

LEVERAGING SYNDROMIC SURVEILLANCE EMERGENCY DEPARTMENT VISIT
DATA FOR LOCAL CHRONIC DISEASE AND MENTAL HEALTH SURVEILLANCE

Amy Irving Ising

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Approved by:

Leah Frerichs

Anna Waller

David Gotz

Kristen Hassmiller Lich

Matthew Scholer

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ABSTRACT

Amy Irving Ising: Leveraging Syndromic Surveillance Emergency Department Visit Data for Local Chronic Disease and Mental Health Surveillance
(Under the direction of Leah Frerichs and Anna Waller)

Local health departments (LHDs) need timely, county level and sub-county level data to monitor health-related trends, identify health disparities, and inform areas of highest need for interventions as part of their ongoing assessment responsibilities, yet many health departments rely on secondary data that are not timely and cannot provide subcounty insights. In this research, we conducted a content analysis of the 100 most recent North Carolina local health department community health assessments to quantify the secondary data sources used to document local chronic disease and mental health burden, compared the data sources identified to syndromic surveillance emergency department (ED) visit data from NC DETECT, and developed and evaluated mental health and asthma and COPD dashboards featuring NC DETECT ED visit data.

We found that death certificate data, hospital inpatient data, data on disease prevalence among Medicare recipients, County Health Rankings (CHR) data, and data from the Behavioral Risk Factor Surveillance System (BRFSS) were the most frequently used secondary data sources to measure chronic diseases (excluding cancer) and mental health. Correlations are low when comparing county level NC DETECT ED visit data to death certificate data, Medicare data and CHR data for select mental health conditions, asthma, and COPD, but stronger when comparing overall county level ED visit rates to CHR health outcomes rankings. The Web-based public-

facing dashboards we built for select mental health conditions, asthma, and COPD to provide LHDs with easier access to annual ED visit trends scored well on usability surveys. More research is needed to identify best practices in disseminating multi-year syndromic surveillance ED visit data on mental health and chronic diseases to LHDs.

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LIST OF ABBREVIATIONS

AHRQ	Agency for Healthcare Research and Quality
BRFSS	Behavioral Risk Factor Surveillance System
CDC	Centers for Disease Control and Prevention
CHA	community health assessment
CHR	County Health Rankings
CKD	chronic kidney disease
CLRD	chronic lower respiratory disease
CMS	Centers for Medicare & Medicaid Services
COPD	chronic obstructive pulmonary disease
CSTE	Council of State and Territorial Epidemiologists
ED	emergency department
EMT-P	Emergency Medical Text Processor
FHLI	Foundation for Health Leadership and Innovation
ICD-10-CM	International Classification of Diseases, Clinical Modification, 10 th Revision
LHD	local health department
LINC	Log Into North Carolina
NC	North Carolina
NC DETECT	North Carolina Disease Event Tracking and Epidemiologic Collection Tool
NSSP	National Syndromic Surveillance Program
SCHS	(North Carolina) State Center for Health Statistics
SUS	System Usability Scale
WNCHN	Western North Carolina Health Network
YRBSS	Youth Risk Behavior Surveillance System

CHAPTER 1: INTRODUCTION

Public Health Chronic Disease Surveillance

Public health agencies have leveraged a variety of data sources over the years to conduct surveillance of chronic diseases such as asthma, chronic obstructive pulmonary disease (COPD), hypertension, stroke, diabetes, and chronic kidney disease (CKD), as well as mental health conditions such as anxiety, depression, and self-harm. Death certificates, risk factor and health examination surveys, and administrative data from the healthcare setting are all commonly used to inform disease incidence, prevalence, and trends.^{1,2} Each of these data sources have limitations, however. Surveys that rely on self-report may be subject to recall bias, may not have the representativeness needed to provide analyses at the county and subcounty level, and can be resource intensive to implement.¹ Administrative and mortality data may have a latency of one to three years.

As part of a vision named Public Health 3.0, national experts have suggested that local public health agencies should act as chief health strategists to address deficiencies in surveillance and community assessment.³ As chief health strategists, local health departments could develop cross-sector partnerships to collect, integrate, and analyze a broader array of data sources to understand more fully the barriers to health and well-being at the local level. While a handful of local health departments (LHDs) have been able to pilot Public Health 3.0 approaches, most health departments are functioning with reduced funding and workforce.^{3,4} In addition, many local health departments are reliant on the provision of clinical services as a revenue stream to offset per capita expenditures and do not have dedicated staff to collect, analyze and disseminate

chronic disease, mental health and other data.⁵ As a result, LHDs with limited capacity may need to explore novel uses of existing data sources in lieu of or in addition to devoting resources to the collection and analysis of new data sources.

To address these shortfalls, existing syndromic surveillance systems should be evaluated to determine their utility for routine chronic disease and mental health surveillance at the county and subcounty level. Syndromic surveillance systems typically collect de-identified emergency department (ED) data at least once daily to detect and characterize disease outbreaks, monitor injuries such as opioid overdoses, and assess the health impacts of natural and man-made disasters.⁶ Given that a majority of local health departments nationally have access to syndromic surveillance systems, soliciting feedback from local public health practitioners on the utility of the ED data in these systems to inform their ongoing programmatic work is warranted.^{4,7}

NC DETECT, North Carolina's syndromic surveillance system, receives ED data three times daily from all 126 civilian hospitals across the state.⁸ These data are available to hospital-based users and public health practitioners in NC through a secure, role-based Web application and include basic patient demographics, chief complaint, initial blood pressure and temperature, ED disposition and final diagnosis codes. The Web-based application provides access to a variety of indicators, as well as graphical, line listing and tabular formats for review within the Web browser and/or downloading for further analysis in a spreadsheet and/or statistical package. In terms of chronic disease and mental health surveillance, NC DETECT ED data have been used to conduct retrospective analyses of the health impacts of disasters, to provide descriptive analyses of mental-health related ED visits, and to suggest improvements to case definitions for asthma and oral health.⁹⁻¹⁶ No previous studies, however, have attempted to determine how NC DETECT can be leveraged by local health departments for ongoing surveillance of chronic

disease and mental health issues. The proposed work for this dissertation is the development and evaluation of mental health and chronic disease surveillance tools using ED data from NC DETECT, with local health departments as the primary audience.

Syndromic surveillance ED visit data for chronic disease and mental health surveillance

Syndromic surveillance ED data have been used to measure chronic disease exacerbations caused by environmental stressors such as air pollution and extreme weather, as well as to document ED utilization for chronic conditions such as asthma, COPD, and oral health at ZIP code and/or county levels. For example, public health researchers from England have used syndromic surveillance ED data to quantify the asthma burden in children when first returning to school, to monitor the impact of thunderstorms on asthma-related ED visits, to monitor the impact of extreme cold weather on cardiac and respiratory conditions, to measure the impact of heatwaves on asthma, cerebrovascular and cardiovascular events, and to describe changes to ED visits for myocardial ischemia and other chronic diseases during poor air quality events.¹⁷⁻²² Similarly, epidemiologists in New York City (NYC) and Boston have used their syndromic ED data to look at differences in ED visit rates for asthma by ZIP code.²³⁻²⁵ Surveillance of ED visits for asthma is ongoing in NYC and can be accessed publicly with daily updates.²⁶

Other jurisdictions have leveraged syndromic surveillance ED data to monitor health impacts, including chronic disease exacerbations, during and after natural disasters.^{14,27-29} Researchers in Ohio and Cook County, Illinois leveraged syndromic surveillance ED data to measure the impact of smoking bans on acute myocardial infarction, acute coronary syndrome, stroke and COPD.^{30,31} Several studies compared ED chief complaint data to hospital discharge data or ambulatory medical survey data for select chronic diseases to compare trends or to measure sensitivity, specificity and positive predictive value of chief complaint-based indicators.³²⁻³⁶

The use of syndromic surveillance ED data for mental health surveillance as described in the literature follows similar patterns to that of chronic disease surveillance. Most papers provide general descriptive statistics of mental-health related ED visits at local, state and national levels, describe the impact of extreme weather on ED utilization for mental health, and/or evaluate mental health-related syndrome definitions through retrospective analyses.^{15,37-41} For example, researchers in Paris and Virginia conducted retrospective analyses of their syndromic ED visit data to analyze trends in anxiety and stress following a local terrorist attack and white supremacist rallies, respectively.^{42,43}

Recent studies related to syndromic surveillance ED data for mental health have focused on self-harm and suicide attempts. For example, several studies have analyzed ED data from the Center for Disease Control's (CDC) National Syndromic Surveillance Program (NSSP) to characterize national and regional trends in non-fatal self-harm. These studies showed an overall increase in non-fatal self-harm from 2016 through 2018 and a temporary increase among 10-19 year-old youth after the premier of the Netflix series *13 Reasons Why*.⁴⁴⁻⁴⁶ A more recent analysis of NSSP data showed an overall increase nationally in mental health-related ED visits and suicide attempts from March to November 2020, compared to the same time period in 2019.⁴⁷ Researchers in Washington, DC found that using a combination of chief complaints and ICD-9-CM discharge diagnosis codes to identify suicide-related ED visits had greater sensitivity than relying on chief complaints alone.⁴⁸ Studies from Salt Lake City, Utah and North Carolina linked syndromic surveillance ED visit data to Violent Death Reporting System (VDRS) data in an attempt to identify any previous ED visits for suicide deaths in the VDRS.^{49,50} The use of syndromic surveillance ED data for suicide attempts is a growing area of interest and the CDC's Division of Violence Prevention encourages the states and communities to explore the use of

syndromic surveillance ED data to detect “suicide-related events at more detailed geographic levels, thus facilitating more rapid and targeted public health prevention and response efforts.”⁴⁵

While these studies leveraged syndromic surveillance ED data to characterize chronic disease and mental health trends and exacerbations in communities, they were primarily retrospective analyses of one-time historic events, especially in urban areas, rather than ongoing surveillance efforts. Although New York City demonstrates active monitoring of asthma through their public facing website, the literature does not identify any widespread, systematic, ongoing use of syndromic surveillance ED visit data for chronic disease burden assessment or for informing prevention and response efforts. Researchers have suggested the value of syndromic surveillance ED data to mobilize public health response for mental health crises triggered by large events, but do not describe systematic, ongoing surveillance efforts. Little is known about the ongoing use of syndromic surveillance ED visit data to inform local health department primary prevention efforts around mental health or the provision of mental health services. Thus, more research is needed to understand the potential utility of syndromic surveillance to broadly inform public health prevention and control efforts. In addition, none of this literature describes the use of ICD-10-CM diagnosis code-based ED data from syndromic surveillance systems for chronic disease surveillance, which is one area of focus of this research.

Gaps in understanding local health department syndromic surveillance data access and use

National organizations and other public health researchers have surveyed local health departments to collect qualitative and quantitative data on a variety of factors influencing their use of data, including training and workforce needs, informatics capacity, funding issues, as well as access to data.⁵¹⁻⁵⁹ While these surveys identified the need for timely, subcounty data to monitor community burden of chronic diseases and mental health issues, they did not explicitly

suggest ways for health departments to leverage syndromic surveillance data to address these identified gaps. In addition, a survey that evaluated local health department use of syndromic surveillance reported that while a majority of respondents had used syndromic surveillance for tracking influenza-like, gastrointestinal, and foodborne illnesses, only 11% of respondents had used syndromic surveillance for non-communicable diseases and <10% had used the data for suicide/self-inflicted injury or mental health.⁷

Local health department use of syndromic surveillance data for injuries is more mature and widespread compared to chronic disease and mental health surveillance. For example, in addition to the reported survey findings described above, a scan of US health department websites shows several with dashboards that provide timely updates on overdose ED visit trends.⁶⁰ In addition, papers have described how syndromic surveillance ED visit data have informed overdose response efforts.^{8,25} Several states, including North Carolina, are currently using syndromic surveillance ED visit data to guide COVID-19-related policies.^{61,62} Little is known, however, about how these same data could be used to inform the chronic disease and mental health related activities of local health departments.

Research Goals

In this research, we quantified the data sources typically used by local health departments through a descriptive content analysis of local health department community health assessments in North Carolina, compared the data sources identified to NC DETECT ED visit data, and developed and evaluated mental health and chronic disease surveillance tools featuring NC DETECT ED visit data.

Aim 1. Identify and describe the current use of secondary data sources, characteristics, and priorities within community health assessments in NC

For Aim 1, we conducted a descriptive content analysis of the most recent community health assessments for all 100 NC counties to identify the data sources used to describe chronic disease burden and mental health status, including the extent to which syndromic surveillance ED data were used. The content analysis also documented the timeliness and granularity of each data source as well as the priorities identified for each NC county.

Aim 2. Assess the utility, strengths, and weaknesses of using syndromic data for chronic and mental health surveillance in comparison/contrast with traditionally used data sources

For Aim 2, we compared NC DETECT ED visit data to census data as well as data sources commonly used in NC community health assessments, including mortality data, Medicare data, County Health Rankings data, and data from the NC Behavioral Risk Factor Surveillance System. These comparisons assessed the similarities and differences in rates and trends for anxiety, asthma, COPD, depression, nonfatal self-harm, suicidal ideation, and trauma- and stressor-related disorders to determine the potential implications for using NC DETECT ED data to inform local public health decision-making for these conditions.

Aim 3. Develop and evaluate public-facing dashboards providing timely NC DETECT ED visit data for asthma, COPD, and mental health conditions

For Aim 3, we developed two public-facing dashboards to show NC DETECT ED data trends for asthma and COPD as well as several mental health-related conditions including depression, suicidal ideation, and self-harm, and solicited feedback on these dashboards through a cognitive walkthrough and a subsequent Web-based survey.

A data use agreement for research involving the NC DETECT ED data was signed with the NC Division of Public Health and UNC IRB approvals were secured for the data analyses, cognitive walkthrough, and survey-based data collection from local health departments.

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CHAPTER 2: DESCRIPTIVE CONTENT ANALYSIS OF NORTH CAROLINA COMMUNITY HEALTH ASSESSMENTS

Introduction

Prior qualitative research has shown that local health departments (LHDs) want timelier, sub-county data to inform their chronic disease and mental health prevention efforts.¹⁻⁹ Research on the specific chronic disease and mental health data needs of North Carolina LHD practitioners is limited, as the most recent studies assessing data use and data gaps focused primarily on infectious disease surveillance.⁹ There is a need to document the data that NC LHDs use to understand community level mental health issues and chronic disease burden, and to quantify current data challenges and gaps.

Community Health Assessments

As part of the community health assessment (CHA) process, LHDs and their partners collect and analyze data to develop LHD priorities, educate and engage communities, allocate resources, inform policies and plans, and to evaluate public health programs.¹⁰ LHDs in North Carolina conduct CHAs every four years as part of the North Carolina LHD accreditation process.¹¹ Local health departments may collaborate with non-profit hospitals on their CHA, as the IRS requires non-profit hospitals to conduct a CHA once every three years.¹² While health departments can leverage a variety of frameworks, methods and tools when conducting a CHA, all CHAs involve the collection, analysis and reporting of both primary and secondary data.¹³ The primary data can take the form of surveys, key informant interviews, and/or focus groups. Secondary data typically include information on demographics, risk factors, morbidity, and mortality, and may also include data on socioeconomics, the environment, and other community

factors impacting health.¹⁴ A review of CHAs can provide insights into the secondary data used by LHDs to measure community-level chronic disease burden and mental health issues.

North Carolina CHA Guidance on Secondary Data

In North Carolina, the Local Data Analysis and Support branch (L-DAS) of the North Carolina Division of Public Health provides guidance to LHDs on the completion of CHAs.¹⁵ L-DAS provides CHA formatting guidance, checklists, and training opportunities. The North Carolina State Center for Health Statistics (SCHS) provides a County Health Data Book, updated annually, to support CHAs.¹⁶ This resource includes links to data on population estimates, pregnancy and live birth, life expectancy, mortality, cancer incidence, and links to outside sources including the Sheps Center for Health Services Research, the North Carolina Department of Public Instruction, Action for Children North Carolina, the State Bureau of Investigation, and a PDF detailing additional external data sources that can be used for CHAs. These resource lists are not meant to be exhaustive or limiting, but, of note, syndromic surveillance ED visit data from NC DETECT are not explicitly mentioned as a source of CHA data.

Secondary Data Use in CHAs as Identified in the Literature

Peer-reviewed literature that describes the types of secondary data used in community health assessments is somewhat limited. Stoto et al (2019) reviewed 10 exemplar non-profit hospital and local health department CHAs from across the United States and provide detailed information on the data sources used.¹⁷ Secondary data sources identified include the Behavioral Risk Factor Surveillance System (BRFSS), vital statistics, County Health Rankings, emergency department and hospitalization data, mortality, and Kaiser Permanente data platform data on health behaviors, social and economic factors, clinical care and health outcomes. Stoto et al (2019) discusses the lack of sub-county data included in these assessments and suggests several

models to provide data at the patient residential ZIP code level based on emergency department and inpatient administrative data.^{18,19} However, the authors do not explicitly mention syndromic surveillance data as a source of county-level or sub-county information for CHAs. Other research that conducted content analyses on CHAs focused on areas other than quantifying data sources, including identification of health needs, health priorities, and implementation strategies, measuring types and depth of community participation in the assessment process, and inclusion of social determinants of health.²⁰⁻²² Other research describes workshops designed to improve use of secondary data in the assessment process, and how height and weight data from electronic health records can be used to provide estimates of childhood obesity for use in a rural county CHA.^{23,24} No literature was identified that described a systematic evaluation of the data sources used in CHAs by NC LHDs to document mental health or chronic disease burden.

We conducted a descriptive content analysis of the most recent CHAs for all 100 NC counties to identify the secondary data most frequently used by LHDs, the granularity and latency of these data sources, and any identified data gaps. While CHAs typically cover a wide range of public health concerns, we limited our analysis of secondary data sources to document use regarding only chronic disease and/or mental health conditions.

Methods

Codebook

To quantify the secondary data sources used for chronic disease and mental health conditions in NC CHAs as part of the content analysis, we downloaded the most recent CHAs from all 100 NC counties from their respective health department public-facing websites in August 2020. we developed a codebook to itemize the data to be abstracted from each content analysis, including CHA date, local health department priorities, and the chronic diseases and mental health conditions identified by death certificate data, Medicare data, BRFSS, the Youth

Risk Behavior Surveillance System (YRBSS), NC DETECT ED visit data, ED data from other sources, hospital inpatient data, and other data sources (Appendix). The most recent date cited and the most granular geographic data presentation (state, region, county, facility/ZIP, census tract) for each data source were also documented. Finally, any mention of data gaps and/or data limitations as noted by CHA authors was also documented. The codebook was adapted for use in Qualtrics® and was piloted with one CHA by two coders. No substantial changes were made to the codebook after the initial test. The data abstraction for all 100 counties was conducted from August 12, 2020 through October 8, 2020. Dates for the CHAs ranged from 2015 to 2020.

Inter-rater reliability

To validate the codebook and abstract, two coders conducted independent coding and abstraction using the Qualtrics® form on 12 overlapping CHAs. The resulting data for these 12 CHAs were compared for percent agreement. Across each category of the content analysis, excluding data gaps, a value of 1 was assigned for an exact match and a 0 was assigned for partial matches or non-matches. The average agreement was calculated for each CHA, across all 12 CHAs and across each category. Results for category-specific agreement are shown in Table 2.1 and CHA-specific agreement are shown in Table 2.2.

Table 2.1: Category-Specific Agreement across 12 Community Health Assessments

CHA Category	Percent Agreement
Average Across Categories	86%
Median Across Categories	92%
CHA Date	100%
Priorities	100%
Does the CHA include mortality data (from death certificates) for chronic disease and/or mental health indicators?	92%
What is the most granular geographic variable used for the mortality data presented?	100%
What is the most recent date for the mortality data presented?	83%
Chronic Disease Indicators of interest described with mortality data: select all that apply (check boxes)	83%
If other, chronic disease indicators for mortality, list here	75%

CHA Category	Percent Agreement
Mental health indicators of interest described with mortality data: select all that apply (check boxes):	58%
Other mental health indicators included with mortality data.	100%
Does the CHA include Medicare data for chronic disease or mental health?	92%
What is the most granular geographic variable used for the Medicare data presented?	92%
What is the most recent date for the Medicare data presented?	92%
Chronic Disease Indicators of interest described with Medicare data: select all that apply (check boxes)	92%
If other chronic disease indicators for Medicare data, list here:	100%
Mental health indicators of interest described with Medicare data: select all that apply (check boxes):	92%
Other mental health indicators included with Medicare data.	100%
Does the CHA include hospital inpatient data for chronic disease or mental health?	75%
What is the most granular geographic variable used for the hospital inpatient data presented?	75%
What is the most recent date for the hospital inpatient data presented?	83%
Chronic Disease Indicators of interest described with hospital inpatient data: select all that apply (check boxes)	75%
If other chronic disease indicators for hospital inpatient data, list here:	83%
Mental health indicators of interest described with hospital inpatient data: select all that apply (check boxes):	100%
Other mental health indicators included with hospital inpatient data.	100%
Does the CHA include NC DETECT ED data for chronic disease or mental health?	100%
What is the most granular geographic variable used for the NC DETECT ED data presented?	100%
What is the most recent date for the NC DETECT ED data presented?	100%
Chronic Disease Indicators of interest described with NC DETECT ED data: select all that apply (check boxes)	100%
If other chronic disease indicators for NC DETECT ED data, list here:	100%
Mental health indicators of interest described with NC DETECT ED data: select all that apply (check boxes):	100%
Other mental health indicators included with NC DETECT ED data.	100%
Does the CHA include other / non-NC DETECT ED data for chronic disease or mental health?	83%
What is the source of this other non-NC DETECT ED data, e.g., directly from the community's hospital, etc.	83%
What is the most granular geographic variable used for the other / non-NC DETECT ED data presented? If at the facility level, select ZIP/city.	83%
What is the most recent date for the non-NC DETECT ED data presented?	83%
Chronic Disease Indicators of interest described with other / non-NC DETECT ED data: select all that apply (check boxes)	83%
If other chronic disease indicators for the other / non-NC DETECT ED data, list here:	83%
Mental health indicators of interest described with the other / non-NC DETECT ED data: select all that apply (check boxes):	92%
Other mental health indicators included with the other / non-NC DETECT ED data	92%
Does the CHA include BRFSS data for chronic disease or mental health?	83%
What is the most granular geographic variable used for the BRFSS data presented?	50%

CHA Category	Percent Agreement
What is the most recent date for the BRFSS data presented?	75%
Chronic Disease Indicators of interest described with BRFSS data: select all that apply (check boxes)	67%
If other chronic disease indicators for BRFSS data, list here:	75%
Mental health indicators of interest described with BRFSS data: select all that apply (check boxes):	83%
Other mental health indicators included with BRFSS data.	83%
Does the CHA include YRBS data for chronic disease or mental health?	92%
What is the most granular geographic variable used for the YRBS data presented?	83%
What is the most recent date for the YRBS data presented?	92%
Chronic Disease Indicators of interest described with YRBS data: select all that apply (check boxes)	92%
If other chronic disease indicators for YRBS data, list here:	92%
Mental health indicators of interest described with YRBS data: select all that apply (check boxes):	92%
Other mental health indicators included with YRBS data.	83%
If the CHA includes other secondary data sources for chronic disease or mental health, please list them here	75%
What is the most granular geographic variable used for the other secondary data presented?	92%
What is the most recent date for the other secondary data presented?	83%
Chronic Disease Indicators of interest described with the other secondary data: select all that apply (check boxes)	58%
If other chronic disease indicators for other secondary data, list here:	92%
Mental health indicators of interest described with other secondary data: select all that apply (check boxes):	58%
Other mental health indicators included with other secondary data.	67%

Table 2.2: Community Health Assessment Content Analysis Percent Agreement

County Community Health Assessment (CHA)	Percent Agreement
Average Across 12 County CHAs	86%
Median Across 12 County CHAs	90%
Alamance	69%
Ashe	90%
Burke	78%
Craven	69%
Davie	95%
Harnett	88%
Lee	90%
Montgomery	86%
Moore	92%
Northampton	90%
Randolph	92%

County Community Health Assessment (CHA)	Percent Agreement
Stokes	97%

The overall agreement of the two coders was high, 86%. Across the specific content analysis categories, most categories had 75% or higher agreement; exceptions were mostly related to the BRFSS and mental health data, including death certificate mental health (58%), BRFSS geographic granularity (50%), BRFSS chronic diseases (67%), other chronic data sources (58%), other mental health data sources (58%) and other mental health conditions identified by other mental health data sources (67%). Most of these lower agreements reflected partial matches. For example, one coder listed Alzheimer’s disease and suicide in the mortality (death certificate) mental health category and the other coder listed Alzheimer’s in the mortality (death certificate) mental health category but suicide in the other mental health category. In several CHAs, suicide was not listed in the leading causes of death table but was included elsewhere and cited differently, potentially causing confusion. In addition, several CHAs did not explicitly identify BRFSS as a data source in graphs and a close review of the text was required for confirmation. Given that percent agreement averaged above 60% across all categories, only abstractions completed by Ising are reported in the results. The lack of consistent, standardized data source references across the 100 CHAs required careful review of tables, graphs, and text to identify secondary data sources with as high a level of accuracy as possible.

Results

Frequency of Data Source Use by Chronic Disease or Mental Health Condition

Death certificate data (n=100), inpatient (n=56), BRFSS (n=36), and Medicare (n=35) data were the most used secondary data sources across all CHAs for chronic disease and mental health conditions. NC DETECT and other sources of emergency department data were used

rarely for chronic disease and mental health conditions. Table 2.3 displays the number of CHAs that included data for a particular chronic disease or mental health condition by data source.

