS HC Component data files.

Accessing Restricted Data Files and Confidentiality

All data for the NAMCS HC Component and its collection adhere to Section 308(d) of the Public Health Service Act and the Confidential Information Protection and Statistical Efficiency Act of 2018. In addition, the Health Insurance Portability and Accountability Act

(HIPAA) of 1996 allows providers to participate in the NAMCS HC Component for public health purposes. More details can be found here: https://www.cdc.gov/nchs/namcs-health-center/about/privacy-and-confidentiality.html.

As noted in the manuscript, NAMCS HC Component restricted datafiles can only be accessed through the National Center for Health Statistics' Research Data Center (RDC). Personally identifiable information collected as part of the NAMCS HC Component is *never* permitted to be accessed by data users. Part of the formal application process to access NAMCS HC Component restricted datafiles in the RDC is a standardized review to ensure all appropriate confidentiality standards will be followed by the applicant if data access is granted. Details on this RDC application process can be found here: https://www.cdc.gov/rdc/index.html.

Note on Technical Resources Available for the NAMCS HC Component

The discussion of the NAMCS HC Component in the main text of his manuscript is intended to increase awareness of the survey, how it can be utilized to understand healthcare provided at FQHCs and look-alikes, and how it can serve as a data resource for patient-centered outcomes research (PCOR). It was beyond the scope of this manuscript to elaborate in detail the considerations and technical aspects of the data resulting from this survey; however, there are resources available that provide this information, and are helpful when using the data to conduct one's own PCOR. For researchers interested in using the NAMCS HC Component visit-level datafiles, previously published reports and manuscripts provide more in-depth details on the sampling,[1] methodology,[1] data collection,[2] survey content of the restricted[3–5] and public use[6,7] files, and analytical considerations.[3–7] Furthermore, technical documentation on data linkage methodology, eligibility, and analytic considerations is also available to researchers for linkage of the NAMCS HC Component to the National Death Index[8] and U.S. Housing and Urban Development administrative data.[9] As additional external data sources are linked to the NAMCS HC Component, it is expected that similar technical documentation will be made available specific to the external dataset. Finally, for those families, clinicians, policymakers, and others who use the interactive data visualizations, these are accompanied by definitions of all health outcomes and patient characteristics, as well as technical notes on the preliminary data, which can all be reviewed to better understand the interactive statistics generated when using these visualizations.[10]

Data Missingness and Weight Normalization

For some of the health centers participating in the NAMCS HC Component, there are instances when data for certain elements may be missing, such as race/ethnicity or even diagnosis.[11] In these instances when a health center in the NAMCS HC Component has complete missingness for a specific variable, they may not be able to be included in a researcher's analysis. As a result, the National Center for Health Statistics suggests the approach to address this and account for this missingness is to normalize the weights used with the remaining health centers, which allows the sum of weights of visits in the analysis to equal the sum of weights of all visits.[3–7] This is performed using the following formula:

$$New\ weight = Original\ weight*(\frac{Sum\ of\ weights\ at\ all\ visits}{Sum\ of\ weights\ at\ included\ visits})$$

TABLE A1.

Types of Data Elements Available in the National Ambulatory Medical Care Survey Health Center Component Restricted and Public Use Datafiles

Type of Data Element Available	Restricted Use Datafile	Public Use Datafile
Day/month of visit	Yes	Yes
Time of visit	Yes	No
Patient's age	Yes	Yes
Patient's sex	Yes	Yes
Patient's race/ethnicity	Yes	Yes
Patient's marital status	Yes	Yes
Diagnoses (ICD-10-CM)	Yes	Yes
Medical procedures	Yes	No
Laboratory tests	Yes	No
Biometric/vitals	Yes	No
Medication	Yes	No
Medication status	Yes	No
Pregnancy status	Yes	No
Survey stratum	Yes	Yes
Survey weight	Yes	Yes

Note: For each type of data element, there may be more than one specific variable included in the data file. For example, for diagnosis there are 30 data variables available for researchers in the public use data file, with even more variables available in the restricted use file. A list of specific variables found in the restricted and public use datafiles can be found here: https://www.cdc.gov/nchs/namcs/documentation/index.html.