Table 2.3: Number of Counties Reporting on Chronic Disease and Mental Health Indicators of Interest

Number (Percentage) of Community Health Assessments Including Data by Data Source & Condition (N=100 Counties)							
Topic	Deaths (Vital Records)	Medicare	Inpatient	NC DETECT ED	Other ED	BRFSS	YRBSS
<i>Chronic Conditions</i>							
Asthma	N/A*	33	46	2	1	9	1
Cancer	97	29	5	0	3	1	0
CKD	89	31	5	0	3	2	0
COPD	N/A*	33	8	1	2	9	0
CLRD	100	N/A	N/A	N/A	N/A	N/A	N/A
Diabetes	98	33	6	0	4	29	0
Heart-related	100	32	11	0	3	8	0
Hypertension	14	32	0	0	0	13	0
Oral Health	N/A	0	1	1	2	10	0
Stroke / Cerebrovascular	99	32	8	1	4	9	0
<i>Mental Health Conditions</i>							
Alzheimer's / Dementia	98	31	3	0	0	0	0
Anxiety	N/A	0	0	1	0	0	1
Depression	N/A	34	0	0	0	5	4
Suicide	88	N/A	N/A	N/A	N/A	N/A	N/A
Suicide attempt / Self-harm	N/A	0	0	2	0	0	5
Suicidal ideation	N/A	0	0	1	0	0	8

*Asthma and COPD deaths were reported in a combined chronic lower respiratory disease (CLRD) category in all CHAs

CKD = chronic kidney disease; COPD = chronic obstructive pulmonary disease; CLRD = chronic lower respiratory disease

Deaths

All 100 CHAs included death certificate data for heart-related conditions and chronic lower respiratory disease (CLRD), which combines conditions like asthma and COPD into a single mortality category. Over 90% of CHAs, included data on deaths for most other chronic diseases included in the analysis and 98% included data for Alzheimer's disease. These data were typically presented in tables listing the top five or 10 leading causes of death at the county

level. Chronic liver disease and cirrhosis as a combined category was listed as a top 10 cause of mortality in 44 CHAs and crude rates for mortality caused by Parkinson's were included in two CHAs.

Medicare Data

Medicare data for both chronic and mental health conditions were used in all 33 of the CHAs completed by the Health ENC collaboration. Health ENC is a program of the Foundation for Health Leadership and Innovation (FHLI) and was formed by local public health and healthcare leadership to coordinate the health assessment process across health departments and non-profit hospitals.²⁵ In addition to the chronic diseases listed in Table 2, these 33 CHAs also included Medicare data for hyperlipidemia, osteoporosis, and rheumatoid arthritis. The Wake County CHA included Medicare data for autism as well as schizophrenia and other psychotic disorders.

Inpatient and Emergency Department Data

Hospital inpatient data were used in 46 CHAs to provide information on asthma. Thirteen CHAs included inpatient and/or emergency department data by broad ICD-9-CM / ICD-10-CM diagnosis code groupings that were difficult to classify into the specific chronic diseases identified as part of this content analysis. These categories included diseases and disorders of the respiratory system, diseases and disorders of the circulatory system, diseases and disorders of the digestive system, other diagnoses including mental disorders, oral health, chronic lower respiratory disease, and endocrine, metabolic and nutritional disease. The Gaston County CHA included ED data on chest pain. The Lincoln County CHA included NC DETECT ED visit data from keyword-based syndromes available in the NC DETET Web application, chronic heart and chronic respiratory.

BRFSS and YRBSS Data

CHAs included data from the BRFSS most often for diabetes prevalence (29%), with fewer CHAs including BRFSS data for hypertension (13%), asthma (9%), oral health (10%), and depression (5%). Ten (63%) of the 16 CHAs for the western NC counties affiliated with the Western North Carolina Health Network (WNCHN) included BRFSS data as a comparison to the primary survey data collected as part of the assessment process. The Gaston County CHA included additional BRFSS data on lupus and arthritis. YRBSS data were included in only 8 CHAs, with only one CHA reporting chronic disease data collected, specifically for asthma.

Other data sources used for chronic and mental health conditions

The most common “other” data sources used in NC CHAs were cancer incidence data from the NC Central Cancer Registry or the National Cancer Institute (67%) and data from the County Health Rankings (CHR) (49%). CHR aggregates data from multiple sources and provides summarized, ranked views at the county level for all US counties.²⁶ NC CHAs included CHR data for select social determinants of health indicators as well as for diabetes prevalence and mental health conditions defined as “poor mental health days” and “frequent mental distress.” CHR bases their rankings for these specific indicators on data collected via BRFSS, using analytical methods to provide county-level estimates. For example, the 2020 CHR provides county-level estimates on diabetes prevalence based on 2016 BRFSS survey results. The 2020 CHR Quality of Life county-level health outcomes, “poor mental health days” and “frequent mental distress”, are based on 2017 BRFSS survey results reporting the average number of mentally unhealthy days reported in past 30 days (age-adjusted).

Additional data sources identified in the “other” data source category include mental health data from Log Into North Carolina (LINC) and the School Health Services Report. LINC

is managed by the North Carolina Office of State Budget and Management and provides county-level data on the number of persons served by outpatient mental health providers and state psychiatric facilities.²⁷ These data were included in 13 CHAs. The NC School Health Services Report provides public information at the state level on chronic disease and mental health conditions including the number of students with asthma or mental health conditions, as reported by school health nurses via a required annual survey.²⁸ Five CHAs included data from this report, primarily to document the number of students statewide with asthma.

Data Latency and Geographic Granularity

Table 4 shows the average number of years between the CHA date and each data source included in the content analysis, as well as the geographic granularity for each data source. For the few CHAs that included NC DETECT ED visit data, the data reported was the same year as the CHA publication date, the shortest latency period included. Inpatient data had the longest latency, with an average of four years. The remaining sources ranged between two to three years, with a mode of two years.

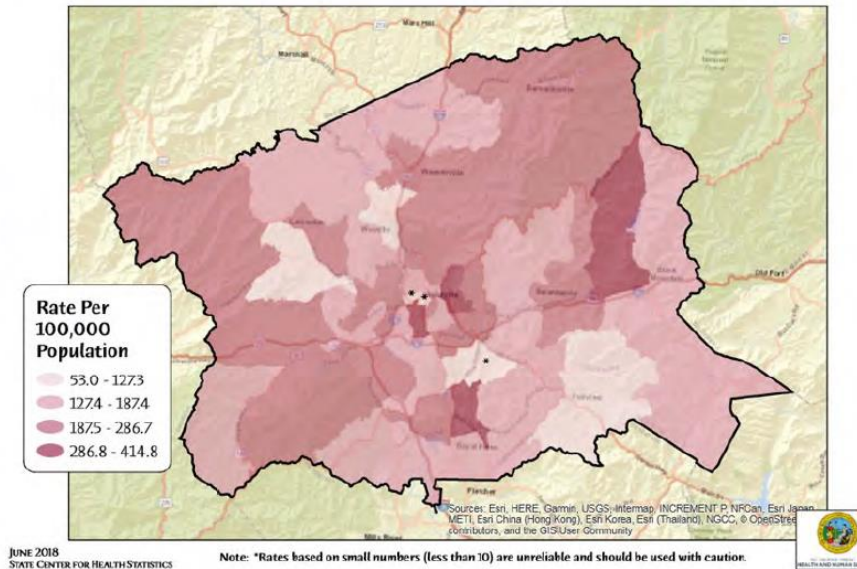
The most granular geographic level for most data sources was county. The small number of CHAs that included ED or inpatient data that were provided directly by hospitals, reported those data by hospital name. In addition to reporting death certificate data and cancer incidence at the county level, seven of the WNCHC county CHAs included census-tract level maps of deaths and cancer incidence. Figure 2.1 shows an example census tract level map from the Buncombe County CHA. The legend for these census track level maps did not include additional details, such as date range.

Table 2.4: Content Analysis Metrics on Latency and Geographic Granularity

<i>Latency between CHA Date and Data Source Date (Latency in Number of Years)</i>								
Topic	Mortality	Medicare	Inpatient	NC DETECT ED	Non-NC DETECT ED	BRFSS	YRBS	Other
# of Years Latency	2	3	4	0	2	2	1	2
<i>Most granular geographic location reported by data source</i>								
County		X		X		X	X	X
ZIP or Facility			X		X			
Census Tract	X							

Figure 2.1: Sample Census Tract Map of Heart Disease Mortality from the 2018 Buncombe County Community Health Assessment

Heart Disease Mortality Rates



Local Health Department Priorities

Each CHA typically identifies two or three priorities that the local health department uses to guide their activities for the next three or four years. LHDs identify priorities from secondary

data as well as primary data in the form of surveys, focus groups and key informant interviews. We abstracted the free text priorities from the 100 most recent CHAs and then manually reviewed and categorized them to calculate frequencies, as shown in Table 2.5. LHDs often combined mental health and substance abuse into one priority, but we separated these two topics during the tabulation process. Similarly, if a LHD listed a priority as “healthy lifestyles/nutrition/obesity” we counted this only in the healthy lifestyles category. If a LHD listed obesity alone as a priority without combining it into a healthy lifestyles/activity/nutrition, we counted it separately. Finally, any mention of tobacco was counted separately even if it was mentioned with substance abuse (in these few instances substance abuse and tobacco were both counted for that health department). Based on these tabulations, substance use, mental health, healthy lifestyles, chronic conditions, and access to care were the five most common priorities in these CHAs.

Table 2.5: Identified priorities in order of frequency

Priority	Number of CHAs
Substance Abuse	76
Mental Health / Behavioral Health	54
Healthy Lifestyles/Physical Activity/Nutrition/Healthy Food Access	48
Chronic Conditions / Chronic Disease Control & Prevention (including specific chronic disease mentions)	40
Access to Care (including mental health services)	37
Obesity (Child and/or Adult)	23
SDOH, including Housing, Transportation & Education	14
Maternal, Fetal and Infant Health	10
Tobacco	7
Teen Pregnancy	6
Economic Issues / Poverty / Employment	6
Oral Health	5
Youth Well-Being	5
Disaster Recovery & Mitigation / Emergency Preparedness / Environmental Health	4
Sexual Health	4

Health Equity	3
Violence Prevention, Including Child Maltreatment, Domestic Violence & Sexual Assault	3
Race Relations	1
Public Safety	1
Motor Vehicle Safety	1
Aging Population	1

Data Gaps Identified in the Community Health Assessments

Community health assessments do not typically have a formal section in the document to discuss data gaps or data limitations. However, 55 CHAs did include disclaimers and/or considerations for the reader regarding the secondary data included. Table 2.6 shows the number of times a data gap or limitation was mentioned in a community health assessment. We counted a CHA more than once if it included more than one of the data gaps listed below.

Table 2.6: Data Gaps and Limitations Documented in Community Health Assessments

Data Gap / Limitation	Number of CHAs
General note about inability to measure subpopulation disparities in secondary data	31
General note about data limitations as respect to sample size, geographic focus, timeliness in included data but no better alternative available	15
General note about small numbers in secondary data; interpreting data based on small numbers	3
Challenges in obtaining county-level mental health data	4
Challenges in obtaining data on youth	2
Challenges in obtaining county-level data in general	2
Challenges in obtaining county-level oral health data	2
Difficulty in obtaining county-level hospital data	1
Challenges in obtaining county-level asthma prevalence data	1

CHAs developed as part of a regional effort were more likely to include comments on data limitations. For example, the Health ENC collaborative CHAs all included some variation of the limitations outlined below.

Several limitations of the data should be considered when reviewing the findings presented in this report. Although the topics by which data are organized cover a wide range of health and health-related areas, within each topic there is a varying scope and depth of data availability. In some topics there is a robust set of secondary data indicators, but in others there may be a limited number of indicators for which data is collected, or limited subpopulations covered by the indicators.

Data scores represent the relative community health need according to the secondary data that is available for each topic and should not be considered to be a comprehensive result on their own. In addition, these scores reflect what was found in the secondary data for the population as a whole, and do not factor in the health or socioeconomic need that is much greater for some subpopulations. In addition, many of the secondary data indicators included in the findings are collected by survey, and though methods are used to best represent the population at large, these measures are subject to instability—especially among smaller populations.

The disparities analysis, used to analyze the secondary data, is also limited by data availability. In some instances, data sources do not provide subpopulation data for some indicators, and for other indicators, values are only available for a select number of race/ethnic groups. Due to these limitations, it is not possible to draw conclusions about subpopulation disparities for all indicators.

A small number of CHAs written by individual health departments also documented challenges in collecting data. The Caswell County CHA (which did not include any emergency department or inpatient data from NC DETECT or other sources) noted that “[h]ospital data is often difficult to obtain for Caswell County, since residents disperse over several hospital systems and two different states when seeking hospital care... Due to the small population size of Caswell County, hospitalization information is not available in separate categories, for example, reason for hospitalization.”²⁹ Similarly, the Person County CHA states that mental health ED visit rates are not available at the county level.³⁰ Jones and Lincoln CHAs state that county-level data are not available for many health indicators.^{31,32} The Durham County CHA

made specific mention of the lack of county-level prevalence data for asthma and oral health.³³ The Forsyth County CHA note that data describing the county-level prevalence of mental health and oral health conditions are limited.³⁴ The Guilford County CHA notes that county-level risk factor data (typically collected via BRFSS) are no longer available at the county level and that data related to “...behavioral health, Adverse Childhood Experiences (ACEs), early childhood development and experiences of discrimination, are either non-existent, old, or collected at geographic levels (such as the NC Piedmont) that render it difficult to analyze for our purposes.”³⁵ The Haywood and Swain CHAs also specifically commented on the lack of data regarding youth health. The Haywood County CHA specifically mentions that the YRBSS is not administered in its county schools.³⁶ The Wake County CHA includes a limitation about data latency as well as gaps in information for specific “sub-segments” of the population including the uninsured, low-income persons, certain minority groups, as well as data stratified by age group.³⁷

Discussion

This content analysis quantified the secondary data sources used by all 100 NC LHDs in their most recent CHAs. The most common data sources used for multiple chronic disease and/or mental health conditions were death certificate data, Medicare data, BRFSS data, County Health Rankings Data, and inpatient data. The most common granular geographic level used across these data sources was county, although death certificate data were provided at the census tract level in several CHAs. The average data latency for data sources was two years, and for the CHAs that included NC DETECT ED visit data, the data reported was the same year as the CHA publication date. The five most common CHA priorities were substance abuse, mental/behavioral health, healthy lifestyles, chronic conditions, and access to care, and

approximately half of the CHAs included some sort of disclaimer or discussion on data gaps, primarily documenting the lack of data to measure disparities in subpopulations.

Findings from this content analysis confirm that data sources compiled by the North Carolina State Center for Health Statistics in the County Health Data Book tend to be the data sources used most frequently in CHAs. The County Health Data Book provides a centralized, reputable location to access multiple sources of secondary data at the county level, easing the burden of those responsible for CHA secondary data collection. The 2020 County Health Data Book currently has data available through 2018 for population data, pregnancy and live births, life expectancy, and death certificate data, and 2016 data for cancer incidence.¹⁶ Health departments utilizing this resource alone are beholden to the latency of the data provided, even if more timely data are available. For example, at the time of this writing, 2019 North Carolina death certificate data are currently available on the CDC Wonder website.³⁸ In addition, the lack of hospitalization data available in the County Health Data Book results in many local health departments not seeking this information from outside sources.

The inclusion of NC DETECT ED visit data in a very small number of CHAs for chronic disease and mental health conditions demonstrates that health departments can use these NC DETECT data in their CHAs, even if this data source is not explicitly listed in the County Health Data Book. The NC DETECT ED visit data on chronic diseases and/or mental health conditions included in the seven CHAs in this content analysis were reported primarily as ED visit counts, as shown in the screenshot from the Catawba County CHA that reports the number of ED visits for stroke (Figure 2.2).³⁹

Figure 2.2: Excerpt from the 2019 Catawba County Community Health Assessment

Chronic Disease

BRAIN DISEASE

ALZHEIMER'S DISEASE

We saw a significant increase in death rates for Alzheimer's Disease among both women and men from 2009-2013 to 2013-2017.

Rates were:

Men: 36.6 Women: 69.8

Women were almost twice as likely to die from the disease as men.

Our overall rate was 58.2 per 100,000 in Catawba County, compared to 33.7 for the state.

STROKE/CEREBROVASCULAR DISEASE

Our Cerebrovascular Disease mortality rate dropped slightly to 42.5, putting us slightly better than the North Carolina rate of 43.2.

Catawba County residents made 4,558 visits to the Emergency Department for stroke from 2015-2018.

3.2% of people in our region reported being diagnosed with a stroke.

LUNG DISEASE

TRACHEA, BRONCHUS, & LUNG CANCER MORTALITY

Rates were:

Men: 63.6 Women: 34.1

Men were more than 1.8 times more likely to die from respiratory cancers than women from 2013-2017. Catawba County's overall rate was 47.1, on par with the rest of the state.

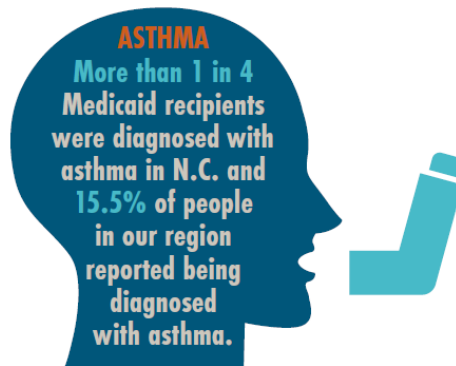
LUNG CANCER INCIDENCE: 66.0

CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

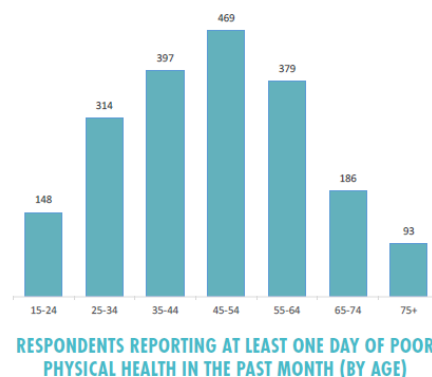
The mortality rate for chronic lung disease was 67.9 from 2013-2017, slightly higher than 2009-2013, and higher than the state's rate of 45.5.

Number of emergency department visits for chronic respiratory disease by Catawba County residents (2015-2018): 2,320

Nearly 1 in 5 Medicaid recipients had been diagnosed with COPD in N.C. Regionally, almost 1 in 10 people reported having COPD.



In the Community Health Opinion Survey, more than 1 in 3 respondents felt they had at least one day in the past month where their physical health was not good.



Another health department included NC DETECT ED visit data from two keyword-based chronic disease syndromes, “chronic heart” and “chronic respiratory” that were developed primarily to monitor chronic disease exacerbations after disasters. There is no written guidance on the most appropriate NC DETECT indicators for CHAs and the NC DETECT Web application does not provide any rate-based data, which may explain why counts are the measure typically reported. As the utility of using NC DETECT ED visit data for CHAs continues to be explored, specific reports and/or guidance should be provided to LHDs so that they use the most appropriate mental health and chronic disease definitions available in NC DETECT. For

example, national definitions based on ICD-10-CM codes for specific chronic diseases would be more appropriate for CHAs than keyword-based syndromes intended for near-real-time disaster-related monitoring.

As non-profit hospitals may collaborate with local health departments on CHAs to meet the IRS community needs assessment requirement, the inclusion of emergency department data provided directly by hospitals in the NC CHAs analyzed as part of this content analysis is not surprising. Facility-specific data were typically reported as counts or percent of total ED visits. For example, the 2017 Watauga CHA reported that chest pain was the most common diagnosis, representing 2.59% of ED visits. Although not tracked, it should be noted that several assessments included information on overall emergency department and/or inpatient utilization trends without stratifying by specific conditions. The 2017 Watauga CHA noted that Watauga Medical Center had 18,707 ED visits during the 2015 fiscal year and the 2018 Davidson CHA included ED visit counts by gender, age group, race and ethnicity combined from two facilities that provided de-identified data and asked that facility names not be included in the assessment.^{40,41} Several CHAs noted limitations in the ability to report county-level data for emergency department and/or inpatient visits, as residents may seek care at multiple facilities and these facilities may be outside of the patient's county of residence. These comments, in addition to the low levels of inclusion of NC DETECT data, suggest that awareness of NC DETECT may be low among some health department staff conducting CHAs.

NC CHAs often included Medicare data to report county-level disease prevalence. The Medicare Chronic Conditions Warehouse currently provides publicly available county-level prevalence information on over 20 indicators based on Medicare administrative claims from

2018.⁴² These data provide unique insights for those on Medicare, and represent an important age group to monitor, as the 65 and over population in NC continues to increase.⁴³

The 2019 YRBSS provides information on risk factors, chronic disease, and mental health conditions for NC youth, but data are available for all of NC and just two local areas, Mecklenburg and Gaston counties. BRFSS provides state and regional estimates, and city-wide data for Raleigh and Charlotte. While the County Health Rankings provide county-level estimates based on BRFSS data, the only county-level estimates provided are for diabetes prevalence, poor mental health days, and frequent mental distress.

Limitations

The results from this CHA content analysis were compiled by one researcher, with another researcher overlapping on 12 CHAs to measure inter-rater reliability. While the reliability findings affirmed overall accurate analysis, errors in identifying secondary data sources, data latencies and gaps may have occurred. Additionally, this content analysis abstracted data only from the published CHAs and did not evaluate the full context of data reviewed by local health departments. For example, local health departments may have reviewed and/or consulted additional secondary data sources that were not included in the CHA because of space limitations. This content analysis was conducted from August to October 2020 and CHAs released during or after this time were not included in the analysis.

Policy and Practice Recommendations

The issues with data latency identified in this content analysis can be partially addressed with the inclusion of syndromic surveillance ED visit data. The seven CHAs that included NC DETECT ED visit data for mental health or chronic conditions in this analysis were able to include data on ED visits for the same year as the CHA publication date. NC DETECT ED visit data were the timeliest secondary data source identified in this analysis

Several CHAs identified data gaps when relying on traditional data sources such as death certificate data, BRFSS data, and data on disease prevalence among Medicare beneficiaries, including the inability to measure chronic disease and or mental health issues among children and other subpopulations. Until YRBSS is administered in every NC school district, NC DETECT ED visit data can provide another source of chronic disease and mental health information for this age group. Additionally, as NC DETECT includes information on insurance coverage for ED visits, local health departments could monitor ED visit trends for chronic diseases and mental health conditions by those on Medicare, as well as those on Medicaid, private insurance, worker's compensation, and those who self-pay and may lack insurance. More research is needed, however, to determine how best to package and share NC DETECT ED visit data on chronic disease and mental health conditions to facilitate easier use in CHAs and other LHD reports.

Conclusion

NC CHAs included secondary data from a variety of data sources to monitor chronic disease and mental health conditions, with death certificate data, Medicare data, inpatient data and BRFSS data comprising the most popular options. NC DETECT ED visit data were used rarely, with only seven local health departments including ED visit counts for asthma, COPD, stroke, chronic syndromes, and mental health conditions. With several health departments noting lack of ability to collect subcounty data, data on youth, and healthcare utilization data for all residents of their county, there are opportunities to enhance NC DETECT data provisioning for the assessment process, as well as increasing overall awareness of NC DETECT data availability.

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CHAPTER 3: DATA SOURCE COMPARISON

Introduction

The assessment and monitoring of population health status is one of the 10 essential public health services that every health department is expected to undertake.¹ In North Carolina (NC), local health departments (LHDs) utilize primary data collection tools, e.g., surveys, focus groups and key informant interviews, as well as secondary data to monitor trends, identify disproportionately affected populations, detect emerging threats, and inform public health action. To understand chronic disease and mental health issues in particular, NC LHDs have relied on death certificate, inpatient, Medicare, Behavioral Risk Factor Surveillance System (BRFSS), and Youth Risk Behavior Surveillance System (YRBSS) data. Each of these data sources have limitations, however. Surveys that rely on self-report may be subject to recall bias, may not have the representativeness needed to provide analyses at the county and subcounty level, and can be resource intensive to implement.² Administrative and mortality data may have a latency of one to three years. To complement these traditional data sources, NC LHDs can leverage other data sources that provide more timely, granular information, such as data from North Carolina's statewide syndromic surveillance system, NC DETECT.

All NC LHDs have access to NC DETECT, North Carolina's statewide syndromic surveillance system, which provides secure role-based access to ZIP code level emergency department visit (ED) data.³ Tabular, graphical, and line listing reports are currently available for a variety of mental health and chronic conditions. Further research is needed, however, to determine how the NC DETECT ED visit data can best be leveraged by local health departments

for ongoing surveillance of chronic disease and mental health issues, as well as how these data compare to the existing data sources typically used by LHDs to understand mental health and chronic disease burden in their communities.

Using Emergency Department Data for Asthma, COPD and Mental Health Surveillance in the Literature

Several publications have described the use of emergency department syndromic surveillance data to monitor asthma, COPD, and mental health conditions.⁴⁻¹⁹ This research has focused primarily on retrospective analyses of one-time historic events, case definition evaluation, and has not included evaluations of the systematic use of ED visit data to inform local prevention and response efforts. Recent studies have used syndromic surveillance data to report on mental health trends during the COVID-19 pandemic at the national level but have not addressed state and/or county-level trends.²⁰⁻²² We conducted an additional scan of the literature to identify studies using any source of emergency department data to inform our detailed analysis of asthma, COPD, and mental health conditions.

National Asthma and COPD ED Visit Studies

Studies measuring national-level asthma ED visit rates have used data from the National Survey of Children's Health (NSCH), the National Health Interview Survey (NHIS), the National Emergency Department Sample (NEDS), and the American Housing Survey (AHS). Two studies measured the relationship between insurance coverage and ED visits for asthma and COPD, and found that lack of insurance increases ED utilization and may result in lack of inpatient admission.^{23,24} Other national studies have analyzed pediatric asthma ED visit trends by housing quality and adult ED visit trends by employment type, suggesting that poor housing quality increases ED utilization for children with asthma and that adults who work in healthcare,

healthcare support, and social assistance industries have the highest asthma prevalence.^{25,26} Other researchers have started using nationally representative EHR data repositories to provide asthma ED visit rate and prevalence estimates.²⁷

State and local level Asthma and COPD ED visit studies

Recent state-level studies on asthma and/or COPD ED visits have used administrative data, ED visit data incorporated into environmental public health tracking systems, or data from one hospital or healthcare system. Two California studies used census-tract level asthma ED visits to examine the relationship between asthma ED visit rates and neighborhood loan risk categories, particulate matter, and public green spaces.^{28,29} Bardach et al (2019) used the Massachusetts All Payer Claims Database to measure asthma ED visit rates among children aged 6 to 21 with comorbid diagnoses of anxiety, depression, or both. They found that children with anxiety, depression or both had higher rates of ED visits compared to those without these diagnoses.³⁰ Marshall et al (2020) used asthma ED visit costs from claims data to evaluate the cost savings from an in-home asthma management and environmental trigger remediation education program. Although their sample size was small (n=70), they found that the average cost per person for ED visits dropped from \$535 per person to \$223 post intervention.³¹ An Arkansas-based study used claims data for two comparable counties to measure the impact of crop burning on asthma and COPD ED visits and found that the county with significant crop burning had lower air quality and higher ED visit rates compared to the control county.³² Researchers from the Boston Children's Hospital compared ED visit trends from 2018 to 2020 during the months of January through May and observed a significant decrease in both counts and percentage of pediatric asthma ED visits during the Massachusetts COVID-19 shutdown.³³

Emergency Department Trends for Mental Health Conditions

Recent research on mental health using ED data has attempted to analyze the impact of the COVID-19 pandemic on emergency department utilization for mental health conditions. The national studies using syndromic surveillance data to report on mental health trends during the COVID-19 pandemic reported proportional increases in mental health-related ED visits among children under 18 and self-inflicted injury among persons aged 12-25 while other types of ED visits dropped significantly for this age group.^{21,22} Studies across the US and France reported decreases in overall ED utilization and utilization for mental health conditions but increases in ED visits for substance use disorders.^{34,35} The challenge of assessing and comparing these studies on ED utilization for mental health during COVID-19 is the use of varying denominators. When using total ED visits as a denominator, for example, the percentage of ED visits for mental health conditions may increase as people avoid the use of the ED during a pandemic so overall ED utilization decreases. But studies reporting on absolute numbers or using population as the denominator may report stable numbers or decrease in rates, again reflecting overall decline in ED census, especially at the start of the pandemic.

Data Source Comparisons for Asthma, COPD, and Mental Health Conditions in the Literature

New York-based researchers have published several articles comparing emergency department data to other sources used to provide disease prevalence estimates. These studies used an emergency department claims database to track unique patients across disparate ED facilities and compared disease prevalence estimates to health survey and registry data. Their studies found high correlation for asthma and mental health conditions at the county level, but a strong negative correlation (-0.88) when comparing diagnoses of depression to reported suicide attempts in the Youth Risk Behavior Survey.^{36,37}

Other studies have compared syndromic ED visit data to other data sources such as school nurse data, claims ED visit data, hospital discharge data, and the National Hospital Ambulatory Medical Care Survey.^{12,38-40} Most of the comparisons described in these papers focused on ED chief complaints for asthma and the correlations ranged from 0.56 for the New York City (NYC) school nurse data to 0.96 when comparing NYC ED syndromic surveillance data to ED claims data.

Outside of multiple New York City based studies comparing survey and registry data to ED claims data, comparisons in the literature of ED data to other data sources commonly used by LHDs are limited, and no recent studies were identified that compared NC emergency department data to other data sources for chronic diseases and mental health conditions. We seek to address this gap by comparing ED visit data from a statewide syndromic surveillance system, NC DETECT, to data sources routinely used by local health departments to document chronic disease and mental health issues in their communities.

Initial steps in evaluating the utility of NC DETECT ED visit data for chronic disease and mental health surveillance include addressing the following questions: (1) How do demographics of ED users in NC DETECT data compare to the overall population? (2) What are the overall statewide disease trends for select chronic and mental health conditions? (3) How do county-level rates of ED visits for select chronic and mental health conditions observed in NC DETECT data compare to traditional surveillance sources used at the county level, including county-level death certificate, Medicare prevalence, and CHR data? (4) For counties that have low correlation between traditional data sources and NC DETECT ED visit data, what might be contributing to those differences?

Methods

Data Sources

The data sources used in this analysis include NC DETECT ED visit data, death certificate data, census data, Medicare prevalence data, and County Health Rankings (CHR) data. We signed a data use agreement with the NC Division of Public Health and received an IRB exemption from UNC Chapel Hill to access the NC DETECT ED visit data.

Syndromic Surveillance ED Visit Data from NC DETECT

The NC DETECT ED visit limited dataset includes all ED visits to 126 NC civilian, acute care, hospital affiliated EDs from January 1, 2017 to December 31, 2020. The data elements include ED visit date, chief complaint (primary reason for visiting the ED), age, sex, ZIP and county of residence, race, ethnicity, insurance coverage and final diagnosis codes. We analyzed ED visit data based on ED visits and not patients; the data do not permit tracking the same patient across ED facilities so calculating descriptive statistics at the patient level is not feasible.

Death Certificate Data and Population / Census Data

We downloaded 2017-2019 NC county-level death certificate counts and crude rates for chronic lower respiratory conditions (CLRD) and suicide, as well as National Center for Health Statistics (NCHS) / Centers for Disease Control and Prevention (CDC) Bridged-Race Population Estimates from the public-facing CDC WONDER website.⁴¹ The U.S. Census bureau produces these annual population estimates in collaboration with NCHS, and the CDC Wonder website allows users to download county-level estimates by year, race, ethnicity and customizable age groups.⁴²

Medicare Prevalence Data

The Medicare prevalence data include the percentage of Medicare enrolled patients who have been diagnosed with a condition in that calendar year. We downloaded the most recent

annual Medicare prevalence data (2018) from the public-facing Medicare Chronic Conditions Dashboard for NC counties for asthma, chronic obstructive pulmonary disease (COPD), and depression.⁴³

We downloaded 2017-2020 CHR data for NC counties from the public-facing County Health Rankings website.⁴⁴ CHR provides county-level estimates and rankings for overall health outcomes and specific health conditions. The county-level estimates are based on a variety of data sources, including BRFSS.⁴⁵

Chronic Disease and Mental Health Measures Used in Analysis

We classified ED visits into chronic disease and mental health conditions of interest using definitions based on International Classification of Disease Clinical Modification, 10th version (ICD-10-CM) final diagnosis codes. We applied these definitions to any diagnosis code received in the ED visit data, regardless of order. For asthma, COPD, and depression we used definitions from the CMS Chronic Conditions Warehouse.⁴⁶ We classified ED visits into a suicidal ideation category using the singular ICD-10-CM code R45.851, and into a self-inflicted injury category using the CSTE Injury Surveillance Toolkit definition for nonfatal self-harm ED visits.⁴⁷ We classified ED visits into anxiety disorders and trauma and stressor-related disorders using the Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project definitions.⁴⁸ We also classified ED visits into a chronic lower respiratory disease category that combines the codes for asthma and COPD into a single definition. Across all comparisons we use the number of ED visits, regardless of the number of ED visits that may occur by the same patient.

Demographic Comparisons

To quantify how the demographics of ED users in NC DETECT data compare to the overall population, we compared NC DETECT ED visit data from 2019 for NC residents to NCHS/CDC Bridged-Race Population Estimates for NC by age group, sex, race, ethnicity at the state and county levels using data from CDC WONDER, and insurance coverage at the state level only using estimates from the Kaiser Family Foundation.⁴⁹

Statewide Disease Trends

We analyzed statewide ED visit patterns from 2017 to 2020 for diagnoses of asthma, COPD, anxiety, depression, self-inflicted injury, suicidal ideation, and trauma and stressor-related disorders.

Correlations between NC DETECT ED Visit Data and Other Data Sources

To understand how ED utilization for select chronic diseases and mental health conditions at the county level compares to other local data used by LHDs, we calculated correlations between county level ED visit crude rates for asthma, anxiety disorders, COPD, depression, suicidal ideation, self-inflicted injury, and trauma and stressor-related disorders to death certificate data, Medicare, and CHR county-level estimates. We calculated crude rates by dividing the number of ED visits for the condition of interest by the appropriate population and multiplying by 10,000. Additional details on specific comparisons conducted are outlined in Table 3.1 below. We calculated correlations using Microsoft® Excel®.

Table 3.1: Data Source Comparisons

ED Condition	Comparison(s)
Anxiety Disorders	Suicide (death certificate), mentally unhealthy days, frequent mental distress (CHR)
Asthma	Asthma (Medicare)
COPD	COPD (Medicare)
CLRD	Chronic Lower Respiratory Disease (Mortality)

ED Condition	Comparison(s)
Depression	Depression (Medicare), Suicide (death certificate), mentally unhealthy days, frequent mental distress (CHR)
Nonfatal Self-Inflicted Injury	Suicide (death certificate), mentally unhealthy days, frequent mental distress (CHR)
ED Visit Crude Rates (overall)	Health Outcome Rankings (CHR)
Suicidal Ideation	Suicide (death certificate), mentally unhealthy days, frequent mental distress (CHR)
Trauma & Stressor-Related Disorders	Suicide (death certificate), mentally unhealthy days, frequent mental distress (CHR)

To maximize the number of counties included in the death certificate comparison, we used combined death certificate data from 2017-2019 for suicide and chronic lower respiratory disease (CLRD) and compared these crude rates to 2017-2019 ED visit crude rates for CLRD and the mental health conditions listed in Table 1. Medicare prevalence data include the percentage of Medicare enrolled patients who have been diagnosed with a condition in that calendar year. We compared 2018 Medicare prevalence data for asthma, COPD, and depression to 2018 ED visit crude rates for these same conditions. We performed two comparisons: (1) ED visit crude rates for ages 65+ and (2) the percentage of ED visits with Medicare documented as the insurance coverage with asthma, COPD, or depression.

CHR develops county-level estimates for mentally unhealth days / poor mental health days and frequent mental distress from BRFSS data. As BRFSS includes those aged 18+ only, we compared 2019 CHR county-level estimates for these conditions to the ED mental health conditions listed in table 1, using 2019 ED visit crude rates for ages 18+. In addition, CHR develops a county-level health outcomes ranking based on several health metrics including length of life and quality of life indicators. CHR calculates these rankings based on BRFSS data (poor or fair health, poor physical health days, poor mental health days) and low birthweight (vital records). The healthiest county based on this analysis is ranked number 1 and lowest, 100.

To compare ED visit data to the CHR county health outcome rankings, we calculated 2019 overall ED visit crude rates for ages 18+, sorted the counties from lowest crude rate to highest and then assigned a ranking from 1 to 100 to use for the comparison.

County-level ED visits trends for select chronic and mental health conditions

We calculated statewide and county-level ED visit crude rates and ED visit percentage for 2017-2020 for anxiety, depression, suicidal ideation, self-inflicted injury, trauma / stressors, asthma, and COPD overall, and by age group, sex, race, ethnicity, and insurance coverage. To understand the types of ED visits included in these ICD-10-CM diagnosis-code based groupings we analyzed the chief complaints for 2019, the most recent, non-provisional data at the time of this research. We calculated ED visit crude rates by dividing the number of ED visits for the condition of interest by the appropriate population and multiplying by 10,000. We calculated ED visit percentages by dividing the number of ED visits for the condition of interest by the total number of ED visits for that population, geography, and time. For example, the percentage of ED visits for suicidal ideation in females in Robeson County in 2019 was calculated by dividing the number of ED visits for suicidal ideation in 2019 by females with a residence of Robeson County by the total number of ED visits in 2019 by females with a residence of Robeson County.

Chief Complaint Analysis

Although the NC DETECT ED visit dataset does not include detailed clinical notes of each ED visit, chief complaints can provide additional context. We created 2019 datasets for asthma, anxiety disorders, COPD, depression, suicidal ideation, self-inflicted injury, and trauma and stressor-related disorders using the definitions previously described. We processed the chief complaints in each of these datasets using the Emergency Medical Text Processor (EMT-P) to standardize the chief complaint terminology. EMT-P is an open-source tool that identifies

common abbreviations, initialisms, acronyms, synonyms, and misspellings in chief complaints and maps them to standardized terms.⁵⁰ We calculated the frequencies of single word (unigram) phrases in the cleaned chief complaints for each of these datasets using Mathematica®.

Results

Statewide Demographic Comparisons

Table 3.2 displays age group, sex, race, ethnicity, and insurance coverage breakdowns for 2019 ED visit data and how these compare to the overall population. Females are over-represented in ED visit data compared to the population, as well as visits by Black or African Americans, those on Medicare, Medicaid or uninsured, and ages < 5, 20-39, and 70+. These trends stay consistent from 2017 to 2020, although 2020 (provisional) show a slight increase in the proportion of visits by males, from 43% to 45%, and a reduction in the proportion of visits by children 1-4 years old (4.98% to 3.55%). Ethnicity information is missing for 15.65% of ED visits in 2019.

The overall ED visit crude rate per 10,000 person-years in 2019 was 4706.07 with ages 85+ having the highest rate (10096.73), and ages 10-14 having the lowest rate (2572.06). Females (5179.07) have a higher ED visit rate than males (4204.00), and Black or African Americans are the race category with the highest rate of ED visits (7032.67), followed by American Indian or Alaska Natives (4047.43). While those not of Hispanic origin have a higher ED visit rate (4054.34) compared to those who are of Hispanic origin (3181.71) the high degree of missingness for ethnicity renders these rates unreliable.

Table 3.2: NC DETECT ED Visit Data Compared to NC Population, 2019

	All NC Resident ED Visits	Census	Crude Rate per 10,000
Total	4,935,765	10,488,084	4706.07
Age Group			

	All NC Resident ED Visits	Census	Crude Rate per 10,000
< 1 year	93,038 (1.88%)	118,891 (1.13%)	7825.49
1-4 years	245,582 (4.98%)	490,879 (4.68%)	5002.90
5-9 years	186,864 (3.79%)	628,866 (6%)	2971.44
10-14 years	171,198 (3.47%)	665,606 (6.35%)	2572.06
15-19 years	258,100 (5.23%)	688,195 (6.56%)	3750.39
20-24 years	359,756 (7.29%)	698,865 (6.66%)	5147.72
25-29 years	401,932 (8.14%)	733,576 (6.99%)	5479.08
30-34 years	363,461 (7.36%)	682,493 (6.51%)	5325.49
35-39 years	323,239 (6.55%)	662,260 (6.31%)	4880.85
40-44 years	296,227 (6.00%)	641,167 (6.11%)	4620.12
45-49 years	306,521 (6.21%)	688,599 (6.57%)	4451.37
50-54 years	309,406 (6.27%)	675,468 (6.44%)	4580.62
55-59 years	313,033 (6.34%)	703,294 (6.71%)	4450.96
60-64 years	275,670 (5.59%)	658,831 (6.28%)	4184.23
65-69 years	250,444 (5.07%)	573,844 (5.47%)	4364.32
70-74 years	237,459 (4.81%)	472,664 (4.51%)	5023.84
75-79 years	196,506 (3.98%)	316,306 (3.02%)	6212.53
80-84 years	155,957 (3.16%)	198,886 (1.9%)	7841.53
85+ years	191,226 (3.87%)	189,394 (1.81%)	10096.73
Missing	146 (0.00%)	N/A	N/A
Sex			
Female	2,790,389 (56.53%)	5,387,820 (51.37%)	5179.07
Male	2,144,153 (43.44%)	5,100,264 (48.63%)	4204.00
Unknown / Missing	1,223 (0.02%)	N/A	N/A
Race			
American Indian or Alaska Native	63,674 (1.29%)	177,169 (1.69%)	4047.43
Asian or Pacific Islander	49,360 (1.00%)	369,134 (3.52%)	875.91
Black or African American	1,696,759 (34.38%)	2,421,439 (23.09%)	7032.67
White	2,708,641 (54.88%)	7,520,342 (71.7%)	3603.44
Other	321,672 (6.52%)	N/A	N/A
Missing	95,659 (1.94%)	N/A	N/A
Ethnicity			
Hispanic	326,561 (6.62%)	1,025,830 (9.78%)	3181.71
Not Hispanic	3,836,562 (77.73%)	9,462,254 (90.22%)	4054.34

	All NC Resident ED Visits	Census	Crude Rate per 10,000
Missing	772,642 (15.65%)	N/A	N/A
Insurance[^]			
Medicaid	1,166,025 (23.62%)	1,813,100 (17.9%)	N/A
Medicare	1,099,856 (22.28%)	1,553,100 (15.3%)	N/A
Private Insurance	1,174,160 (23.79%)	5,367,300 (53%)	N/A
Self-Pay / Uninsured	921,830 (18.68%)	1,159,300 (11.4%)	N/A
Worker's Compensation	42,407 (0.86%)	N/A	N/A
Other	269,277 (5.46%)	N/A	N/A
Unknown/Missing	262,210 (5.31%)	N/A	N/A

[^]KFF Insurance Data for NC, 2019

County Level Demographic Comparisons

County-level descriptive data by sex, age group, race, ethnicity, and insurance coverage vary compared to the 2019 statewide data. Compared to the 2019 statewide ED visit rate of 4706.07 per 10,000 person years, the 2019 median ED visit crude rate is 5,245 with the 25th percentile at 4,152 and the 75th percentile at 6,250.

Sex

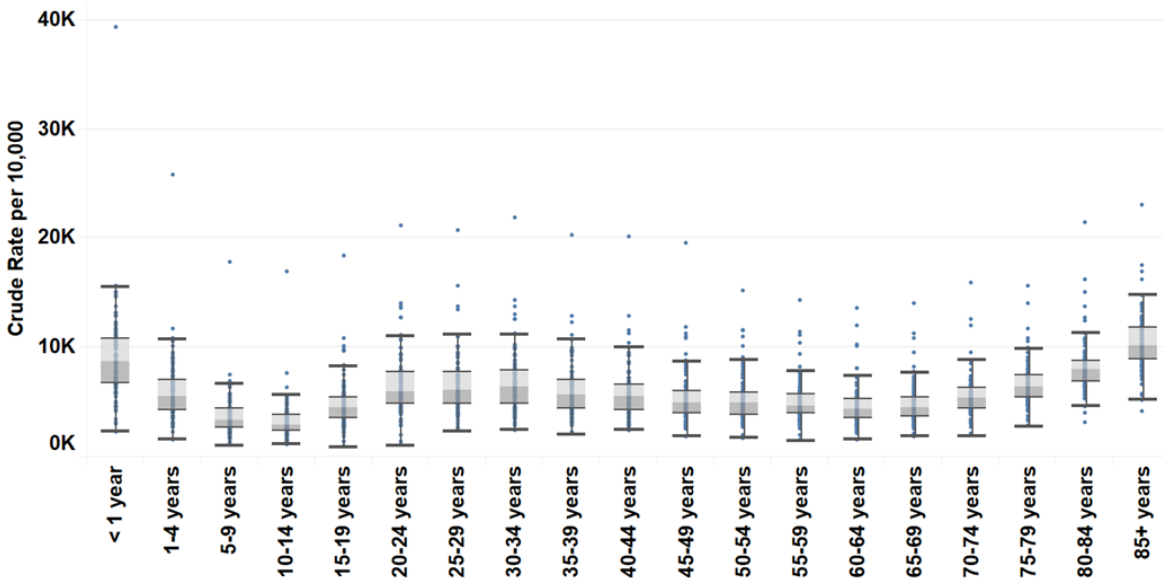
Females represent the majority proportion of ED visits across all counties with a range of 51% of ED Visits (51% of the population) in Dare County to 62% of ED visits (53% of the population) in Martin County. Counties with a minority proportion of female residents, Alexander (49%), Anson (49%), Avery (54%), Bertie (49%), Greene (45%), Hyde (47%), Onslow (45%), Pamlico (49%), and Tyrell (44%) still have a higher percentage of female ED visits compared to males: Alexander (53%), Anson (57%), Avery (55%), Bertie (57%), Greene (54%), Hyde (52%), Pamlico (54%), and Tyrell (52%). The county with the biggest difference between population sex and ED visit sex is Onslow County where 55% of the population is male, but males make only 41% of the ED visits. In 2019, the median ED visit crude rate per 10,000

person-years for females is 5,740 and for males is 4,255, higher than the statewide rates of 5,179 and 4,204, respectively.

Age Group

County level rates are comparable to statewide rates for ED visits by age group, with those under 1 (median rate 8,710) and those ages 85+ (median rate 10,177) having the highest rates per 10,000 person-years. The median rates for all age groups are higher than the statewide rates per 10,000 person-years. The median rates for all age groups are higher than the statewide rates, except for the 10-14 age group which is slightly lower (2,939 median rate vs. 2,572 statewide rate).

Figure 3.1: County-level ED Visit Crude Rates by Age Group

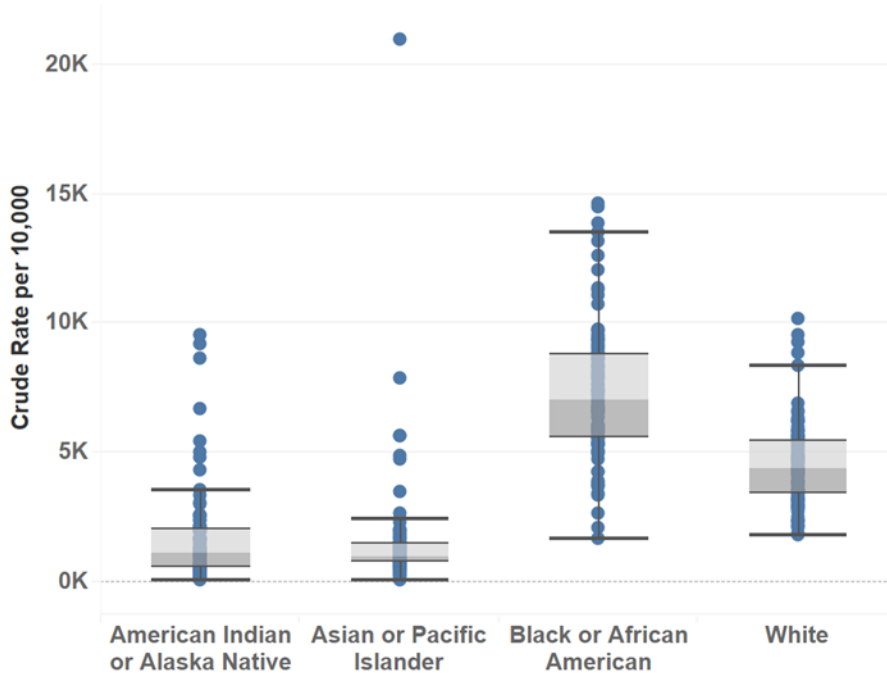


Race

In the 2019 data, Black or African Americans are heavily overrepresented in ED visits in 87 counties compared to the population. Percent differences between ED visit proportions and population proportions among Black or African Americans range from Mitchell County with an overrepresentation of 159.62% to Bertie with an overrepresentation of just 1.20%.

Black or African Americans have the highest crude ED visit rates in 2019 for most counties, followed by whites, American Indian or Alaska Natives and Asian or Pacific Islanders.

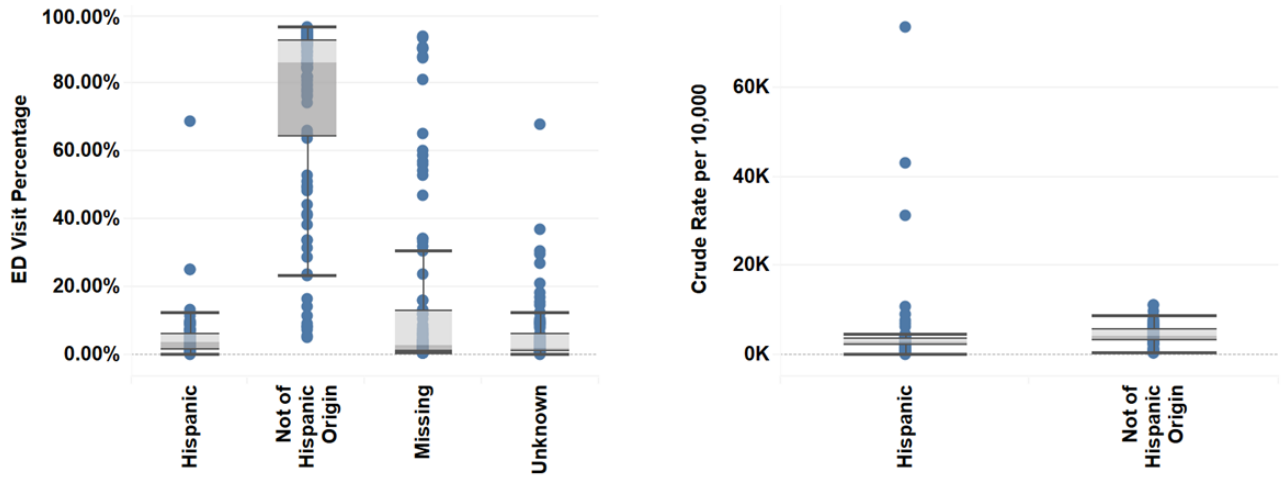
Figure 3.2: County-level ED Visit Crude Rates per 10,000 person-years by Race Category, 2019



Ethnicity

With the high level of missingness in the ethnicity data, county-level rates may be unreliable, so box plots for both rate and percentage distributions are shown in Figure 3.3.