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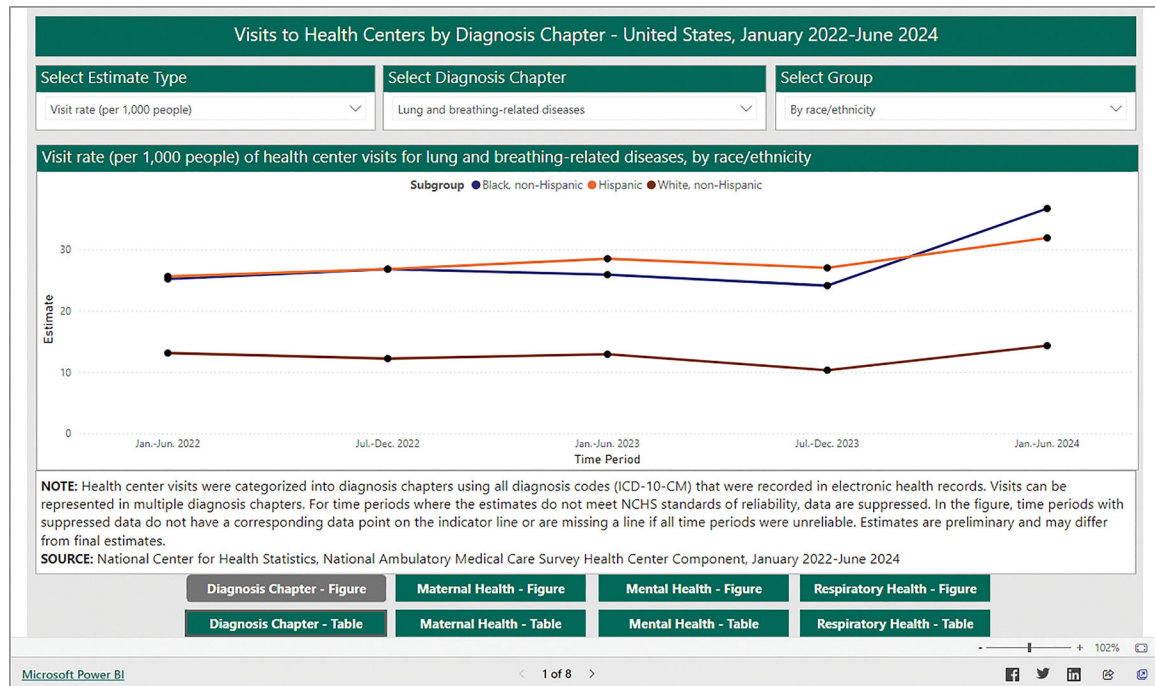
FIGURE 1.

Visit Rate (per 1,000 People) of Health Center Visits for Lung/breathing-related Diseases, by Race/Ethnicity: Visual Example from the *Preliminary Estimates of Visits to Health Centers in the United States* Interactive Dashboard, Accessed January 8, 2025 at: https://www.cdc.gov/nchs/dhcs/prelim-hc-visits/index.htm.

TABLE 1.

National Ambulatory Medical Care Survey Health Center Component Restricted and Public Use Datafiles, Counts of Participating Health Centers and Visit Records

	Restricted Use Datafile				Public Use Datafile			
	# of Health Centers				# of Health Centers			
	NR	PYP	Total	# of Visits	NR	PYP	Total	# of Visits
2021	29	n/a	29	3,543,927	n/a	n/a	n/a	n/a
2022	38	26	64	5,640,370	38	26	64	282,017
2023	32	63	95	9,012,885	32	63	95	450,645

Notes: NR=newly recruited; PYP=previous year participant; n/a=not available. Public use datafiles, which contain a random sample of 5% of visits from the restricted use datafile, were first made available with the 2022 data. In 2023, of the 32 newly recruited health centers, 5 were first contacted in prior years but did not provide data in 2022.

Data source: National Center for Health Statistics, National Ambulatory Medical Care Survey Health Center Component, 2021–2023, restricted and public use datafiles.

TABLE 2.

Rates (per 1,000 Women) of Maternal Health Visits to Health Centers and Visits to Health Centers with a Diagnosis of Gestational Diabetes, by Age Group: United States, 2023

Age Group (yrs.)	Maternal Health Visits		Visits with Diagnosis of Gestational Diabetes	
	Visit Rate (per 1,000)	95% CI	Visit Rate (per 1,000)	95% CI
12–19	29.7 *b,c*	(21.4–41.4)	0.1 *b,c,d*	(<0.1–0.1)
20–29	134.6 *a,d*	(94.3–192.2)	2.6 *a,d*	(1.8–3.7)
30–39	101.0 *a,d*	(74.1–137.8)	4.3 *a,d*	(3.0–6.2)
40–55	20.3 *b,c*	(15.4–26.8)	0.8 *a,b,c*	(0.5–1.3)

[a]Significantly different from ages 12–19 yrs.