Figure 3.3: Ethnicity Distributions by Percentage of ED Visits and Crude Rates, 2019

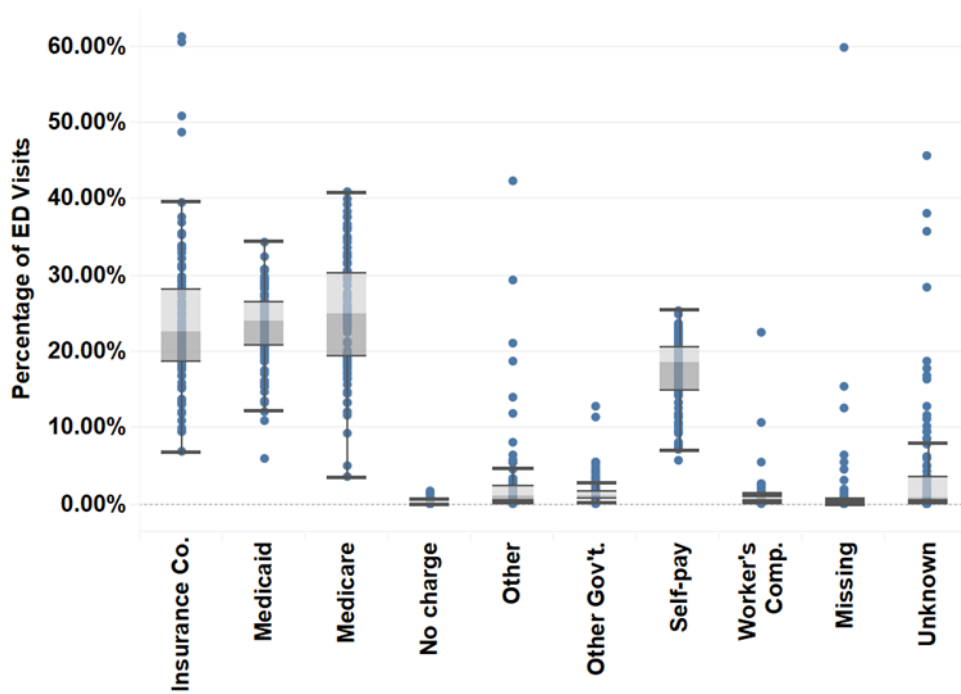


Insurance Coverage

Detailed information on the insurance coverage for populations at the county level is not readily available, but ED visit trends by insurance coverage can be compared to statewide ED visit insurance coverage percentages. In the counties with under 10% missing insurance coverage in 2019, 49 counties had a higher percentage of self-pay ED visits compared to the overall NC ED visit percentage (18.68%), with Clay (25.30%), Mecklenburg (24.81%), Wayne (23.52%), Caldwell (23.34%), and Cherokee (23.20%) comprising the top five counties, and Mitchell (9.56%), Yancey (9.11%), Warren (7.81%), Yadkin (7.47%), and Vance (7.32%) the bottom five counties. Twenty-eight counties had a higher proportion of ED visits with private insurance compared to the statewide ED visit percentage (23.79%), with Pasquotank (61.20%), Camden (60.58%), Currituck (50.78%), Perquimans (48.69%) and Lee (39.50%) comprising the top five and Forsyth (13.35%), Ashe (12.07%), Gaston (10.87%), Craven (9.92%), and Person (9.44%) at the bottom. Fifty-four counties are higher than the statewide percentage for Medicaid coverage (23.62%). Durham (34.31%), Vance (32.28%), Richmond (30.74%), Lenoir (30.64%), and

Robeson (30.38%) make up the top five while Cumberland (15.48%), Bladen (15.42%), Washington (15.42%), Dare (14.57%), and Martin (5.87%) are at the bottom. Keeping in mind that some counties have larger proportions of the population over 65 years of age, 65 counties have a higher proportion of ED visits with an insurance coverage of Medicare compared to overall NC ED visits (22.28%). Transylvania (40.79%), Ashe (40.03%), Yancey (39.12%), Macon (38.34%) and Mitchell (37.66%) represent the top five while Cumberland (13.22%), Perquimans (12.16%), Currituck (11.64%), Camden (4.87%) and Pasquotank (3.51%) are at the bottom.

Figure 3.4: County-level ED Visits by Insurance Coverage Distribution, 2019



Statewide & County Level ED Visit Trends for Select Mental Health and Chronic Conditions

Statewide ED Visit Trends for Anxiety-Related Disorders

The statewide crude rate per 10,000 person-years for ED visits with an anxiety-related diagnosis has declined each year from 2017 (220.23) to 2020 (172.72), although these visits have remained relatively stable as a percentage of total ED visits across this same time with an average of 4.54%. The decline in the 2020 ED visit rate represents an overall drop in ED visits during that year. From 2017 to 2019, overall NC ED visits averaged over 4.9 million ED visits; this number fell to just over 4 million ED visits in 2020.

Anxiety-related diagnosis codes are used sparingly in ED visits for the under 18 population, and females of all ages receive these diagnosis codes at twice the rate of males. Asians and Pacific Islanders have, by far, the lowest rates for anxiety-related diagnoses with the white population having the highest rate, except for 2020 during which American Indian and Alaska Natives had the highest rate (184.68). The largest proportion of ED visits with an anxiety-related diagnosis are covered by Medicare, followed by private insurance and Medicaid. On average, 6.5% of ED visits covered by Medicare have an anxiety-related diagnosis.

Table 3.3: Anxiety-related disorders as any diagnosis: ED visit count, ED visit crude Rate per 10,000 person-years & percentage of total ED Visits, NC DETECT 2017-2020

	2017	2018	2019	2020 (Provisional)
Anxiety ED Visits	226,133	224,924	220,663	181,156
Crude Rate per 10,000	220.23	216.66	210.39	172.73
Percentage of Total ED Visits	4.56%	4.62%	4.47%	4.49%
Age Group				
< 18	7,547	8,222	8,209	6,670
	32.80	35.72	35.68	28.99
	0.88%	1.02%	1.00%	1.32%
18+	218,583	216,702	212,452	174,485
	274.34	268.20	259.49	213.11
	5.33%	5.34%	5.17%	4.94%
Sex				

	2017	2018	2019	2020 (Provisional)
Female	154,517 293.14 5.50%	153,024 287.03 5.57%	150,314 278.99 5.39%	122,057 226.54 5.47%
Male	71,157 142.39 3.33%	71,360 141.30 3.39%	70,311 137.86 3.28%	59,077 115.83 3.28%
Unknown / Missing	459	540	38	22
Race				
American Indian or Alaska Native	2,984 172.47 4.73%	3,585 204.74 6.15%	3,485 196.70 5.47%	3,272 184.68 6.63%
Asian or Pacific Islander	604 17.48 1.49%	649 18.15 1.38%	750 20.32 1.52%	683 18.50 1.24%
Black or African American	39,147 165.50 2.42%	40,752 170.19 2.46%	39,973 165.08 2.36%	34,375 141.96 2.49%
White	174,400 236.18 5.99%	169,866 227.87 6.19%	165,435 219.98 6.11%	131,135 174.37 5.96%
Other	5,224 N/A 2.05%	6,328 N/A 2.24%	6,627 N/A 2.06%	6,331 N/A 2.35%
Missing	3,774 N/A 5.29%	3,744 N/A 4.73%	4,393 N/A 4.59%	5,360 N/A 6.03%
Ethnicity				
Hispanic	6,644 69.13 2.17%	8,388 84.33 2.64%	8,192 79.86 2.51%	7,592 74.01 2.89%
Not Hispanic	194,603 209.09 4.79%	189,473 201.85 4.88%	175,195 185.15 4.57%	142,182 150.26 4.53%
Missing	24,886 4.22%	27,063 4.07%	37,276 4.82%	31,382 4.94%
Insurance				
Count				
Percentage of Condition				
Percentage of Total Visits				
Medicaid	46,662 21.51% 3.67%	43,154 19.19% 3.61%	42,045 19.05% 3.61%	38,180 21.08% 4.24%
Medicare	76,201 33.70% 7.04%	72,837 32.38% 6.73%	72,594 32.90% 6.60%	55,885 30.85% 5.83%
Private Insurance	48,632 21.51% 4.47%	55,248 24.56% 4.83%	54,413 24.66% 4.63%	49,345 27.24% 4.83%
Self-Pay / Uninsured	33,172 14.67% 3.59%	33,797 15.03% 3.62%	31,123 14.10% 3.38%	24,613 13.59% 3.29%
Worker's Compensation	1,026 0.45%	1,131 0.50%	1,452 0.66%	1,245 0.69%

	2017	2018	2019	2020 (Provisional)
	2.87%	2.88%	3.42%	4.13%
Other	7,464 3.30% 3.75%	6,601 2.93% 3.50%	6,967 3.85% 2.64%	6,967 3.85% 2.64%
Unknown/Missing	12,976 5.74% 3.97%	12,156 5.40% 4.25%	11,360 5.15% 4.33%	4,949 2.73% 4.41%

Statewide ED Visit Trends Depression

American Indian and Alaska Natives had the highest crude ED visit rates for depression-related diagnoses in 2019 and 2020. Those aged 0-17 have the lowest rates for depression-related diagnoses, but this age group had the only increase as a percentage of total ED visits in 2020.

Medicare makes up the largest proportion of insurance coverage across all four years, followed by private insurance and then Medicaid.

Table 3.4: Depression

	2017	2018	2019	2020 (Provisional)
Total ED Visits	193,876	183,647	181,831	146,008
Crude Rate per 10,000	188.81	176.90	173.37	139.21
Percentage of ED Visits	3.91%	3.77%	3.68%	3.62%
Age Group				
0-17	9,461 41.12 1.11%	9,754 42.38 1.20%	10,010 43.51 1.21%	8,295 36.05 1.64%
18-64	135,615 213.91 4.31%	125,667 196.59 4.09%	121,725 189.12 3.95%	98,365 152.83 3.72%
65+	48,800 299.83 5.10%	48,224 285.78 4.92%	50,095 286.08 4.86%	39,352 224.73 4.43%
Sex				
Female	127,313 241.53 4.53%	118,550 222.37 4.31%	116,677 216.56 4.18%	93,120 172.83 4.17%
Male	66,132 132.34 3.09%	64,588 127.89 3.07%	65,127 127.69 3.04%	52,875 103.67 2.93%
Unknown / Missing	431	509	27	18
Race				
American Indian or Alaska Native	2,566 148.31 4.07%	3,117 177.98 5.35%	3,237 182.71 5.08%	2,883 162.73 5.84%
Asian or Pacific Islander	482 13.95	626 17.51	666 18.04	527 14.28

	2017	2018	2019	2020 (Provisional)
	1.19%	1.33%	1.35%	0.96%
Black or African American	39,120 165.39 2.42%	38,433 160.50 2.32%	38,019 157.01 2.24%	30,279 125.05 2.20%
White	144,391 195.54 4.96%	133,564 179.18 4.87%	131,240 174.51 4.85%	103,567 137.72 4.71%
Other	4,351 N/A 1.71%	5,027 N/A 1.78%	5,366 N/A 1.67%	4,689 N/A 1.74%
Missing	2,966 N/A 4.16%	2,880 N/A 3.64%	3,303 N/A 3.45%	4,068 N/A 4.58%
Ethnicity				
Hispanic	4,749 49.41 1.55%	6,117 61.50 1.92%	6,004 58.53 1.84%	4,790 46.69 1.82%
Not Hispanic	167,217 179.67 4.12%	153,607 163.64 3.96%	144,250 152.45 3.76%	115,278 121.83 3.67%
Missing	21,910 N/A 3.71%	23,923 N/A 3.60%	31,577 N/A 4.08%	25,945 N/A 4.09%
Insurance Coverage				
Count				
Percentage of Condition				
Percentage of Total Visits				
Medicaid	41,710 21.51% 3.27%	37,872 20.62% 3.17%	37,230 20.48% 3.19%	32,882 22.52% 3.65%
Medicare	67,426 34.78% 6.23%	62,347 33.95% 5.76%	61,939 34.06% 5.63%	48,585 33.28% 5.07%
Private Insurance	38,272 19.74% 3.51%	39,673 21.60% 3.47%	39,743 21.86% 3.38%	35,483 24.30% 3.47%
Self-Pay / Uninsured	26,521 13.68% 2.80%	25,940 14.12% 2.78%	24,182 13.30% 2.62%	17,349 11.88% 2.32%
Worker's Compensation	859 0.44% 2.41%	919 0.50% 2.34%	1,199 0.66% 2.83%	1,001 0.69% 3.32%
Other	7,389 3.81% 3.71%	6,396 3.48% 3.40%	7,750 4.26% 2.88%	6,736 4.61% 2.56%
Unknown/Missing	11,699 6.03% 3.58%	10,500 5.72% 3.68%	9,788 5.38% 3.73%	4,022 2.75% 3.58%

Statewide ED Visit Trends for Self-Inflicted Injury

Rates for nonfatal self-inflicted injury are lower than the other mental health-related conditions included in this chapter. Rates declined from 2018 to 2020 but increased slightly as a percentage of total visits in 2020. Unlike the other mental health conditions covered in this chapter, rates are higher in the under 18 age group compared to the 18 and over age group. Whites had the highest rates in 2017 and 2018, while Blacks or African Americans had the highest rates in 2019 and 2020.

Table 3.5: Nonfatal Self-Inflicted Injury

	2017	2018	2019	2020 (Provisional)
Total ED Visits	11,582	12,044	12,096	11,088
Crude Rate per 10,000	11.28	11.60	11.53	10.57
Percentage of ED Visits	0.23%	0.25%	0.25%	0.27%
Age Group				
< 18	2,538 11.03 0.30%	2,775 12.06 0.34%	2,794 12.14 0.34%	2,779 12.08 0.55%
18+	9,041 11.35 0.22%	9,269 11.47 0.23%	9,299 11.36 0.23%	8,308 10.15 0.24%
Sex				
Female	7,127 13.52 0.25%	7,313 13.72 0.27%	7,235 13.43 0.26%	6,689 12.42 0.30%
Male	4,423 8.85 0.21%	4,698 9.30 0.22%	4,853 9.52 0.23%	4,387 8.60 0.24%
Unknown / Missing	32	33	8	12
Race				
American Indian or Alaska Native	164 9.48 0.26%	125 7.14 0.21%	114 6.43 0.18%	101 5.70 0.20%
Asian or Pacific Islander	94 2.72 0.23%	113 3.16 0.24%	109 2.95 0.22%	90 2.44 0.16%
Black or African American	2,367 10.01 0.15%	2,619 10.94 0.16%	2,752 11.37 0.16%	2,509 10.36 0.18%
White	8,181 11.08 0.28%	8,320 11.16 0.30%	8,041 10.69 0.30%	7,380 9.81 0.34%
Other	575 N/A 0.23%	698 N/A 0.25%	867 N/A 0.27%	790 N/A 0.29%
Missing	201	169	213	218
Ethnicity				
Hispanic	598	714	716	712

	2017	2018	2019	2020 (Provisional)
	6.22 0.19%	7.18 0.22%	6.98 0.22%	6.94 0.27%
Not Hispanic	9,764 10.49 0.24%	9,945 10.59 0.26%	9,769 10.32 0.25%	8,831 9.33 0.28%
Missing	1,220 N/A 0.21%	1,385 N/A 0.21%	1,611 N/A 0.21%	1,545 N/A 0.24%
Insurance				
Count				
Percentage of Condition				
Percentage of Total Visits				
Medicaid	3,581 30.92% 0.28%	3,728 30.95% 0.31%	3,558 29.41% 0.31%	3,501 31.57% 0.39%
Medicare	1,216 10.50% 0.11%	1,170 9.71% 0.11%	1,167 9.65% 0.11%	1,162 10.48% 0.12%
Private Insurance	2,923 25.24% 0.27%	3,071 25.50% 0.27%	3,105 25.67% 0.26%	3,076 27.74% 0.30%
Self-Pay / Uninsured	2,388 20.62% 0.25%	2,522 20.94% 0.27%	2,516 20.80% 0.27%	1,975 17.81% 0.26%
Worker's Compensation	10 0.09% 0.03%	21 0.17% 0.05%	18 0.15% 0.04%	21 0.19% 0.07%
Other	711 6.14% 0.36%	737 6.12% 0.39%	947 7.83% 0.35%	1,059 9.55% 0.40%
Unknown/Missing	753 6.50% 0.23%	795 6.60% 0.28%	785 6.49% 0.30%	288 2.60% 0.26%

Statewide ED Visit Trends for Suicidal Ideation

Trends in crude rates for suicidal ideation increased from 2017 to 2019 and then decreased in 2020 mirroring the reduction in ED visits statewide during the COVID-19 pandemic (Table 3.6). Suicidal ideation ED visits as a percentage of total ED visits increased from 2017 to 2020, especially among those under 18, which increased from 0.80% in 2017 to 1.47% in 2020. Rates for suicidal ideation ED visits increased for Black or African Americans, Asian and Pacific Islanders, and Whites from 2017 to 2019 and then decreased in 2020. Rates for American Indian or Alaska Natives increased across all four years. Suicidal ideation as a

percentage of total ED visits increased for all race categories across all four years except for a decrease in 2020 for Asian and Pacific Islanders. American Indian or Alaska Natives had the highest rates for suicidal ideation in 2017 and 2020, while Black or African Americans had the highest rates in 2018 and 2019. Medicaid covers the largest proportion of suicidal ideation ED visits across all four years, followed by self-pay and private insurance.

Table 3.6: Suicidal Ideation as any diagnosis: ED visit count, ED visit crude Rate per 10,000 person-years & percentage of total ED Visits, NC DETECT 2017-2020

	2017	2018	2019	2020 (Provisional)
Total ED Visits	43,073	47,396	50,751	44,547
Crude Rate per 10,000	41.95	45.65	48.39	42.47
Percentage of ED Visits	0.87%	0.97%	1.03%	1.10%
Age Group				
< 18	6,863 29.83 0.80%	7,926 34.43 0.98%	8,396 36.49 1.02%	7,471 32.47 1.47%
18+	36,209 45.45 0.88%	39,468 48.85 0.97%	42,355 51.73 1.03%	37,077 45.29 1.05%
Sex				
Female	20,094 38.12 0.72%	21,616 40.55 0.79%	23,095 42.87 0.83%	19,914 36.96 0.89%
Male	22,898 45.82 1.07%	25,620 50.73 1.22%	27,638 54.19 1.29%	24,630 48.29 1.37%
Unknown / Missing	81	160	18	8
Race				
American Indian or Alaska Native	838 48.43 1.33%	906 51.73 1.55%	922 52.04 1.45%	1,005 56.73 2.04%
Asian or Pacific Islander	196 5.67 0.48%	245 6.85 0.52%	306 8.29 0.62%	269 7.29 0.49%
Black or African American	10,974 46.39 0.68%	12,976 54.19 0.78%	14,499 59.88 0.85%	12,624 52.13 0.92%
White	28,782 38.98 0.99%	30,383 40.76 1.11%	31,753 42.22 1.17%	27,371 36.40 1.24%
Other	1,609 N/A 0.63%	2,026 N/A 0.72%	2,436 N/A 0.76%	2,314 N/A 0.86%
Missing	674	860	835	969
Ethnicity				
Hispanic	1,598 16.63 0.52%	1,953 19.64 0.61%	2,121 20.68 0.65%	1,962 19.13 0.75%

	2017	2018	2019	2020 (Provisional)
Not Hispanic	36,559 39.28 0.90%	39,531 42.11 1.02%	40,824 43.14 1.06%	35,340 37.35 1.13%
Missing	4,916 0.83%	5,912 0.89%	7,806 1.01%	7,245 1.14%
Insurance				
Count				
Percentage of Condition				
Percentage of Total Visits				
Medicaid	14,202 32.97% 1.11%	15,493 32.69% 1.30%	16,179 31.88% 1.39%	15,239 34.21% 1.69%
Medicare	6,192 14.38% 0.57%	6,830 14.41% 0.63%	7,268 14.32% 0.66%	6,615 14.85% 0.69%
Private Insurance	7,311 16.97% 0.67%	8,156 17.21% 0.71%	8,864 17.47% 0.75%	8,231 18.48% 0.80%
Self-Pay / Uninsured	9,919 23.03% 1.05%	11,048 23.31% 1.18%	11,124 21.92% 1.10%	8,808 19.77% 1.18%
Worker's Compensation	45 0.10% 0.13%	73 0.15% 0.19%	84 0.17% 0.20%	81 0.18% 0.27%
Other	2,729 6.34% 1.37%	2,924 6.17% 1.55%	4,338 8.55% 1.61%	4,497 10.09% 1.71%
Unknown/Missing	2,675 6.21% 0.82%	2,872 6.06% 1.01%	2,894 5.70% 1.10%	1,065 2.39% 0.95%

Statewide ED Visit Trends for Trauma and Stressor-Related Disorders

Trends in crude rates for trauma- and stressor-related disorders increased slightly from 2017 to 2018, stabilized in 2019 and then decreased in 2020 (Table 7). Females represent the larger proportion of ED visits for this mental health subset, but the difference in rates (approximately 30%) is not as high as anxiety-related disorders. While rates for other mental health conditions vary among race categories by year, rates for trauma- and stressor-related disorders are highest among Black or African Americans across all four years.

Table 3.7: Trauma and Stressor-Related Disorders as any diagnosis

	2017	2018	2019	2020 (Provisional)
Total ED Visits	34,887	36,704	37,063	28,503
Crude Rate per 10,000	33.98	35.35	35.34	27.18
Percentage of ED Visits	0.70%	0.75%	0.75%	0.71%
Age Group				
< 18	3,298 14.33 0.39%	3,590 15.60 0.44%	3,715 16.15 0.45%	3,065 13.32 0.60%
18+	31,587 39.64 0.77%	33,114 40.98 0.82%	33,348 40.73 0.81%	25,437 31.07 0.72%
Sex				
Female	20,696 39.26 0.74%	21,556 40.43 0.78%	21,359 39.64 0.77%	16,455 30.54 0.74%
Male	14,109 28.23 0.66%	15,033 29.77 0.72%	15,694 30.77 0.73%	12,044 23.61 0.67%
Unknown / Missing	82	115	10	4
Race				
American Indian or Alaska Native	448 25.89 0.71%	534 30.49 0.92%	484 27.32 0.76%	416 23.48 0.84%
Asian or Pacific Islander	144 4.17 0.36%	150 4.19 0.32%	191 5.17 0.39%	150 4.06 0.27%
Black or African American	8,010 33.86 0.50%	8,894 37.14 0.54%	9,466 39.09 0.56%	7,335 30.29 0.53%
White	24,633 33.36 0.85%	25,181 33.78 0.92%	24,588 32.70 0.91%	18,452 24.54 0.84%
Other	1,062 0.42%	1,313 0.46%	1,524 0.47%	1,255 0.47%
Missing	590 0.83%	632 0.80%	810 0.85%	895 1.01%
Ethnicity				
Hispanic	1,220 12.69 0.40%	1,454 14.62 0.46%	1,446 14.10 0.44%	1,158 11.29 0.44%
Not Hispanic	29,751 31.97 0.73%	30,608 32.61 0.79%	29,266 30.93 0.76%	22,130 23.39 0.71%
Missing	3,916 0.66%	4,642 0.70%	6,351 0.82%	5,215 0.82%
Insurance				
Count				
Percentage of Condition				
Percentage of Total Visits				
Medicaid	10,383 29.76%	10,740 29.26%	10,433 28.15%	8,551 30.00%

	2017	2018	2019	2020 (Provisional)
	0.81%	0.90%	0.89%	0.95%
Medicare	8,197 23.50% 0.76%	8,123 22.13% 0.75%	8,315 22.43% 0.76%	6,083 21.34% 0.63%
Private Insurance	5,843 16.75% 0.54%	6,822 18.59% 0.60%	7,124 19.22% 0.61%	6,052 21.23% 0.59%
Self-Pay / Uninsured	5,918 16.96% 0.62%	6,618 18.03% 0.71%	6,423 17.33% 0.79%	4,432 15.55% 0.59%
Worker's Compensation	103 0.30% 0.29%	104 0.28% 0.26%	152 0.41% 0.36%	123 0.43% 0.41%
Other	2,502 7.17% 1.26%	2,470 6.73% 1.31%	3,062 8.26% 1.14%	2,607 9.15% 0.99%
Unknown/Missing	1,941 5.56% 0.59%	1,827 4.98% 0.64%	1,554 4.19% 0.59%	659 2.31% 0.41%

Statewide ED Visit Trends for Asthma

For all ages and the under 18 age group, ED visit crude rates per 10,000 person-years decreased from 2017 through 2020. The 18+ age group ED visit increased slightly from 2017 to 2018 but declined in 2019 and 2020. Asthma as a percentage of all ED visits increased across all age groups for 2017 and 2018, with decreases in 2019 and 2020.

Table 3.8: Asthma as any diagnosis: ED visit count, ED visit crude Rate per 10,000 person-years & percentage of total ED Visits, NC DETECT 2017-2020

	2017	2018	2019	2020 (Provisional)
Total	212,920	214,665	191,626	144,538
Crude Rate per 10,000	207.38	206.77	182.70	137.81
Percentage of ED Visits	4.30%	4.41%	3.88%	3.58%
Age Group				
< 18	48,418 210.44 5.67%	47,148 204.82 5.82%	41,667 181.10 5.05%	21,334 92.73 4.21%
18+	164,534 206.50 4.01%	167,517 207.32 4.13%	149,957 183.15 3.65%	123,204 150.48 3.49%
Sex				
Female	135,106 256.32 4.81%	136,410 255.87 4.96%	121,682 225.85 4.36%	93,623 173.77 4.19%

	2017	2018	2019	2020 (Provisional)
Male	77,503 155.09 3.63%	77,710 153.87 3.70%	69,920 137.09 3.26%	50,898 99.79 2.82%
Unknown / Missing	311	545	24	14
Race				
American Indian or Alaska Native	2,942 170.04 4.67%	2,949 168.39 5.06%	2,921 164.87 4.59%	2,233 126.0 4.5%
Asian or Pacific Islander	795 23.01 1.96%	880 24.61 1.87%	887 24.0 1.8%	600 16.3 1.1%
Black or African American	92,517 391.13 5.72%	96,061 401.17 5.80%	86,925 359.0 5.1%	64,176 265.0 4.7%
White	104,293 141.24 3.58%	101,046 135.55 3.68%	87,036 115.7 3.2%	66,677 88.7 3.0%
Other	8,928 N/A 3.51%	10,438 N/A 3.69%	10,198 N/A 3.2%	7,271 N/A 2.7%
Missing	3,445 N/A 4.83%	3,291 N/A 4.16%	3,659 N/A 3.83%	3,576 N/A 4.02%
Ethnicity				
Hispanic	10,533 109.59 3.43%	12,089 121.55 3.80%	11,203 109.21 3.43%	8,317 81.08 3.17%
Not Hispanic	181,613 195.13 4.47%	176,728 188.27 4.55%	150,387 158.93 3.92%	112,666 119.07 3.59%
Missing	20,774 N/A 3.52%	25,848 N/A 3.89%	30,036 N/A 3.89%	23,550 N/A 3.71%
Insurance				
Count				
Percentage of Condition				
Percentage of Total Visits				
Medicaid	72,458 34.03% 5.68%	69,303 32.28% 5.80%	62,143 32.43% 5.33%	44,981 31.12% 4.99%
Medicare	39,977 18.77% 3.69%	36,945 17.21% 3.42%	32,838 17.14% 2.99%	25,182 17.42% 2.64%
Self-Pay / Uninsured	35,509 16.67% 3.74%	38,549 17.96% 4.13%	35,579 18.57% 3.86%	26,527 18.35% 3.55%
Private Insurance	43,529 20.44% 4.00%	50,724 23.63% 4.44%	46,363 24.19% 3.95%	38,510 26.64% 3.77%
Worker's Compensation	1,092 0.51% 3.06%	1,324 0.62% 3.37%	1,558 0.81% 3.67%	993 0.69% 3.29%
Other	6,763	6,126	6,973	5,624

	2017	2018	2019	2020 (Provisional)
	3.18%	2.85%	3.64%	3.89%
	3.40%	3.25%	2.59%	2.13%
Unknown/Missing	13,592	11,694	6,172	2,704
	6.38%	5.45%	3.22%	1.87%
	4.16%	4.09%	2.35%	2.41%

Statewide ED Visit Trends for COPD

The 75+ age group consistently has the highest COPD crude rates from 2017-2020, but the 65-74 age group has the highest percentage of ED visits with a COPD diagnosis (12.29% in 2019). American Indian or Alaska Natives have the highest rate of COPD (291.47 in 2019), followed by Black or African Americans (231.52 in 2019) and whites (231.06) which have very similar rates across all four years. Medicare covers the majority of ED visits with a COPD diagnosis (51.44% in 2019), followed by private insurance (19.32% in 2019) and Medicaid (13.59 in 2019).

Table 3.9: COPD as any diagnosis: ED visit count, ED visit crude Rate per 10,000 person-years & percentage of total ED Visits, NC DETECT 2017-2020

	2017	2018	2019	2020 (Provisional)
Total	246,398	254,581	242,349	183,613
Crude Rate per 10,000	239.96	245.22	231.07	175.07
Percentage of ED Visits	4.97%	5.23%	4.91%	4.55%
Age Group				
< 18	3,005 13.06 0.35%	2,656 11.54 0.33%	2,174 9.45 0.26%	722 3.14 0.14%
18-44	26,308 72.37 1.36%	25,733 70.06 1.37%	22,621 60.97 1.21%	14,121 38.06 0.88%
45-54	39,222 283.42 6.10%	38,563 280.04 6.19%	33,862 248.24 5.50%	24,341 178.44 4.66%
55-64	61,965 469.17 11.05%	65,427 487.43 11.51%	63,207 464.03 10.74%	50,443 370.33 9.80%
65-74	58,413 596.33 12.93%	61,111 605.23 13.18%	59,951 572.87 12.29%	47,839 457.13 11.20%
75+	57,482 887.03 11.40%	61,088 901.36 11.81%	60,533 859.13 11.13%	46,217 655.95 10.02%
Sex				

	2017	2018	2019	2020 (Provisional)
Female	140,113 265.82 4.99%	144,202 270.48 5.24%	136,906 254.10 4.91%	101,076 187.60 4.53%
Male	105,693 211.50 4.94%	109,818 217.45 5.22%	105,412 206.68 4.92%	82,596 161.94 4.58%
Unknown / Missing	592	561	31	14
Race				
American Indian or Alaska Native	4,488 259.39 7.12%	5,623 321.07 9.65%	5,164 291.47 8.11%	4,280 241.58 8.67%
Asian or Pacific Islander	531 15.37 1.31%	534 14.93 1.14%	578 15.66 1.17%	380 10.29 0.69%
Black or African American	53,940 228.04 3.33%	57,346 239.49 3.46%	56,062 231.52 3.30%	41,711 172.26 3.02%
White	180,856 244.92 6.22%	184,209 247.12 6.71%	173,767 231.06 6.42%	131,896 175.39 6.00%
Other	4,024 N/A 1.58%	4,160 N/A 1.47%	3,963 N/A 1.23%	2,774 N/A 1.03%
Missing	2,559 N/A 3.59%	2,709 N/A 3.42%	2,815 N/A 2.94%	2,645 N/A 2.98%
Ethnicity				
Hispanic	5,122 53.29 1.67%	5,266 52.95 1.66%	5,314 51.80 1.63%	3,925 38.26 1.50%
Not Hispanic	217,783 234.00 5.36%	220,734 235.15 5.68%	201,755 213.22 5.26%	151,223 159.82 4.82%
Missing	23,493 N/A 3.98%	28,581 N/A 4.30%	35,280 N/A 4.56%	28,466 N/A 4.48%
Insurance				
Count				
Percentage of Condition				
Percentage of Total Visits				
Medicaid	36,570 14.84% 2.87%	35,444 13.92% 2.97%	32,942 13.59% 2.83%	25,837 14.07% 2.87%
Medicare	129,600 52.60% 11.97%	131,342 51.59% 12.14%	124,661 51.44% 11.33%	96,250 52.42% 10.04%
Self-Pay / Uninsured	23,156 9.40% 2.44%	23,697 9.31% 2.54%	21,117 8.71% 2.29%	13,577 7.39% 1.18%
Private Insurance	34,453 13.98% 3.16%	43,063 16.92% 3.77%	35,479 19.32% 3.47%	35,479 19.32% 3.47%

	2017	2018	2019	2020 (Provisional)
Worker's Compensation	862 0.35% 2.41%	1,033 0.41% 2.63%	1,281 0.53% 3.02%	1,050 0.57% 3.48%
Other	6,042 2.45% 3.04%	6,028 2.37% 3.20%	7,268 3.00% 2.70%	6,687 3.64% 2.54%
Unknown/Missing	15,715 6.38% 4.81%	13,974 5.49% 4.89%	11,018 4.55% 4.20%	4,809 2.62% 4.29%

Chief Complaint Analysis: Unigrams

The results of the chief complaint frequency analysis for the unigram (single word) frequencies are shown in the next seven figures as bar graphs with the following terms removed: *of, in, to, on, or, by*. *Pain* is the most frequent unigram for anxiety-related disorders (n=57,868, 12.8%), asthma (n=48,270, 9.7%), COPD (n=51,300, 8.1%), depression (n=38,319, 8.7%), and trauma and stressor-related disorders (n=7,026, 9.7%). The most frequent unigram for ED visits with a diagnosis of suicidal ideation is *suicidal* (n=13,808, 11.6%), and the most frequent unigram for ED visits with a self-inflicted injury diagnosis is *overdose* (n=4,062, 14.3%).

The chief complaint terms shown in the word cloud figures also reflect a variety of conditions which may or may not be explicitly related to the mental health, asthma, or COPD diagnosis code included for that ED visit. For example, of the 451,864 unigrams identified in the anxiety-related disorder chief complaint dataset, the unigram *fall*, which appears to be injury-related, is one of the top 10 most popular unigrams for an ED visit with an anxiety-related diagnosis, representing 1.5% (n=6,940) of unigrams. The unigram *fall* represents 1.3% (n=8,245) of the COPD unigrams, and 1.4% (n=6,357) of depression unigrams. ED visits with an asthma diagnosis also see unigrams for *fall* (n=3,836, 0.77%) and *injury* (n=4,370, 0.87%). We excluded the following unigrams from the graphs: *of, in, to, on, or, by, as, for, has, is, at, with, too, the, she, he*.

Figure 3.5: Anxiety-related disorders Unigrams

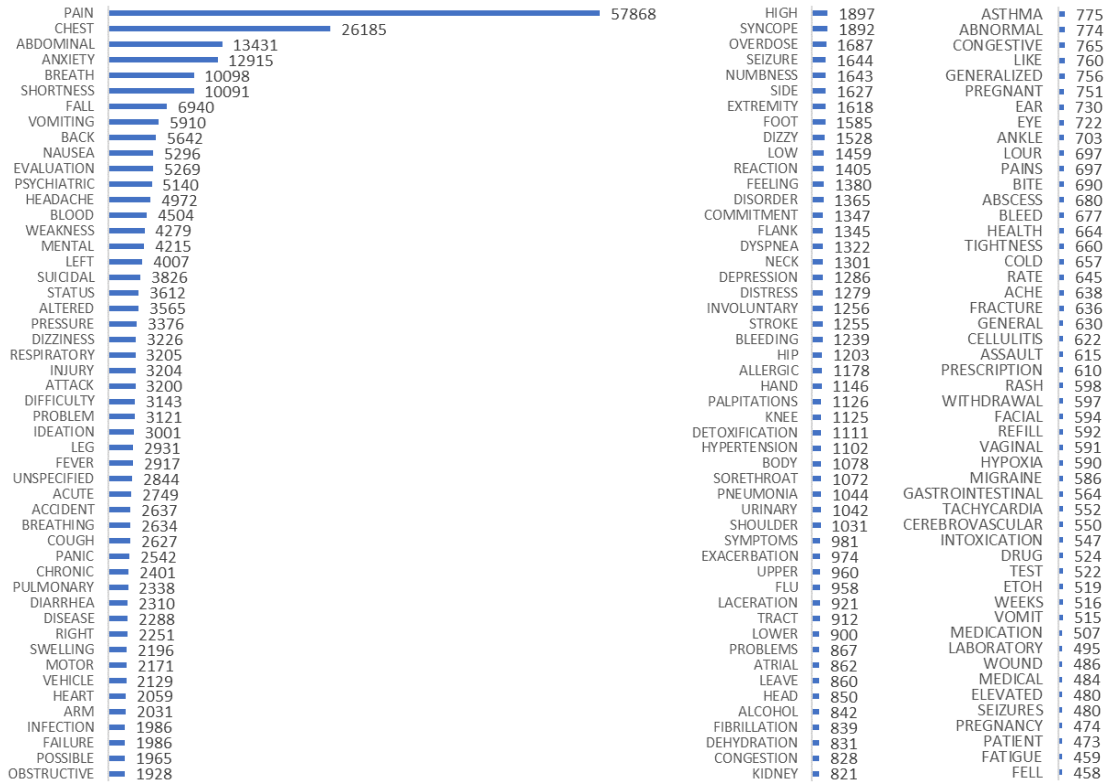


Figure 3.6: Depression Unigrams

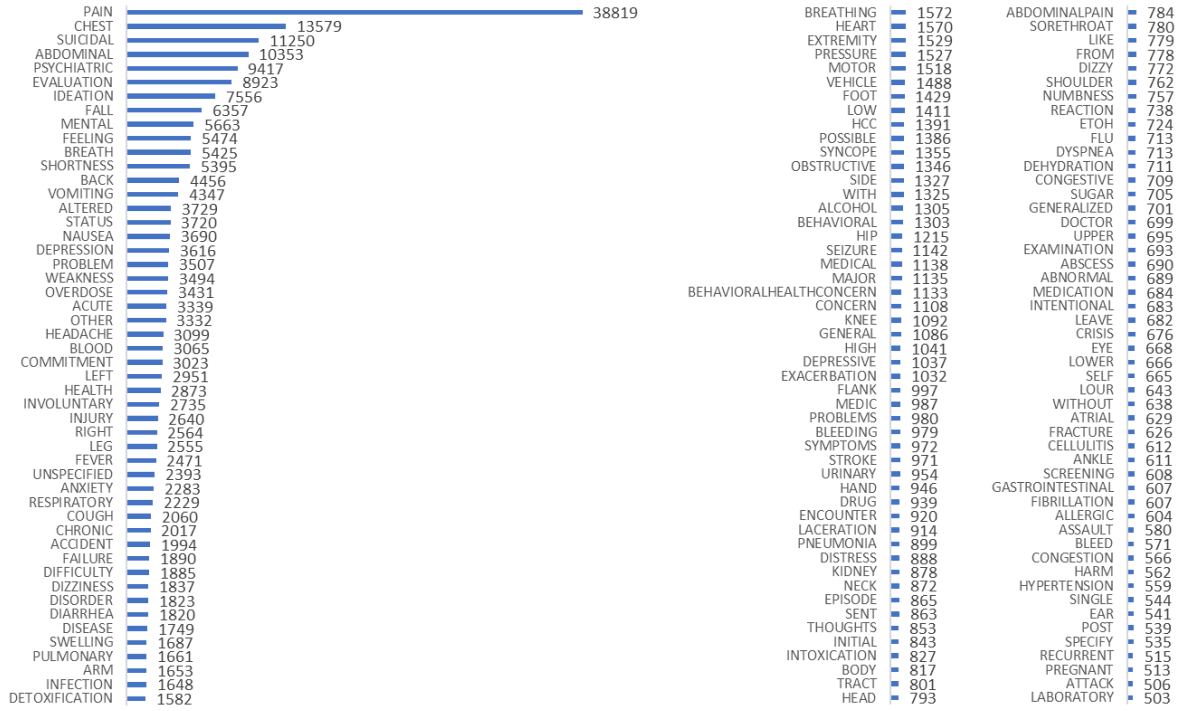


Figure 3.7: Self-Inflicted Injury Unigrams

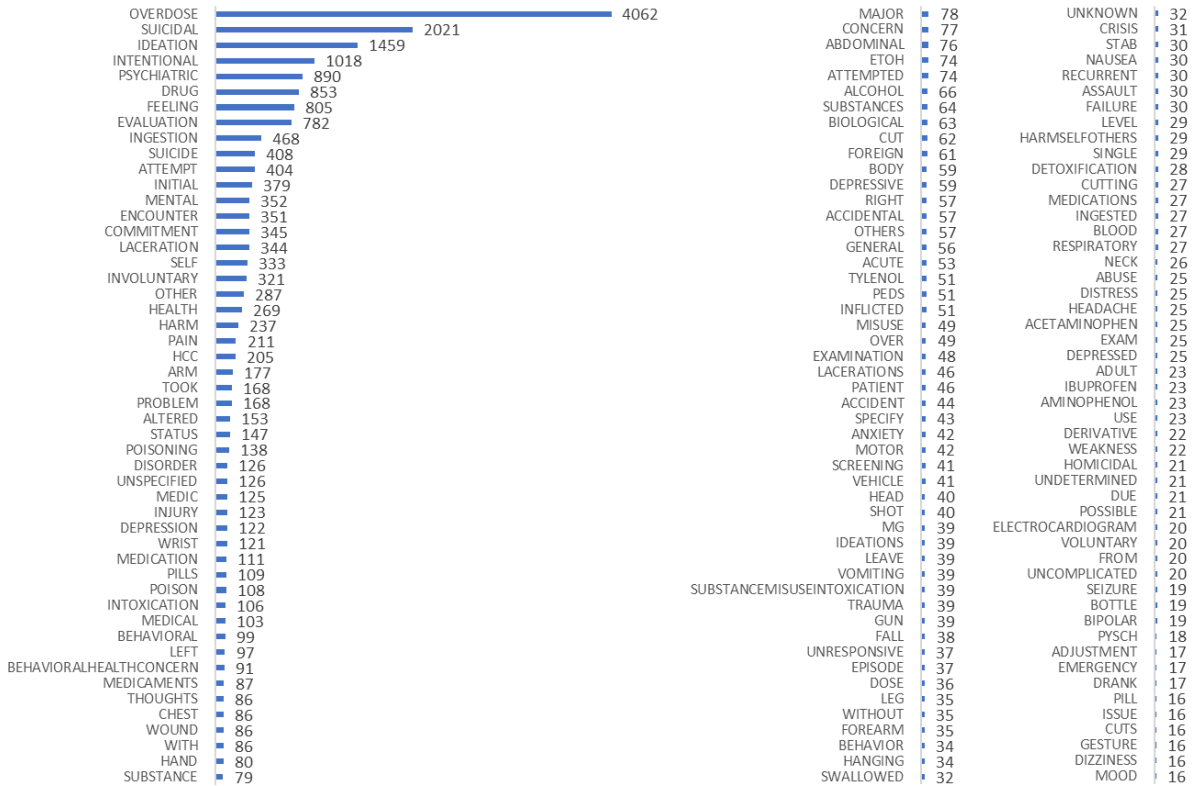


Figure 3.8: Suicidal Ideation Unigrams

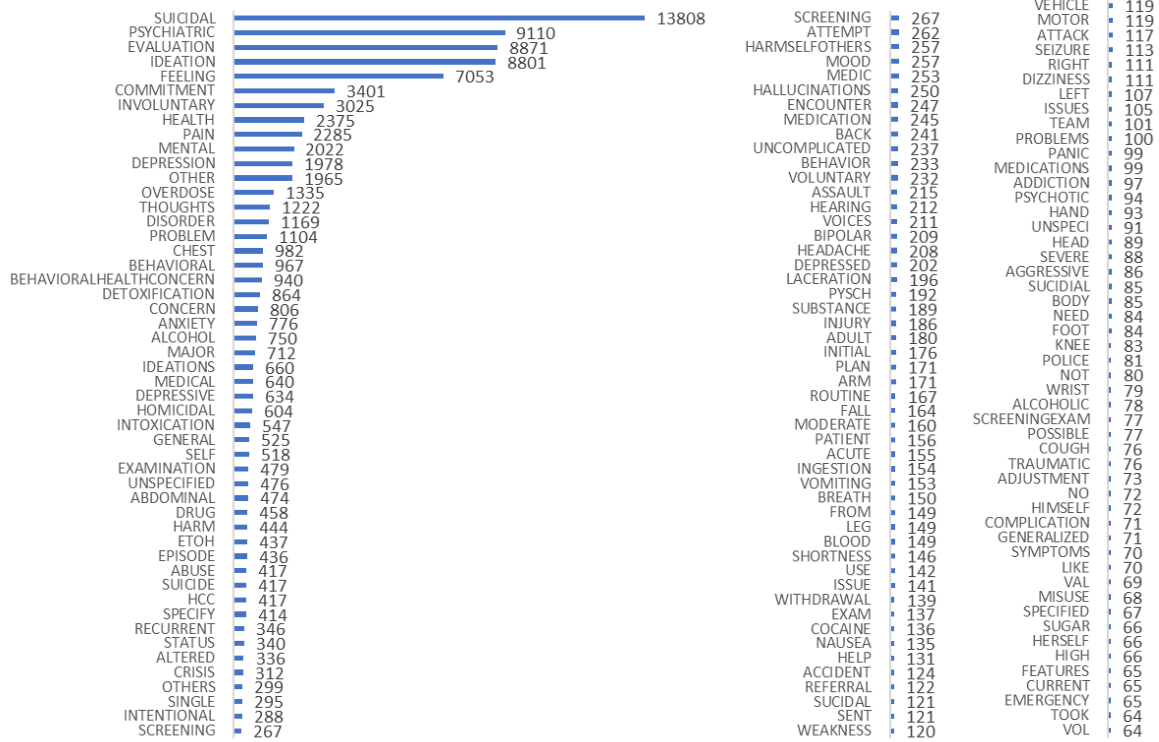


Figure 3.9: Trauma- and Stressor-Related Disorders Unigrams

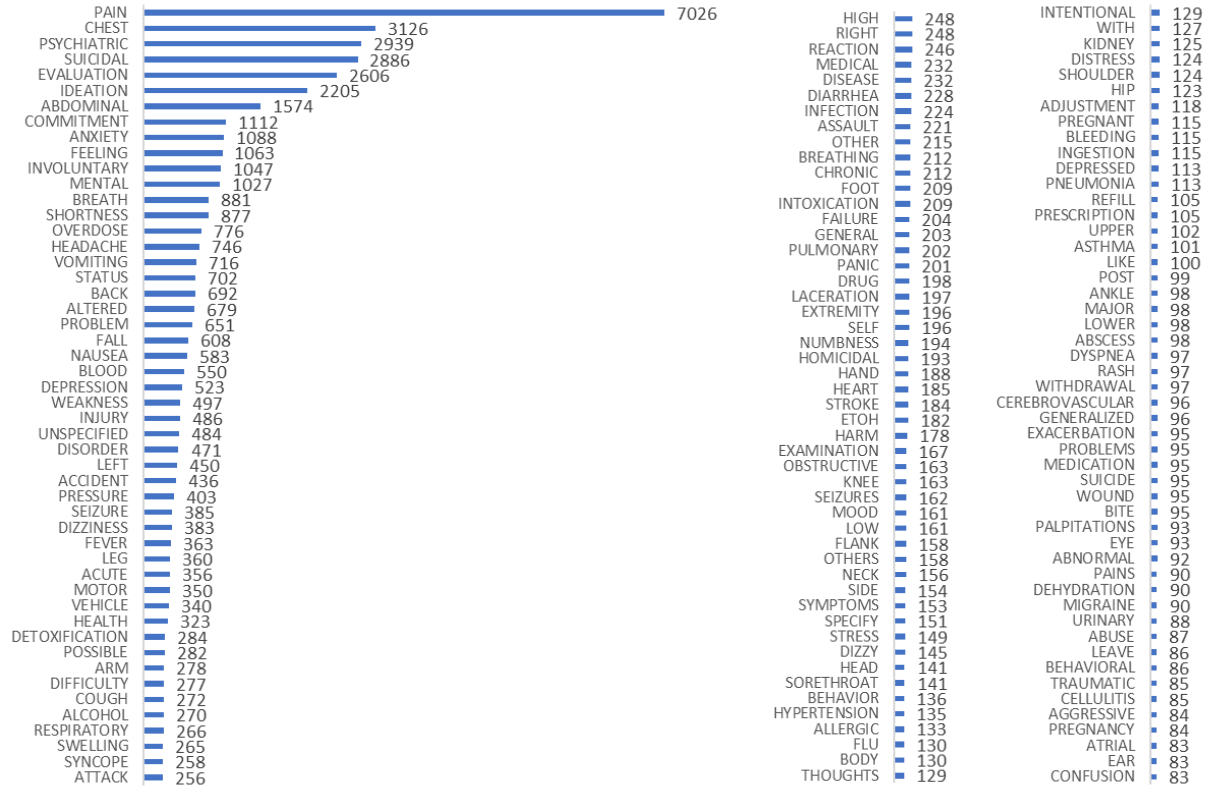


Figure 3.10: Asthma Unigrams

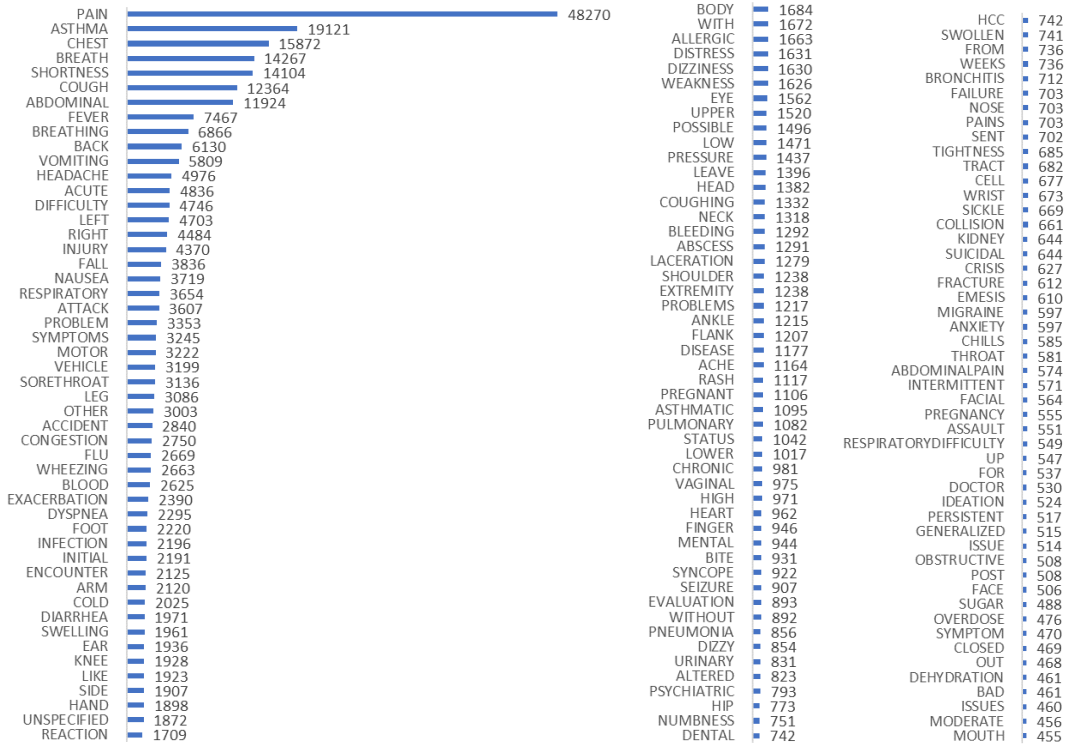
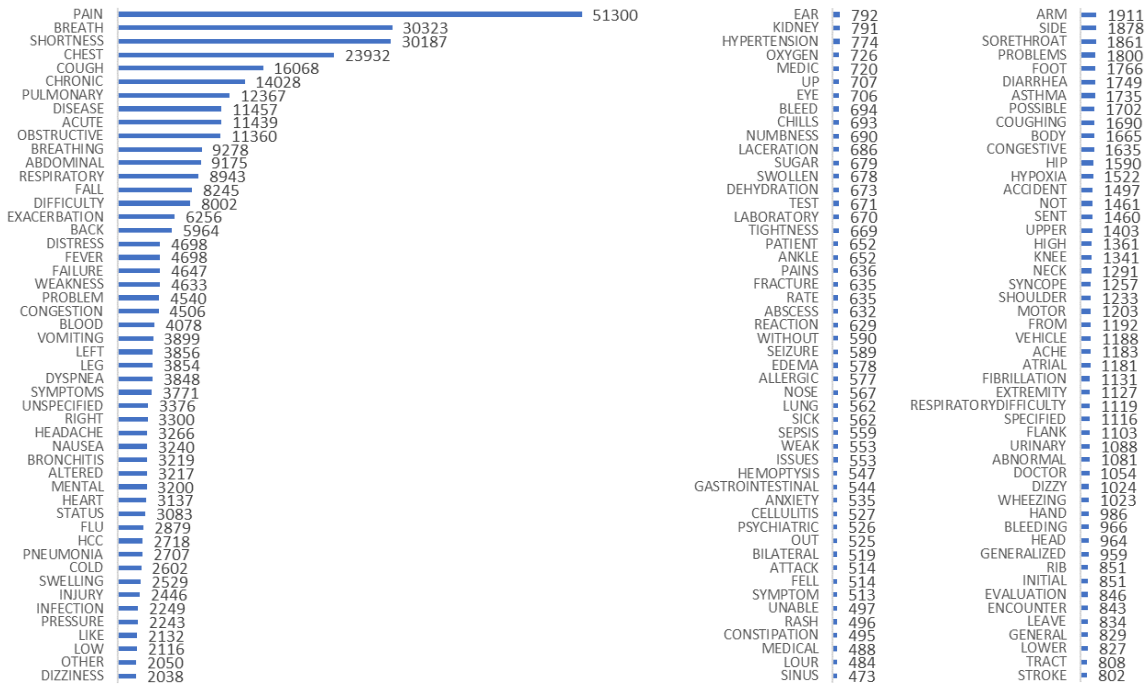