[b]Significantly different from ages 20–29 yrs.

[c]Significantly different from ages 30–39 yrs.

[d]Significantly different from ages 40–55 yrs.

Notes: Rates are calculated by dividing the number of health center visits by estimates of the U.S. civilian noninstitutionalized population of women in 2023 (obtained from the U.S. Census Bureau's Population Division) for the age group (12–55 years) of interest. These rates are among all women, not just those who are pregnant. Maternal health visits are identified by the following *ICD-10-CM* codes: O00-O92, Z3A, Z30-Z34, Z36, Z37, and/or Z39. Visits with gestational diabetes are identified as visits with an *ICD-10-CM* code of O244.

Data source: National Center for Health Statistics, National Ambulatory Medical Care Survey Health Center Component, 2023, restricted use datafile.

TABLE 3.

Preliminary Biannual Rates (per 1,000 People) for Lung/Breathing-related Disease Visits to Health Centers, by Race/Ethnicity: United States, January 2022-June 2024

Race/Ethnicity	Jan.-Jun. 2022		Jul.-Dec. 2022		Jan.-Jun. 2023		Jul.-Dec. 2023		Jan.-Jun. 2024	
	Visit Rate (per 1,000)	95% CI	Visit Rate (per 1,000)	95% CI	Visit Rate (per 1,000)	95% CI	Visit Rate (per 1,000)	95% CI	Visit Rate (per 1,000)	95% CI
Black, non-Hispanic	25.2	8.7–41.6	26.8	10–43.6	25.9	10.7–41.1	24.1 [a]	12.4–35.9	36.8 [a]	18.7–54.8
Hispanic	25.6	11.9–39.2	26.8 [a]	13.4–40.2	28.5 [a]	15.3–41.7	27.0 [a]	17.8–36.2	31.9 [a]	20.4–43.5
White, non-Hispanic	13.1	7.3–18.9	12.2 [b]	7.1–17.4	12.9 [b]	7.9–18	10.3 [b,c]	6.1–14.4	14.3 [b,c]	8.1–20.4
All visits	18.0	11.6–24.5	17.8	11.7–24	18.5	12.5–24.6	19.6	13.4–25.8	23.9	16.1–31.7

[a] Significantly different from White, non-Hispanic.

[b] Significantly different from Hispanic.

[c] Significantly different from Black, non-Hispanic.

Notes: Rates are calculated by dividing the number of health center visits by estimates of the U.S. civilian noninstitutionalized population from the year prior (obtained from the U.S. Census Bureau's Population Division) for the race/ethnicity group of interest. Lung/breathing-related disease visits are defined as any visit in which had one or more *ICD-10-CM* diagnosis codes of J00-J99, U070, U071, and U099. Two-tailed significance tests (p<.05) were conducted to test for differences between racial/ethnic groups.

TABLE 4.

Linked 2021 National Ambulatory Medical Care Survey Health Center (NAMCS HC) Component and 2020–2022 U.S. Housing and Urban Development (HUD) Administrative Records: Sample Sizes and Linkage Rates, by Age and Sex

2021 NAMCS HC Component	Sample Size			Percentage Linked
	Total Sample	Eligible for Linkage [a]	Linked to 2020–2022 HUD Administrative Data [b]	Eligible Sample [c]
Age (in years) [d]				
0–17	185,969	185,968	8,253	4.4
18–44	271,315	271,312	8,169	3.0
45–64	184,080	184,080	5,712	3.1
65 and over	85,020	85,019	3,994	4.7
Not calculated	848	5	0	0.0
Total	727,232	726,384	26,128	3.6
Sex				
Male	309,817	309,815	8,951	2.9
Female	414,112	414,109	17,128	4.1
Missing	3,303	2,460	49	2.0
Total	727,232	726,384	26,128	3.6

[a] Eligibility for linkage is based upon having sufficient personally identifiable information in at least two of three valid data elements: social security number, name, and date of birth.

[b] This group includes linkage-eligible patients who linked to HUD enrollment database at any time during the linkage interval (2020–2022).

[c] This percentage is calculated by dividing the number of linked patients by the total number of linkage-eligible patients.

[d] Age is as of final health center visit (date of last known contact) and calculated by subtracting patient date of birth (DOB) from the final visit date. If more than one DOB was present, the minimum of the non-missing DOB was selected.

Source: https://www.cdc.gov/nchs/data/datalinkage/NAMCS-HC-HUD-Methodology-Analytic-Considerations.pdf