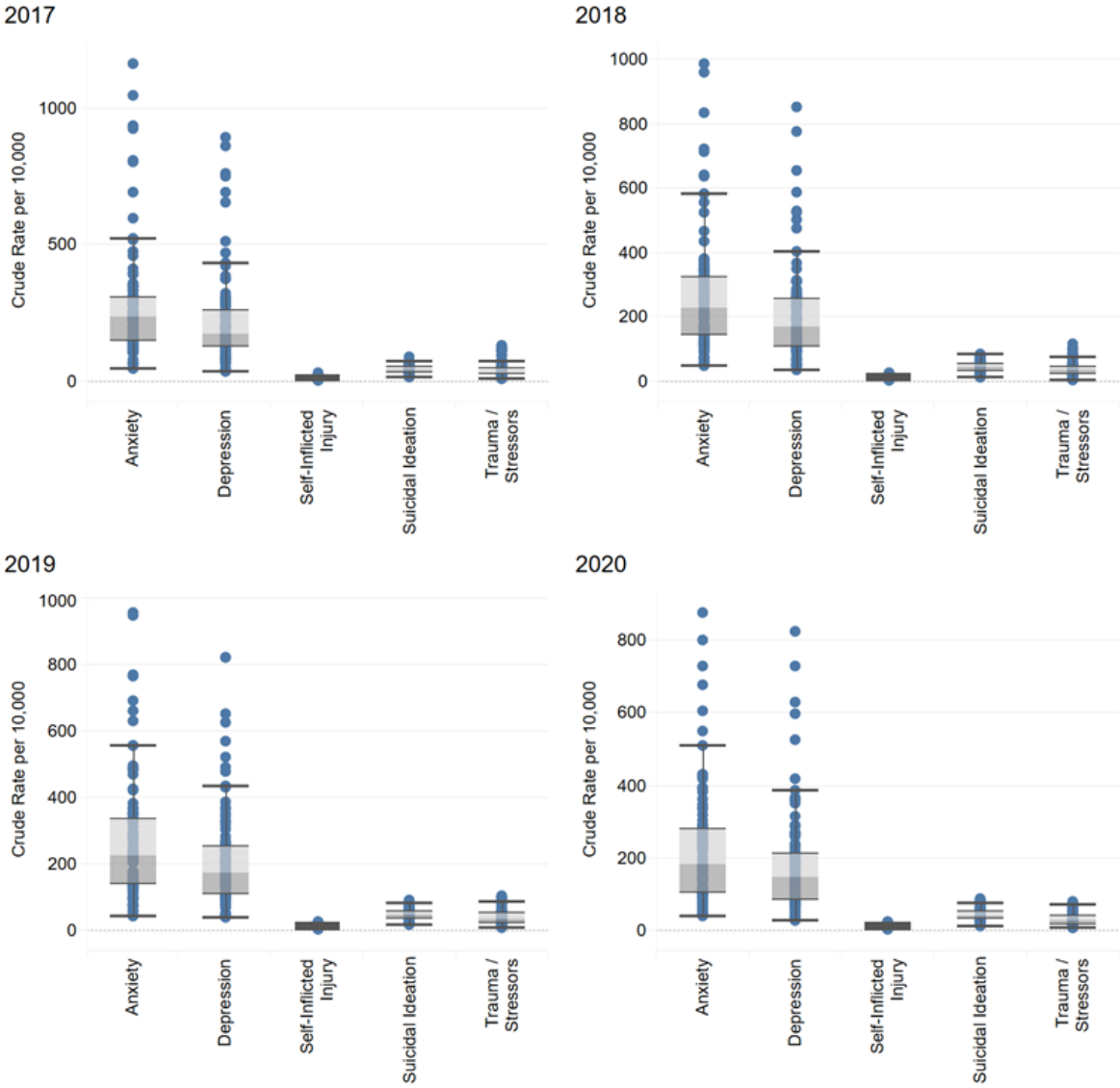
Figure 3.11: COPD Unigram Bar Graph



County-level Disease Trends

For the mental health conditions of interest from 2017 to 2020, anxiety and depression have the widest variation in terms of county-level crude rates, while self-inflicted injury has the lowest. While most counties saw a decline in mental health ED visit crude rates in 2020 commensurate with the overall drop in ED visits in that year, Alleghany, Beaufort, Buncombe, Camden, Clay, Craven, Currituck, Dare, Duplin, Graham, Granville, Jackson, Lenoir, Nash, New Hanover, Sampson, Swain, and Wilson had an increase in one or more of the mental health conditions when comparing 2019 to 2020.

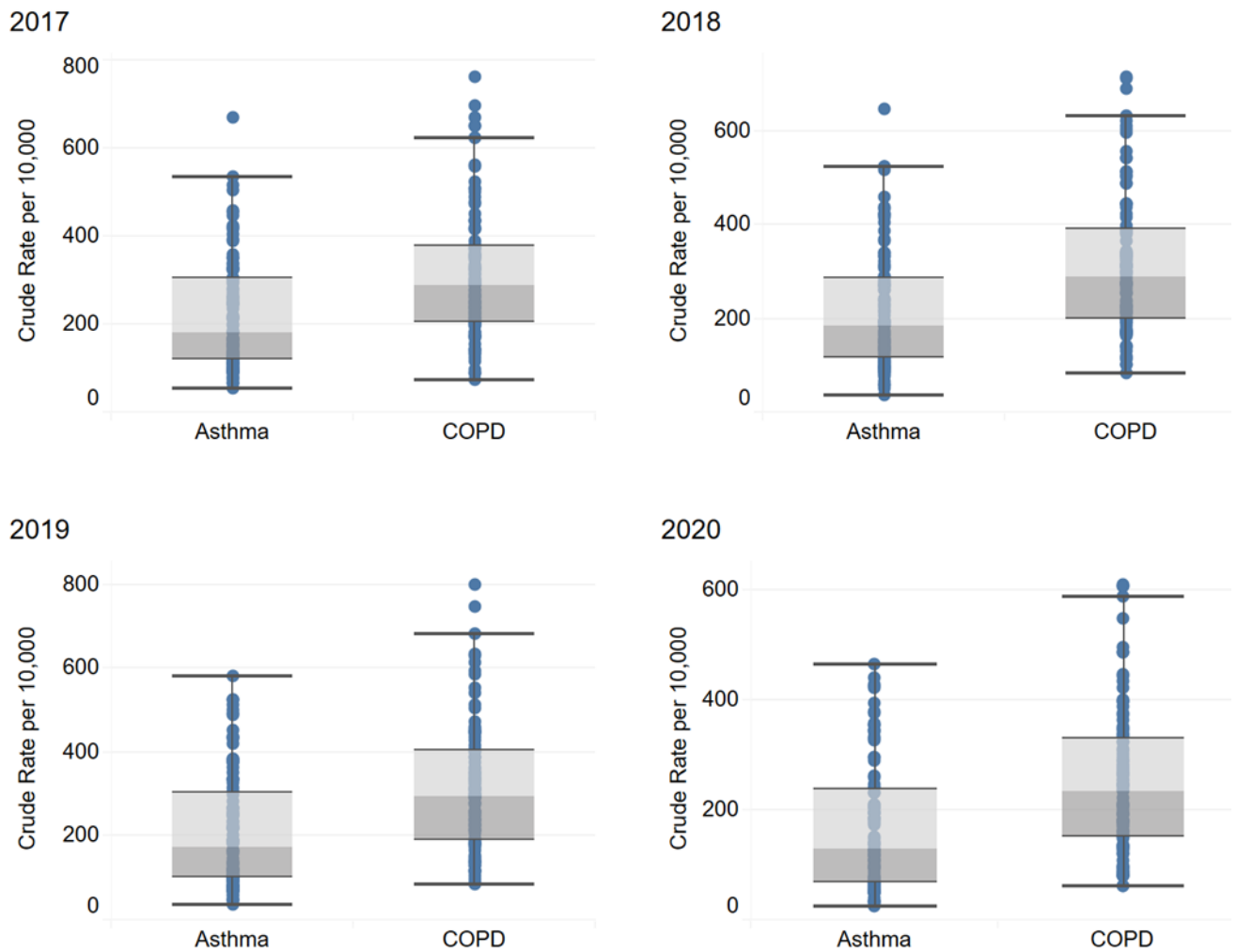
Figure 3.12: County-level ED Visit Crude Rates for Select Mental Health Conditions, 2017-2020



County-level disease trends for asthma and COPD also show significant variation, and like the mental health conditions, select counties go against the statewide trends and show increases in ED visit crude rates for asthma and/or COPD in 2020. Several of these counties overlap with those showing increases in ED visit crude rates for the mental health conditions and include

Alleghany, Chatham, Columbus, Graham, Jackson, Lenoir, McDowell, Sampson, Swain, and Wilson.

Figure 3.13: County-level ED Visit Crude Rates for Asthma & COPD, 2017-2020



County-level ED visit trends by sex, age group, race, ethnicity, and insurance coverage for asthma, COPD, anxiety, depression, self-inflicted injury, suicidal ideation, and trauma / stressors stratified do not uniformly mirror statewide trends. For example, while the trend of females having higher rates for anxiety and depression holds true across all 100 counties from 2017 to 2020, rates for self-inflicted injury are consistently higher among males in four counties (Alexander, Bertie, Greene, and Mitchell) and rates for suicidal ideation are consistently higher

for females in five counties (Alleghany, Ashe, Avery, Camden, and Onslow). This county-level variability continues by age group, race, ethnicity, and insurance coverage across all of the conditions included in this analysis (detailed data not shown).

Correlations between NC DETECT ED Visit Data and Other Data Sources

NC DETECT ED Visit Data Comparison to County Health Rankings

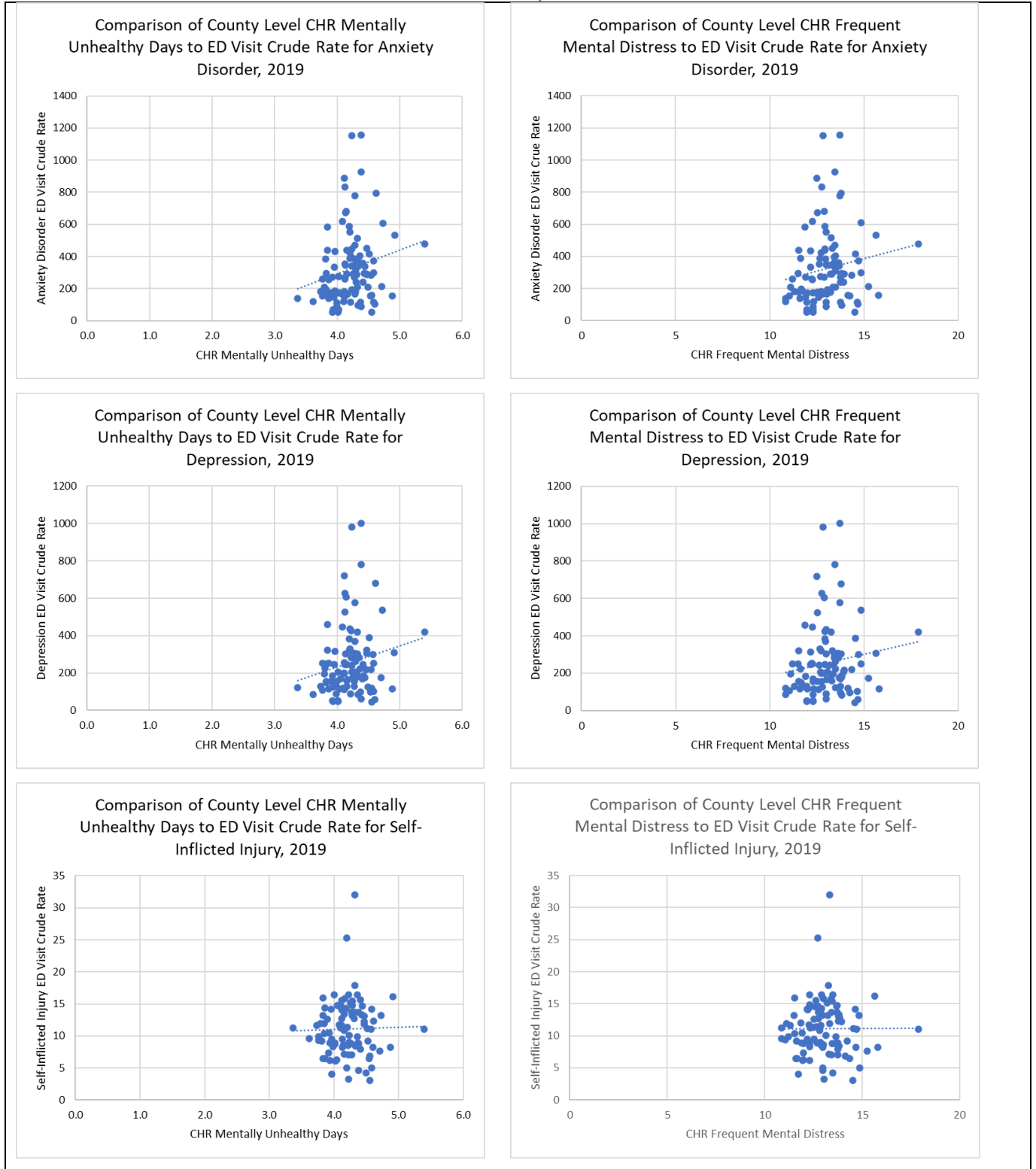
Correlations between CHR county-level mental health estimates and ED crude rates for anxiety, depression, self-inflicted injury, suicidal ideation, and trauma / stressors were relatively low (Table 3.10). Scatter plots are shown in Figure 14 and comparative maps are shown in Figure 15. Suicidal ideation had the highest correlation with the CHR mental health measures, although they were still low (0.34 and 0.39 for number of mental unhealthy days and frequent mental distress, respectively). The CHR maps do not show a concentration of increased mental stress in the western NC counties that is reflected in the ED visit crude rates for anxiety, depression, and trauma / stressor indicators.

The correlation between 2019 overall ED visit crude rates for those ages 18+ and the CHR 2019 county level health outcomes rankings is 0.73, the highest correlation between ED visits and CHR estimates. The corresponding scatter plot is shown in Figure 3.16 and map comparison in Figure 3.17.

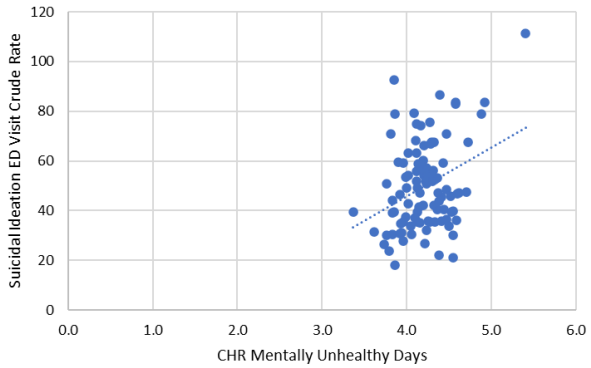
Table 3.10: Correlation between CHR and ED Visit Data

Condition	Number of Mental Unhealthy Days	Frequent Mental Distress
Anxiety	0.19	0.16
Depression	0.18	0.14
Self-Inflicted Injury	0.02	0.00
Suicidal Ideation	0.34	0.39
Trauma / Stressors	0.14	0.13

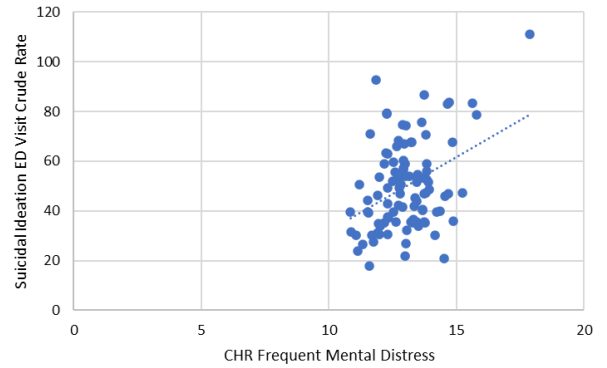
Figure 3.14: Scatter Plots comparing CHR Mental Health Conditions to ED Visit Mental Health Conditions, 2019



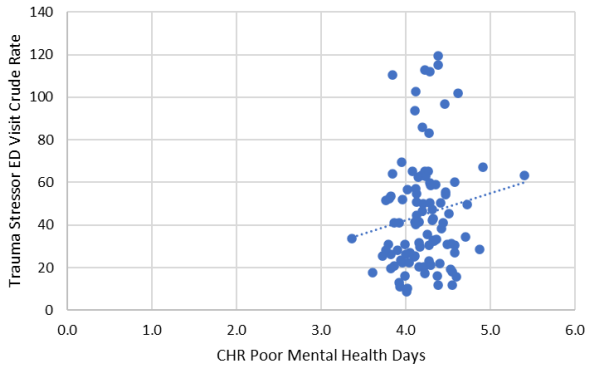
Comparison of County Level CHR Mentally Unhealthy Days to ED Visit Crude Rate for Suicidal Ideation, 2019



Comparison of County Level CHR Frequent Mental Distress to ED Visit Crude Rate for Suicidal Ideation, 2019



Comparison of County Level CHR Mentally Unhealthy Days to ED Visit Crude Rates for Trauma/Stressors, 2019



Comparison of County Level Frequent Mental Distress to ED Visit Crude Rates for Trauma/Stressors, 2019

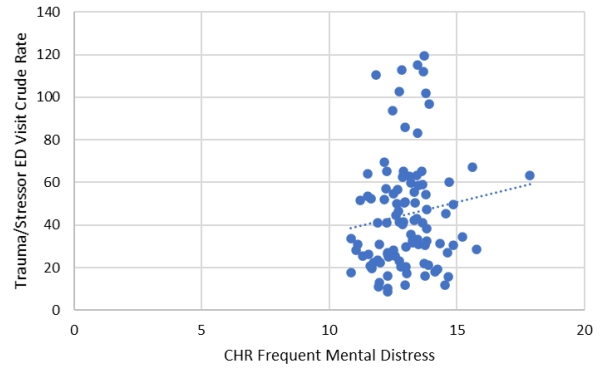
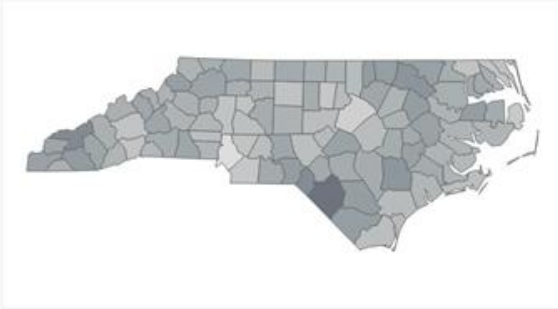
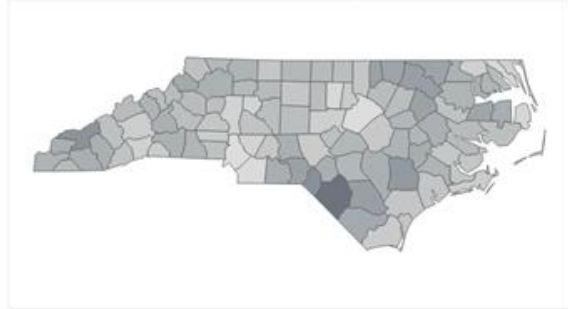


Figure 3.15: Maps comparing County Level CHR Mental Health Conditions to ED Visit Crude Rate Mental Health Conditions

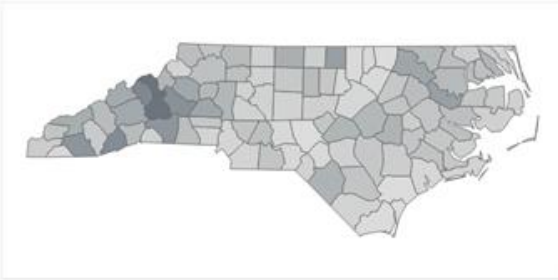
2019 CHR Mentally Unhealthy Days



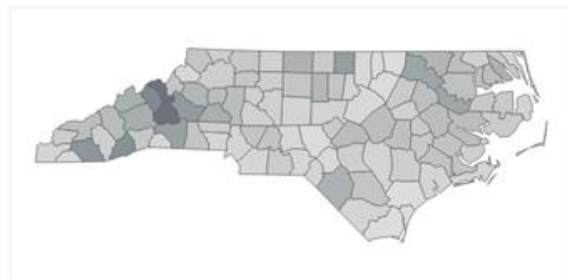
2019 CHR Frequent Mental Distress



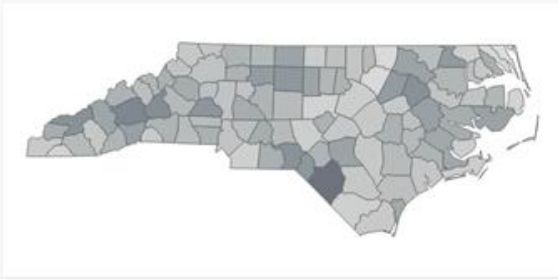
2019 Anxiety ED Visit Crude Rate per 10,000 (Ages 18+)



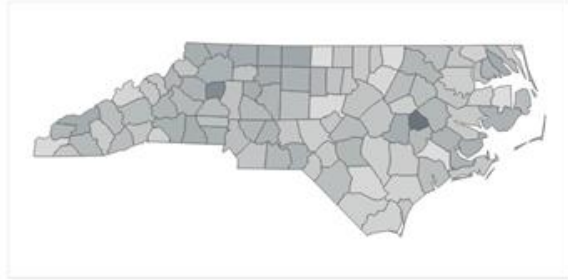
2019 Depression ED Visit Crude Rate per 10,000 (Ages 18+)



2019 Suicidal Ideation ED Visit Crude Rate per 10,000 (Ages 18+)



2019 Self-Inflicted Injury ED Visit Crude Rate per 10,000 (Ages 18+)



2019 Trauma / Stressors ED Visit Crude Rate per 10,000 (Ages 18+)

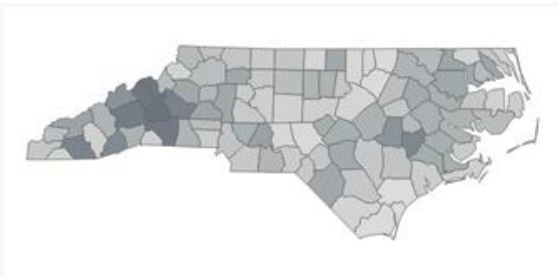


Figure 3.16: Comparison of CHR Health Outcomes Rankings and ED Visit Crude Rates Ages 18+, 2019

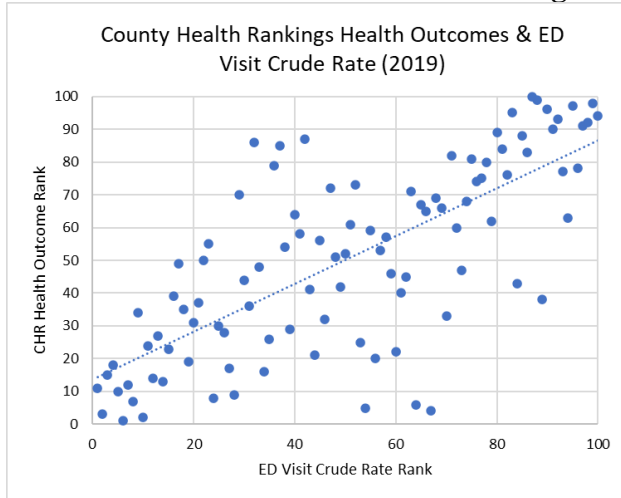
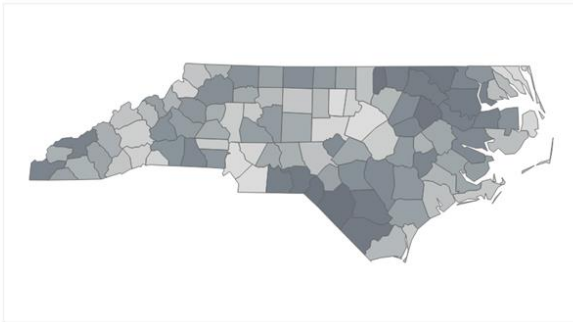
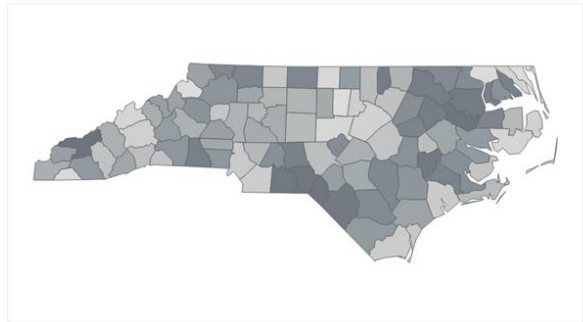


Figure 3.17: Comparison of CHR Health Outcomes Rankings to Counties Ranked by ED Visit Crude Rate Ages 18+, 2019

2019 County Rankings by CHR Health Outcomes



2019 County Rankings by ED Visit Crude Rate, Ages 18+



NC DETECT ED Visit Data Comparison to Medicare

We compared 2018 Medicare care data from the Medicare Chronic Conditions Warehouse to 2018 NC DETECT ED Visit data for asthma, COPD, and depression. Correlations were higher when comparing Medicare prevalence data to 65+ ED visit crude rates for asthma than percentage of Medicare ED visits for these conditions, but slightly lower for depression. COPD had the highest correlation.

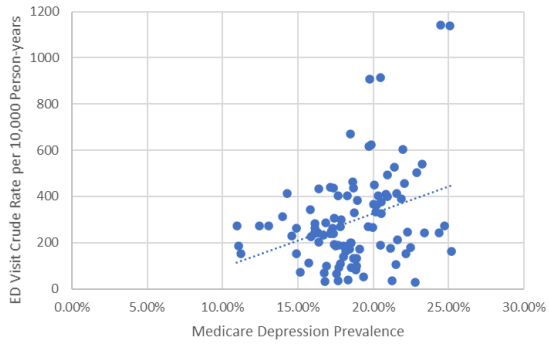
Table 3.11: Correlation County-level Medicare Prevalence and NC DETECT ED Visit Data, 2018

Condition	ED Visits Ages 65+ Crude Rate	Percentage of ED Visits with Medicare
Asthma	0.43	0.37
COPD	0.46	0.32
Depression	0.33	0.35

Figure 3.18: Medicare and ED Visit Scatter Plot Comparisons for Asthma, COPD and Depression



Comparison of County Medicare Prevalence for Depression to ED Visit Crude Rate for Depression, Ages 65+



Comparison of County Medicare Prevalence for Depression to Percentage of Medicare Insurance Coverage ED visits with Depression

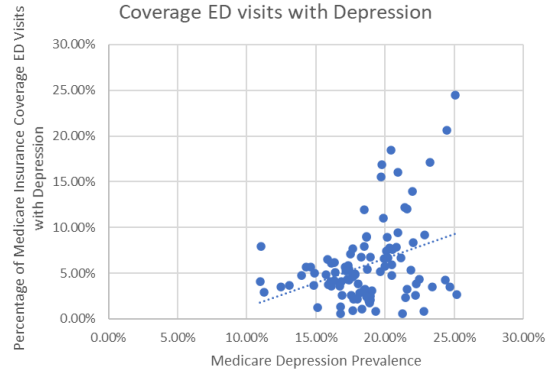
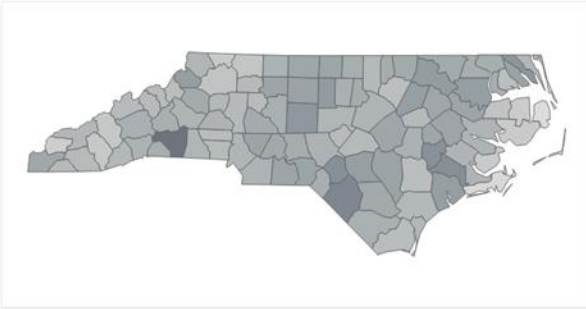
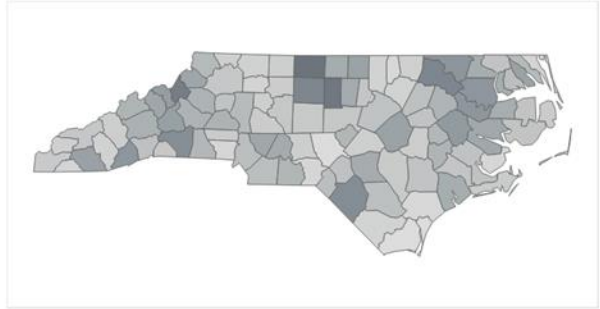


Figure 3.19: Map Comparisons of Medicare to ED Visit Crude Rates for Asthma, COPD, and Depression

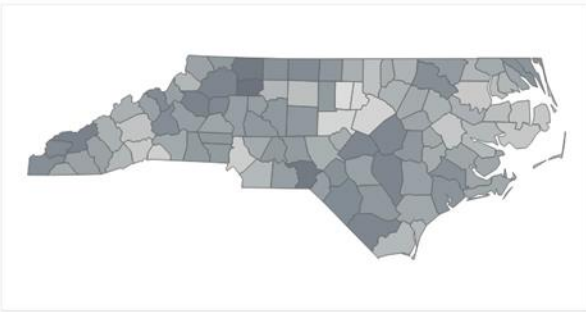
2018 Medicare Asthma Prevalence



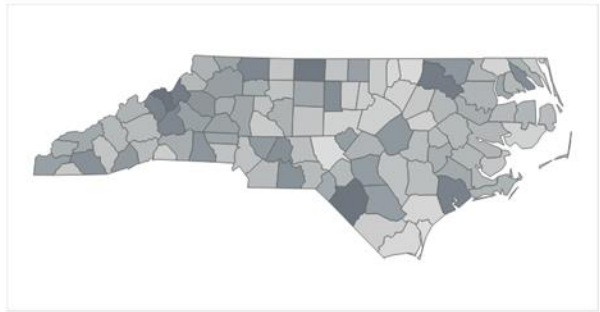
2018 Asthma ED Visit Crude Rate Ages 65+



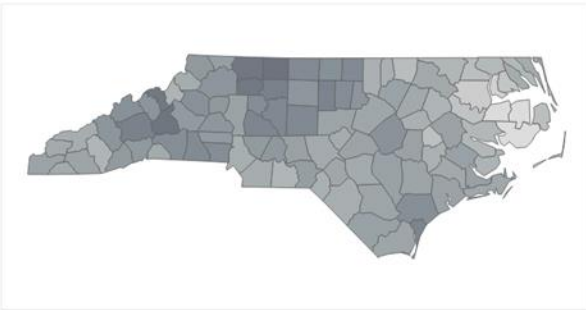
2018 Medicare COPD Prevalence



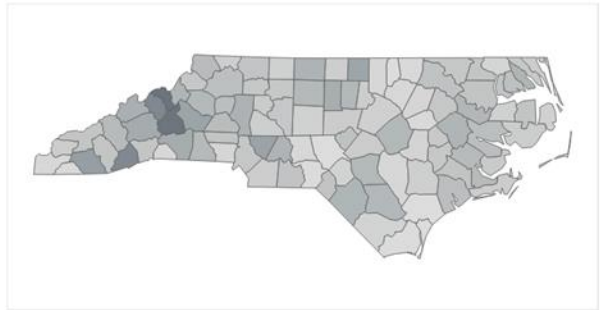
2018 COPD ED Visit Crude Rate Ages 65+



2018 Medicare Depression Prevalence



2018 Depression ED Visit Crude Rate Ages 65+



NC DETECT ED Visit Data Comparison to ED Death Certificate Data

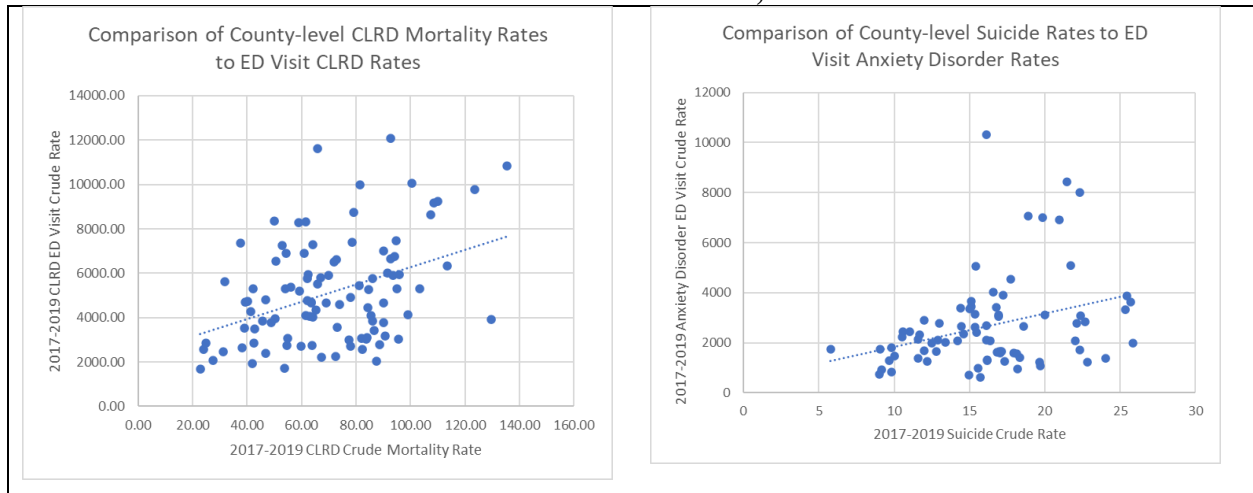
We compared 2017-2019 cumulative death certificate data for CLRD and suicide from CDC Wonder to 2017-2019 cumulative NC DETECT ED Visit data for CLRD, anxiety, depression, self-inflicted injury, suicidal ideation, and trauma / stressors. The highest correlation was for CLRD (0.40), and the lowest correlation was between suicide and suicidal ideation

(0.06). The complete list of correlations is shown in Table 3.12, scatter plots for the comparisons are shown in Figure 3.20, and map comparisons are shown in Figures 3.21 and 3.22. Counties with fewer than 10 suicides from 2017–2019 are not shown on the maps and were excluded from the correlation analysis.

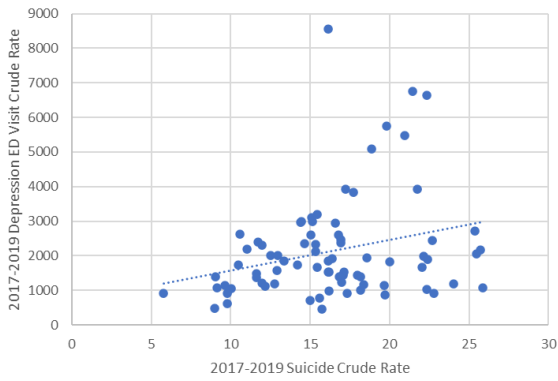
Table 3.12: Correlation County-level Death Certificate Data and NC DETECT ED Visit Data, 2017-2019; Comparison of County-Level Crude Rates per 100,000 person-years

Cause of Death	ED Visit Condition	Correlation
CLRD	CLRD	0.40
Suicide	Anxiety-Related Disorders	0.32
Suicide	Depression	0.26
Suicide	Self-Inflicted Injury	0.25
Suicide	Suicidal Ideation	0.06
Suicide	Trauma / Stressors	0.23

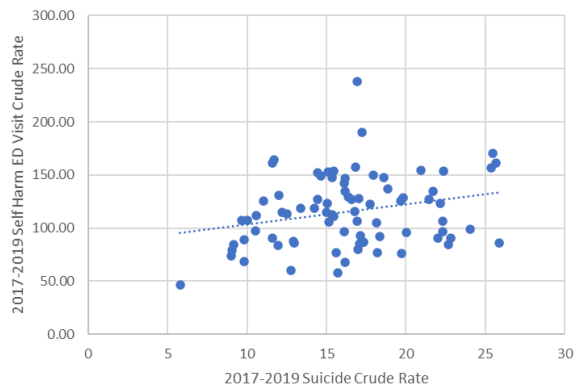
Figure 3.20: Scatter Plot Comparisons between Death Certificate data and ED Visit crude rate data for select conditions, 2017-2019



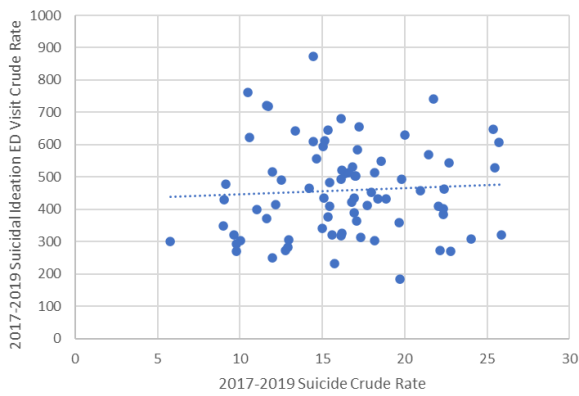
Comparison of County-level Suicide Rates to ED Visit Depression Rates



Comparison of County-level Suicide Rates to ED Visit Self Harm Rates



Comparison of County-level Suicide Rates to ED Visit Suicidal Ideation Rates



Comparison of County-level Suicide Rates to ED Visit Trauma / Stressor Rates

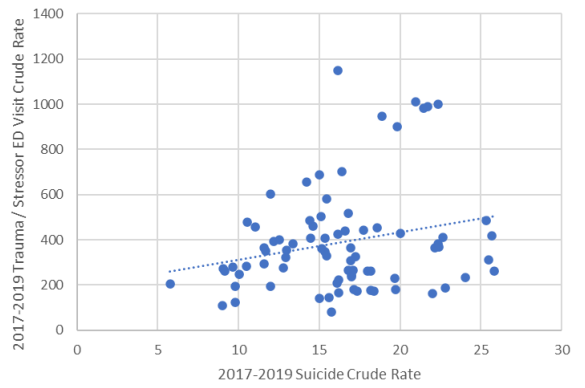
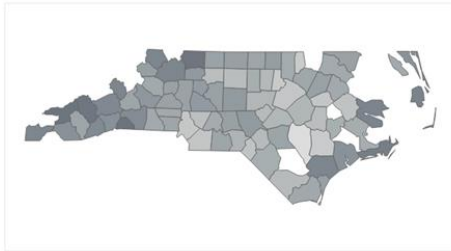
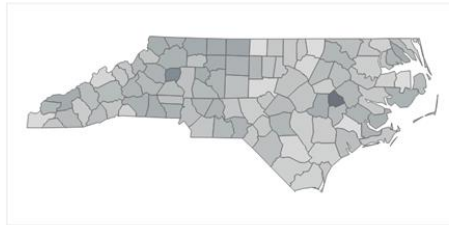


Figure 3.21: Map Comparisons for Suicide and ED Visit Crude Rates for Select Mental Health Conditions, 2017-2019

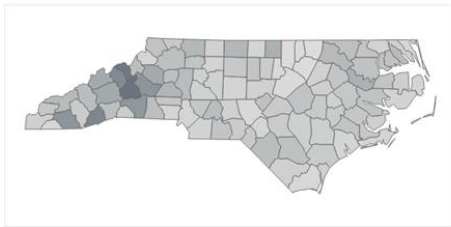
2017-2019 Suicide Crude Mortality Rate



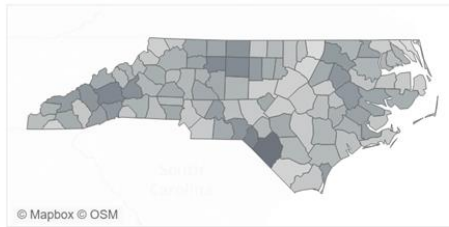
2019 Self-Inflicted Injury ED Visit Crude Rate per 10,000 (Ages 18+)



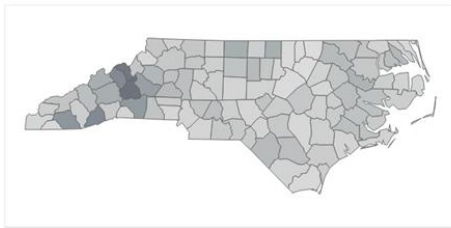
2017-2019 Anxiety ED Visit Crude Rate per 10,000



2017-2019 Suicidal Ideation ED Visit Crude Rate per 10,000



2017-2019 Depression ED Visit Crude Rate per 10,000



2017-2019 Trauma/Stressor ED Visit Crude Rate per 10,000

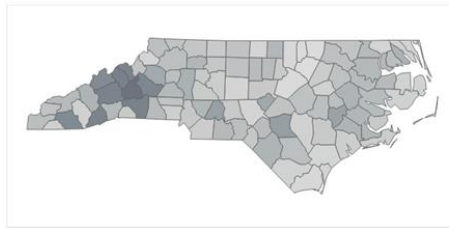
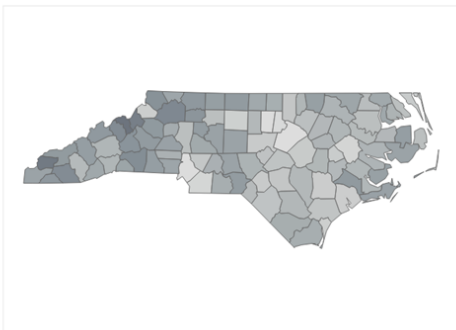
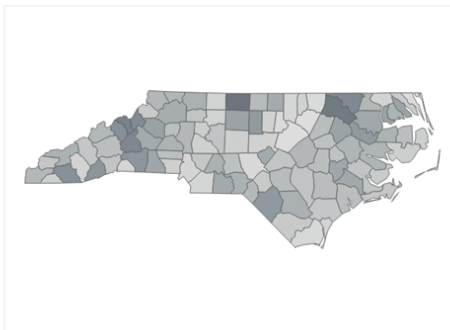


Figure 3.22: CLRD Death Certificate Comparison to CLRD ED Visit Comparison, 2017-2019

2017-2019 CRLD Crude Mortality Rate



2017-2019 CLRD ED Visit Crude Rate



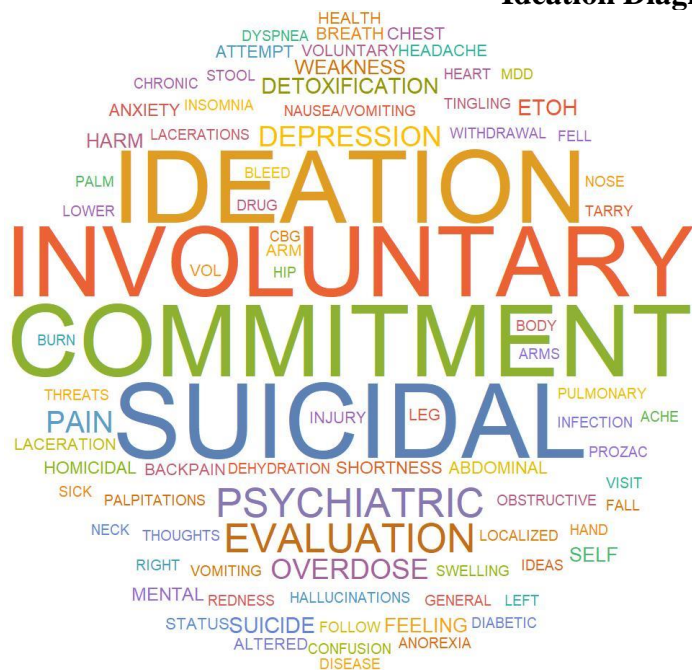
Contributing factors to county-level disease-specific patterns: Suicidal Ideation

Of the mental health conditions studied in the ED visit data, suicidal ideation had the lowest correlation with suicide deaths tabulated from death certificate data. Among the top 10 counties for suicide rates in 2017-2019 with at least 10 suicide deaths (Polk, Swain, Surry, Haywood, Carteret, Dare, Beaufort, Wilkes, Yancey, and Cherokee) only Haywood County has an ED visit crude rate in the highest top 10, ranked eighth overall out of 100 counties. Conversely, Dare County is ranked the 76^{th highest} county for suicidal ideation ED visit rates.

Although Dare and Haywood Counties are similar in terms of age group and race distributions in the population, the overall Dare County ED visit crude rate from 2017 to 2019 is 3,588 per 10,000 person-years compared to the Haywood County ED visit crude rate of 4,769. When looking specifically at suicidal ideation, the 18+ age group has a higher rate of ED visits in Haywood County (average of 67.5 per 10,000 person-years from 2017 to 2020) compared to those under 18 (52.5 per 10,000 person-years), but in Dare County the age group crude rate trends vary and 2018 is the only year during which the suicidal ideation ED visit rate was higher for those 18+ compared to those under 18. The average suicidal ideation ED visit crude rate from 2017 to 2020 in Dare County is very similar across both age groups, however: 27.0 for those under 18 and 26.8 for those 18+.

Insurance coverage trends for suicidal ideation ED visits for Dare and Haywood counties are difficult to compare because Haywood County data has a high percentage of missing insurance information (27%). The 2017-2019 combined ED visit rate for Black or African Americans in Haywood (80.1) is higher than the White crude rate (48.1); ED counts are too low in Dare County to calculate a reliable rate for suicidal ideation ED visit rates for Black or African Americans, even when combining multiple years of data.

Figure 3.24: Chief Complaint Unigrams for Haywood County ED Visits with a Suicidal Ideation Diagnosis



Discussion

ED Visit Data Descriptive Analysis

The 2017 to 2020 overall NC ED visit trends show that ED data capture healthcare seeking behaviors of residents who are more likely to be covered by Medicare, Medicaid or uninsured compared to the overall population. The relatively high correlation between CHR county-level health outcome rankings and county-level ED visit crude rates suggests that high ED visit rates in a county reflect poorer health in a community, and/or higher challenges with accessing non-acute healthcare compared to those with lower ED visit rates, regardless of reason for the ED visit.

One potential contributing factor to the variation in NC county-level ED visit rates are underlying social determinants that can impact health, especially among those living in rural areas. Nationally, those residing in rural areas have less access to public transportation, have higher poverty rates compared to national averages, and may be at greater risk for exposure to

environmental hazards.⁵¹ According to the NC Rural Center, NC has 80 counties (80%) that are rural, categorized using a threshold of 250 or fewer people per square mile.⁵² Rural NC counties rank lower in the CHR health outcomes data compared to suburban and urban counties, and the average 2019 ED visit crude rate for ages 18+ used to compare to CHR data is 4,231 per 10,000 person-years for urban counties, 4,867 for suburban counties, and 6,142 for rural counties. These rural, suburban, and urban ED visit rate differences may continue to diverge in NC as a recent study of national ED utilization found that rural EDs have experienced increased ED utilization at a faster rate than urban EDs.⁵³

ED Visit Trends for Asthma, COPD, and Mental Health Conditions

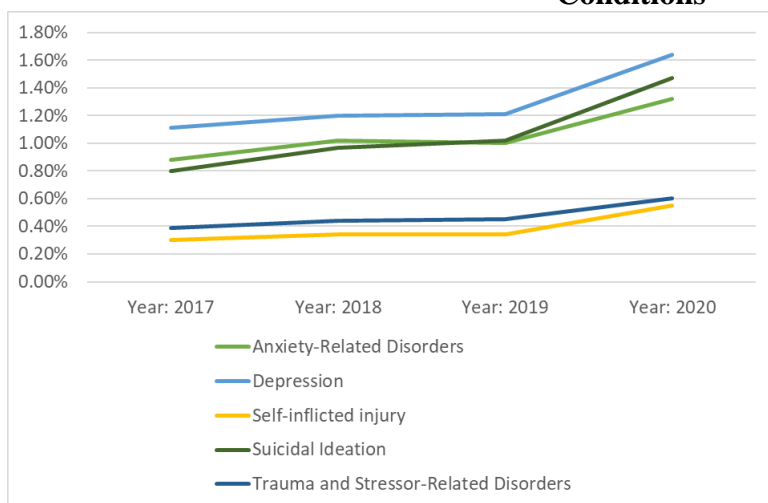
ED visit crude rate trends in asthma and COPD declined from 2019 to 2020, similar to findings in other studies.⁵⁴ In particular, the statewide ED visit counts with an asthma diagnosis for those aged under 18 reflect a 49% decrease in visits from 2019 to 2020. Ongoing nonpharmaceutical interventions to mitigate the spread of COVID-19 in school settings including improved ventilation may continue to result in reductions in asthma-related ED visits for this age group. Ongoing monitoring is needed to understand the impact of COVID-19 on ED utilization for these chronic conditions.

The variation in ED visit trends by age group, sex, and race for diagnoses of anxiety-related disorders, depression, self-inflicted injury, suicidal ideation, and trauma and stressor-related disorders show that a singular indicator to quantify mental health ED utilization would be problematic. The mental health issues contributing to ED visits are multi-faceted and require tailored public health response efforts to be effective.

The significant drop in ED census in 2020 resulting from the COVID-19 pandemic demonstrates the value of presenting ED visit data for a particular condition as crude rates, i.e.,

divided by the population, and as a percentage of total ED visits. For example, statewide crude rates for ED visits with a diagnosis of anxiety-related disorders, depression, self-inflicted injury, and suicidal ideation all decreased in 2020 compared to 2019 for patients under 18. However, ED visit counts with a mental health diagnosis did not decrease as significantly as overall ED visits for those under 18, and trends as a percentage of ED visits increased for this age group from 2019 to 2020 (Figure 3.25).

Figure 3.25: Trends in Percentage of ED visits for Ages <18 for Select Mental Health Conditions



Chief Complaint Unigram Analysis

The chief complaints associated with the ED visits included in this analysis include a variety of unigram terms, with *pain* being a frequent term across both mental health and chronic conditions. The presence of unigrams like *fall* and *injury* implies that diagnoses of asthma, COPD and the mental health conditions analyzed in this study may be documented as co-morbid conditions and not the primary reason for the ED visit. Nevertheless, understanding overall local trends of these conditions, either as primary events or co-morbidities, can provide additional community level information to local health departments to inform public health programs. More

research is needed, however, to understand the impact of hospital coding practices on the variation in local trends seen in the NC DETECT ED visit data.

Data Source Comparison for Mental Health Conditions, Asthma, and COPD

The correlations between NC ED visit data and the data sources typically used by local health departments to quantify prevalence and monitor trends in community-level mental health, asthma, and COPD all fell below 0.50. The correlations between ED visit crude rates for mental health conditions and CHR mental health estimates were ranged from 0.00 for self-inflicted injury and frequent mental distress to 0.39 for suicidal ideation and frequent mental distress. CHR prevalence estimates for mental health issues in a county do not reflect or predict ED visits with mental health diagnoses but providing county-level estimates of ED visits for various mental health conditions can provide additional context for local health departments attempting to document mental health burden in their communities.

Correlation between Medicare prevalence rates and ED visit crude rates was higher for asthma and COPD than depression. Several counties with higher depression prevalence in the Medicare data have low ED visit rates for depression, e.g., Pender and New Hanover counties in Southeastern NC. The hospitals in these counties may have different coding practices for documenting depression as a co-morbidity than other counties in NC, particularly the hospitals covering Western NC. More research is needed to understand how hospital coding and data extraction practices may impact the variation in county-level mental health ED visit rates seen in the NC DETECT ED visit data. For example, some hospitals may be more likely to document co-morbid conditions in the data sent to NC DETECT, and NC DETECT may be receiving ICD-10-CM diagnosis codes from billing systems in some hospitals and directly from electronic health records from other hospitals.

The overall lack of correlation at the county level between the ED mental health conditions and suicide deaths suggests that rates of ED visits with a mental health diagnosis are not a singular predictor of suicide death rates. This finding is consistent with 2018 circumstance data from the North Carolina Violent Death Reporting System that documents 48.8% of suicide deaths in that year had a documented mental health problem. Providing data on mental health-related ED visits to local health departments, however, can provide additional contextual information on their communities and complement existing primary and secondary data sources in use.

County-level Variation in Suicidal Ideation for Dare and Haywood Counties

The chief complaint analysis for ED visits with a suicidal ideation diagnosis in Dare and Haywood Counties showed a difference in chief complaint proportions for involuntary commitments. Understanding this finding requires further investigation beyond the scope of this dissertation.

Limitations

Several limitations must be considered when reviewing the results in this chapter. NC DETECT does not include data from specialty emergency departments, Veteran's Administration, or military hospitals and, as such, does not represent full ED utilization across NC. In addition, residents in border counties may visit hospitals out of state and these visits are not included in NC DETECT. NC DETECT is a visit-based system that cannot track unique patients across NC EDs. Some of the descriptive statistics may reflect multiple visits by the same patient for a mental health or chronic condition.

The ED visit data in NC DETECT are secondary data; the data are collected primarily for patient treatment, and we do not have control over how the data are entered into the electronic health record before transmission to NC DETECT. Some of the findings in this analysis may

reflect data quality issues rather than true disparities; for example, some of the outliers for select conditions by race may reflect mis-mapping of local race codes to the standardized race codes in NC DETECT. Hospitals may send inaccurate county of residence information which may impact the county-level trends presented in this chapter.

We used ICD-10-CM based case definitions developed by national organizations in these analyses. We searched on codes in any position and, therefore, the codes may reflect a co-morbid condition rather than the primary reason for ED visit. Diagnosis code completeness varies by hospital and may impact the county-level rates used in these analyses.

Policy and Practice Recommendations

The incorporation of ED visit data into ongoing, systematic data collection and analysis at LHDs will provide additional information on populations impacted by mental health and chronic conditions not readily available through more routine data sources, including death certificate data, Medicare prevalence data, and CHR data. LHDs can monitor ED visit trends over time to understand the impact of public health programs and other external forces (COVID-19 pandemic, governmental policies, etc.) on their communities, especially on vulnerable populations who are more likely to visit the ED.

LHDs should work with local EDs and other partners, e.g., those who manage the ED visit data in NC DETECT, to document how facility-level ICD-10-CM coding and documentation practices for key variables like race, ethnicity, patient ZIP and county of residence may impact local disease trends based. This additional metadata will identify any additional and data limitations.

Conclusion

Based on our analysis, NC residents visiting the 126 NC EDs transmitting data to NC DETECT were more likely to be very young (under 5), elderly (70 or older), female, Black or

African American, or on Medicare, Medicaid, or no documented insurance compared to the overall NC population. The ED visit data showed variability by type of mental health condition. Females had higher ED visit crude rates with a diagnosis of depression, anxiety, self-inflicted injury, or trauma and stressor-related disorders, while males had higher rates for suicidal ideation. Black or African Americans and Native Americans and Alaska Natives had higher rates for suicidal ideation and trauma and stressor-related disorders while ED visit rates for anxiety, depression, and self-inflicted injury were highest for Whites. Asthma and COPD ED visit rates were highest among Black or African Americans and Native American or Alaska Natives, respectively. NC DETECT ED visit data demonstrated low correlation at the county level for asthma, COPD, and mental health conditions with more traditional data sources including death certificate data, Medicare prevalence data, and CHR data, but had a relatively high correlation when compared to overall CHR county-level health outcome rankings. Clearly, NC DETECT ED visit data provide additional community-level insights that can be informative to LHDs, but more research is needed to document the limitations of these data as well as how best to present these data to inform local decision-making.

CHAPTER 3: REFERENCES

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CHAPTER 4: DASHBOARD DEVELOPMENT AND EVALUATION

Introduction

Previous studies have shown that local health departments (LHDs) need timely, county level and sub-county level data to monitor health-related trends, identify health disparities, and inform areas of highest need for interventions as part of their assessment role in the 10 essential public health services.¹⁻⁵ Some LHDs have evaluated electronic health records (EHRs) as a source of timelier, subcounty data for behavioral risk factors and chronic diseases, but incorporating new data sources requires considerable technological and informatics resources that many LHDs are not equipped to support.^{2,3,6-8} LHDs without the resources to ingest new data do have the option of utilizing existing data sources in novel ways. For example, while traditionally used for infectious disease surveillance, syndromic surveillance systems that receive near real time emergency department visit data can be used to monitor chronic diseases and mental health conditions.⁹⁻¹²

In North Carolina, LHD staff have access to a statewide, near real time syndromic surveillance system, NC DETECT, that provides access to data from 126 NC civilian, acute care, hospital-affiliated emergency departments (EDs).¹³ The NC DETECT Web application allows users to monitor trends and view detailed record level de-identified information across a variety of infectious disease, injury, mental health, and chronic conditions. The NC DETECT Web application is designed primarily for near real time monitoring of potential public health threats, however, and is not ideally suited for multi-year trend analyses. To evaluate the utility of NC

DETECT ED visit data to fill gaps in LHD data needs, we sought to develop public-facing dashboards to provide easier access to multi-year data.

With the availability of dashboard development tools including Tableau® and Microsoft® Power BI®, publicly accessible interactive dashboards of public health data are increasingly available across the United States. State and local health departments have leveraged these technologies to present interactive information to a variety of stakeholders on topics including the overdose crisis and the COVID-19 pandemic.^{14,15} In addition to dashboards for COVID-19 and its Opioid Action Plan, the North Carolina Division of Public Health (NC DPH) used Tableau® to develop public facing dashboards for alcohol data and the NC Violent Death Reporting System.¹⁶ A collaboration between the University of North Carolina at Chapel Hill and the NC DPH developed the NC Transportation Safety and Public Health Data Dashboard.¹⁷ Dashboard development best practices identified in the literature include favoring simplicity over complexity, employing judicious use of color, reducing non-data pixels, including metadata with any information that may be copied from the dashboard, including meaningful comparisons, making items of concern readily apparent, including historical trends when possible, avoiding need for mental math, and using appropriate outputs, e.g., tables, line graphs, bar graphs, maps, etc. depending on anticipated user needs for the data interpretation.^{18,19}

Best practices for and evaluations of public health dashboards specifically are sparse in the literature. Krackov and Martin (2019) provide 10 recommendations for health departments using dashboards specifically to communicate about the opioid epidemic. They suggest using dashboards to tell stories with persuasive imagery and anecdotes as well as to provide data and they stress the importance of involving end users throughout the development process.²⁰ A recent usability evaluation of 16 state health department COVID-19 websites evaluated embedded

dashboards, and found that while the dashboards presented aggregate information well, they did not score highly for communicating risk information effectively to the public.²¹ Based on their findings the authors also suggest that public health dashboards should avoid excessive “non-data ink,” e.g., reduce the use of borders, colors and lines that do not convey meaning, and eliminate unnecessary data, figures, graphs, and maps that are not appropriate or useful. A focus group-based evaluation of a European childhood obesity dashboard found that participants primarily valued the unique access to localized behavioral health data combined with more routine nationally collected statistics.²² We did not identify any studies evaluating dashboards developed primarily for a local health department audience.

With this research we aimed to develop a better understanding of how best to present multi-year syndromic surveillance ED visit data to a LHD audience specifically for chronic disease and mental health conditions, with the goal of enabling efficient use of these data in community health assessment and other reporting needs.

Methods

We developed two public-facing Tableau® dashboards, one focused on mental health conditions and one focused on asthma and chronic obstructive pulmonary disease (COPD). We evaluated the utility and usability of these dashboards through semi-structured interviews and a Web-based survey.

Dashboard Descriptions

We developed two interactive, public-facing dashboards presenting NC DETECT ED visit data primarily for a NC LHD audience using Tableau® public software: (1) a dashboard of five mental health-related conditions (anxiety-related disorders, depression, self-inflicted injury, suicidal ideation, and trauma- and stressor-related disorders) and (2) a dashboard for asthma and chronic obstructive pulmonary disease (COPD). We classified ED visits into these conditions

using definitions based on International Classification of Disease Clinical Modification, 10th version (ICD-10-CM) final diagnosis codes. We applied these definitions to any diagnosis code received in the ED visit data, regardless of order. For asthma, COPD, and depression we used definitions from the CMS Chronic Conditions Warehouse.²³ We classified ED visits into a suicidal ideation category using the singular ICD-10-CM code R45.851, and into a self-inflicted injury category using the CSTE Injury Surveillance Toolkit definition for nonfatal self-harm ED visits.²⁴ We classified ED visits into anxiety disorders and trauma and stressor-related disorders using the Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project definitions.²⁵ The dashboards include data from 2017 through 2020 and provide counts, crude rates, and ED visit percentages at statewide and county levels, as well as breakdowns by county, ZIP code, sex, age group, race, ethnicity, and insurance coverage. We developed each dashboard as a Tableau® “Story” that allows separate dashboard pages to be accessed using tabs at the top. Counts under 5 were excluded from the dashboard to adhere to the NC Division of Public Health’s data suppression guidelines for public sharing of NC DETECT ED visit data.²⁶ Screenshots from these initial draft versions are available in Appendix 4.1.

Dashboard Design Choices

We made specific dashboard design choices for the intended LHD audience. With the dashboard structure, we aimed to facilitate easy viewing of trends of the four years of annual data available, easy comparison of county-level trends to statewide and peer county trends, as well as easy access to tabular data to view detailed counts, crude rates and percentage information when needed. We specifically included these comparisons to statewide and peer county trends to provide LHD users with benchmarks by which they could evaluate and measure the ED visit trends in their county(ies). For example, is the ED visit rate for suicidal ideation in

my county higher or lower compared to the statewide average and my county's peer counties? We also aimed to keep the design intuitive and simple to facilitate ease of use without the need for extensive training.

Semi-structured Interviews

Participant Recruitment

After development of the initial draft versions of the dashboards, we recruited NC LHD public health practitioner volunteers by email to provide feedback via one-on-one Web-based, qualitative semi-structured interviews. The email was distributed to LHD users with an active NC DETECT account (n=224) and interviews were scheduled with the first ten respondents who agreed to participate.

Semi-structured Interview Procedures

The first six semi-structured interviews focused on the mental health dashboard while the remaining four focused on the asthma / COPD dashboard. The interviews focused on the mental health dashboard included task completion, data interpretation activities and open-ended discussions about the dashboard features and functionality, while the interviews about the asthma and COPD dashboard were qualitative feedback sessions only. We asked participants to use the dashboards to look up information for their county(ies) of interest and to compare that information to peer county and statewide data. We developed a task-focused document and semi-structured interview questions to guide the interviews of the mental health dashboard (Appendix 4.2) and an interview guide for the asthma and COPD dashboard discussion sessions (Appendix 4.3). For the mental health dashboard, we designed the tasks to collect qualitative data on the usability of the dashboard as well as the ability of the user to interpret accurately the information included on the different dashboard tabs. The asthma and COPD qualitative interviews focused on overall design and content and did not assess task completion or data interpretation. With

participant approval, we recorded the videoconference sessions using Zoom® software with the participants sharing their screen and capturing audio; we turned off our Web cameras during recording. At the start of the interview, we provided the user with access to the dashboard by pasting the dashboard link in the chat. Dashboards were not available on the NC DETECT website during this stage and participants had not been given access to the dashboards prior to the interview.

During the interviews for the mental health dashboard, we observed the user's ability to select a county, year and/or health condition successfully, and to compare county-level information to statewide and peer-county information. For both dashboards we led open-ended discussions to collect additional qualitative information on dashboard improvements. These interview methods were determined to be exempt by the UNC IRB.

Web-based Questionnaire

We used the feedback and notes on usability from the semi-structured interviews to update both dashboards (Appendix D). We posted these revised versions to the NC DETECT website (<https://ncdetect.org/dashboard/>) and then solicited additional feedback from a wider NC LHD audience through a Web-based questionnaire in Qualtrics® (Appendix E). In addition to capturing each respondent's current role, years of experience in that role, and years of experience using NC DETECT ED visit data (for any purpose), the survey asked respondents to provide feedback on the utility and ease of use of the dashboards using the System Usability Scale (SUS).²⁷ The SUS is a list of 10 Likert scale questions to collect data on the effectiveness, efficiency and user satisfaction of a system; in the first standardized list of 10 questions we replaced "system" with "mental health dashboard" and for the second standardized list we replaced "system" with "asthma and COPD dashboard." Finally, we asked respondents to

provide free text recommendations for further improvements and to describe how they might use the information available in the dashboard. A gift card drawing that preserved anonymity was used to incentivize responses. We solicited survey responses by sending an email to all active NC DETECT users affiliated with an LHD (n=224). The questionnaire was determined to be exempt by the UNC IRB.

Results

Semi-structured Interview Summary

We conducted 10 virtual one-on-one semi-structured usability interviews using Zoom® from July 13, 2021, through July 29, 2021. Participants provided feedback on the dashboard designs, making suggestions regarding labelling, data context, organization of information, color choices, and incorporation of additional information. They represented a variety of roles and experience with using NC DETECT ED visit data, evenly split between relatively new users and very experienced users.

Table 4.1: Semi-structured Interview Participant Demographics

Dashboard	Gender	Role	Years of Experience with NC DETECT
Mental Health	F	Behavioral Health System Coordinator	<1
Mental Health	F	Community Health Coordinator	5+
Mental Health	F	Epidemiologist	5+
Mental Health	F	Epidemiologist	<1
Mental Health	F	Health Informatics Manager	5+
Mental Health	F	Public Health Education Supervisor	5+
Asthma / COPD	F	Community Health Improvement Specialist	<1
Asthma / COPD	F	Epidemiologist	<1
Asthma / COPD	F	Epidemiologist	5+
Asthma / COPD	M	Program Evaluation Specialist	<1

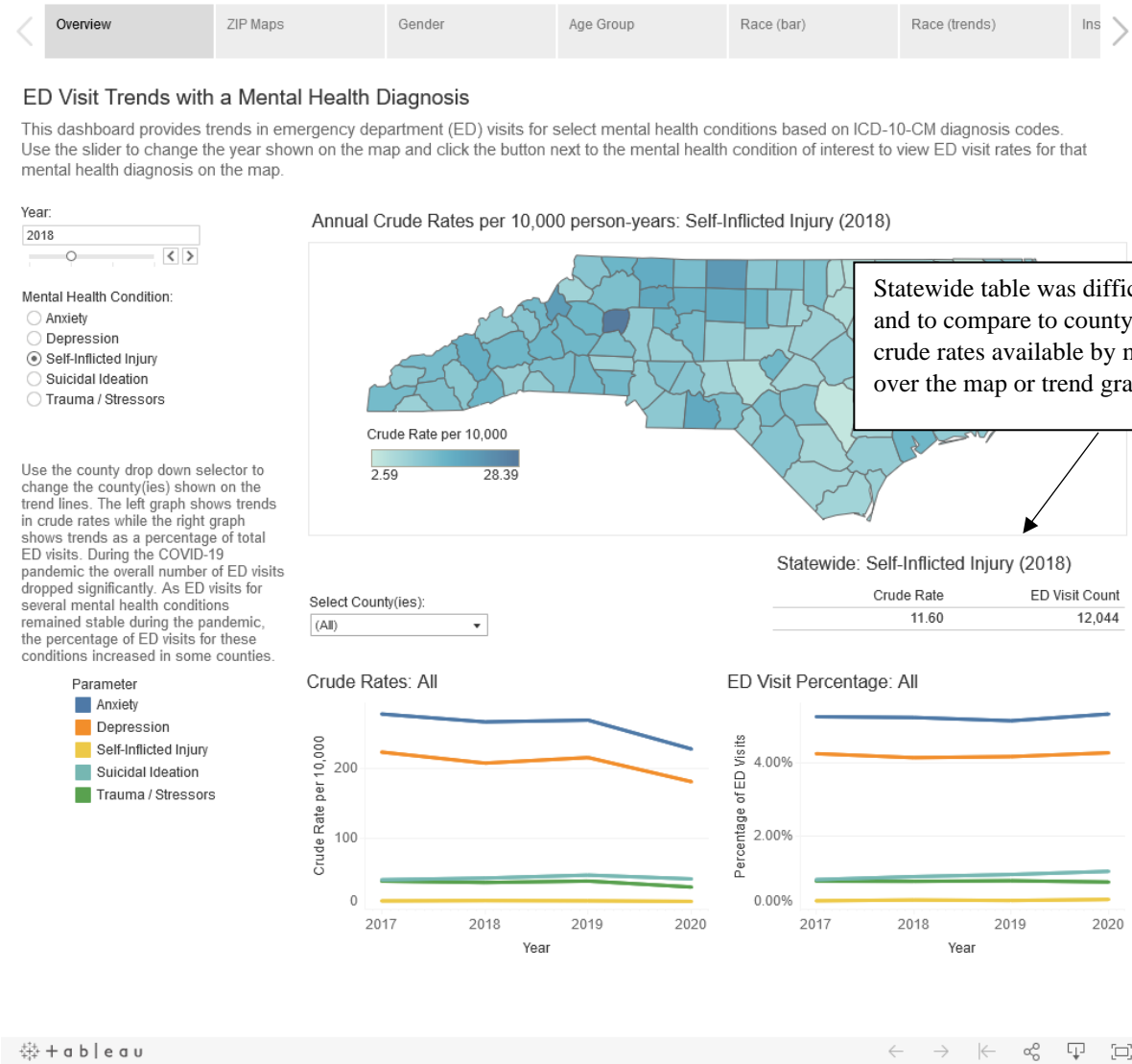
Semi-Structured Interview Task Completion on the Mental Health Dashboard

We asked participants to complete tasks on the Mental Health dashboard and interpret the data shown. Across all tabs, users were successfully able to use the county drop down menu, the

year selection menu, and the parameter selection menu to select a county, year, and parameter of interest. For specific tasks included in the Web-based sessions, all participants successfully identified differences among overall rates for the mental health conditions included as well as differences across the mental health conditions by sex, age group, and insurance. On the ZIP maps, all six participants were able to explain why there were two maps (one using population as the denominator and one using total ED visits as the denominator). The most problematic tab was the Overview tab. The initial version of this tab provided a county-level map with additional county-level information available on mouseover, a statewide table with crude rate data for comparison, and two trend graphs showing county-level trends for all mental health conditions by crude rates and percentage of ED visits (Figure 4.1). Four participants had difficulty comparing data in the statewide table to the data available in the map and two graphs.

Figure 4.1: NC DETECT Mental Health Dashboard Overview Tab

NC DETECT: Mental Health



Semi-Structured Interview Qualitative Feedback on Both Dashboards

Contextual Information

Common themes emerged across both dashboards in the interviews. Participants reported that the dashboards should include explanations of the source of the ED visit data, how the ICD-10-CM definitions were applied to the data, how the data were suppressed, as well as data limitations. One participant suggested that additional contextual information related to events that impacted ED utilization, e.g., the COVID-19 pandemic, should be noted where possible.

Another participant suggested to make it more explicit that county data are based on patient county of residence (as opposed to county location of the ED). All participants reported the benefits of having data reported based on crude rates and percentage of ED visits, but they stressed the important of describing on the dashboard how we calculated these measures.

Pervasive Metadata

Several participants recommended that each table, graph, and map on a dashboard page should be labelled with the year, disease, and location, even if this information appears to be redundant when viewing the dashboard; they explained the importance of keeping the metadata associated with each object on the dashboard for instances when the user downloads or screenshots just a portion of the dashboard page.

Interactivity Expectations

When a county map is displayed along with a table and trend graphs as on the Overview page (Figure 1), users expect that selecting a county on the map would impact what is shown in the table and on the trend graph(s). For example, if a user selected Chatham County on the NC statewide map, any tabular data and/or graphical data available on that dashboard should have updated to be Chatham County data only. The initial version of this dashboard page did not have this functionality.

Data Presentation

We asked participants if they prefer to have dashboard pages that are primarily graphical in nature and then separate dashboard pages for tabular data or if these should be combined onto one dashboard page. All participants preferred to have graphical and tabular data on the same page, as shown in Figure 4.2.

Figure 4.2: NC DETECT Asthma & COPD Dashboard Displaying Graphical and Tabular Data on the Same Tab

NC DETECT: Asthma & COPD



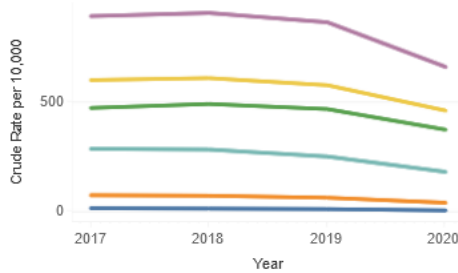
ED Visit Trends by Age Group

Parameter
 Asthma
 COPD

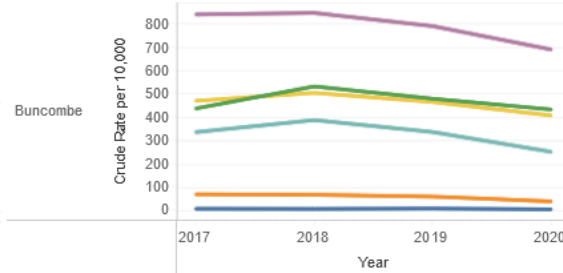
Age Group
 Ages 0-17
 Ages 18-44
 Ages 45-54
 Ages 55-64
 Ages 65-74
 Ages 75+

County
 Buncombe

Statewide ED Visit Trends by Age Group: COPD



ED Visit Trends by Age Group for COPD: Buncombe



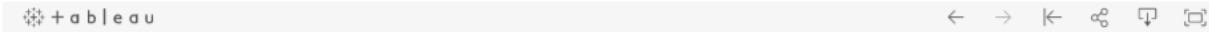
Statewide ED Visit Trends by Age Group: COPD

Age Group		2017	2018	2019	2020
Ages 0-17	ED Visit Count	3,005	2,656	2,174	722
	Crude Rate	13.1	11.5	9.4	3.1
	ED Visit %	0.35%	0.33%	0.26%	0.14%
	ED Visit %	0.35%	0.33%	0.26%	0.14%
Ages 18-44	ED Visit Count	26,308	25,733	22,621	14,121
	Crude Rate	72.4	70.1	61.0	38.1
	ED Visit %	1.36%	1.37%	1.21%	0.88%
	ED Visit %	1.36%	1.37%	1.21%	0.88%
Ages 45-54	ED Visit Count	39,222	38,563	33,862	24,341
	Crude Rate	283.4	280.0	248.2	178.4
	ED Visit %	6.10%	6.19%	5.50%	4.66%
	ED Visit %	6.10%	6.19%	5.50%	4.66%
Ages 55-64	ED Visit Count	61,965	65,427	63,207	50,443
	Crude Rate	469.2	487.4	464.0	370.3
	ED Visit %	11.05%	11.51%	10.74%	9.80%
	ED Visit %	11.05%	11.51%	10.74%	9.80%
Ages 65-74	ED Visit Count	58,413	61,111	59,951	47,839
	Crude Rate	596.3	605.2	572.9	457.1
	ED Visit %	12.93%	13.18%	12.29%	11.20%
	ED Visit %	12.93%	13.18%	12.29%	11.20%
Ages 75+	ED Visit Count	57,482	61,088	60,533	46,217
	Crude Rate	887.0	901.4	859.1	655.9
	ED Visit %	11.40%	11.81%	11.13%	10.02%
	ED Visit %	11.40%	11.81%	11.13%	10.02%

Counts < 5 are excluded.

ED Visit Trends by Age Group for COPD: Buncombe

Age		2017	2018	2019	2020
Ages 0-17	ED Visit Count	32	29	36	21
	Crude Rate	6.63	6.05	7.59	4.43
	ED Visit %	0.34%	0.30%	0.36%	0.34%
	ED Visit %	0.34%	0.30%	0.36%	0.34%
Ages 18-44	ED Visit Count	617	603	538	352
	Crude Rate	68.83	66.57	58.82	38.48
	ED Visit %	1.85%	1.66%	1.53%	1.21%
	ED Visit %	1.85%	1.66%	1.53%	1.21%
Ages 45-54	ED Visit Count	1,110	1,282	1,109	829
	Crude Rate	334.73	386.16	335.15	250.53
	ED Visit %	10.26%	11.13%	9.80%	9.34%
	ED Visit %	10.26%	11.13%	9.80%	9.34%
Ages 55-64	ED Visit Count	1,572	1,902	1,707	1,542
	Crude Rate	436.04	530.59	477.88	431.69
	ED Visit %	15.98%	17.35%	15.25%	16.50%
	ED Visit %	15.98%	17.35%	15.25%	16.50%
Ages 65-74	ED Visit Count	1,390	1,544	1,474	1,290
	Crude Rate	468.68	502.90	463.70	405.81
	ED Visit %	17.48%	17.81%	15.58%	16.13%
	ED Visit %	17.48%	17.81%	15.58%	16.13%
Ages 75+	ED Visit Count	1,702	1,775	1,712	1,495
	ED Visit %	17.48%	17.81%	15.58%	16.13%



Data Comparisons

Participants expressed the importance of allowing comparisons to statewide data as well as one or more peer counties on the same page. While some participants remarked that their primary comparisons are to statewide data, other participants who represented counties with substantially different demographics than the NC average rely primarily on comparisons to peer counties.

Tabular Displays

While all participants preferred that the dashboard show counts, crude rates, and percentage of ED visits across all stratifications (age group, sex, race, etc.), preferences on how best to order and group these tabular data were mixed. Some participants preferred to group the data by output type (count, crude rate, ED visit percentage) (Figure 4.3), while others preferred to group the data by stratification (age group, sex, race, etc.) (Figure 4.4).

Figure 4.3: Tabular Example of Grouping Data by Count/Rate/Percentage and then Stratification

Statewide ED Visit Trends by Race: COPD					ED Visit Trends by Race for COPD: Mecklenburg					
		2017	2018	2019			2017	2018	2019	2020
ED Visit Count	American Indian or Alaska Native	4,488	5,623	5,111	ED Visit Count	American Indian or Alaska Native	40	7	11	
	Asian or Pacific Islander	531	534	511		Asian or Pacific Islander	113	87	103	
	Black or African American	53,940	57,346	56,011		Black or African American	7,223	7,958	6,701	
	White	180,856	184,209	173,711		White	7,221	6,883	5,387	
	Other	4,024	4,160	3,911		Other	382	415	423	
	Unknown	2,559	2,709	2,811		Unknown	134	133	166	
Crude Rate	American Indian or Alaska Native	259.4	321.1	291.1	Crude Rate	American Indian or Alaska Native	42.2	7.3	10.9	
	Asian or Pacific Islander	15.4	14.9	14.9		Asian or Pacific Islander	15.9	11.8	13.9	
	Black or African American	228.0	239.5	233.1		Black or African American	199.1	215.3	178.0	
	White	244.9	247.1	233.1		White	113.9	107.4	82.9	
	Other					Other				
	Unknown					Unknown				
Percentage of ED Visits	American Indian or Alaska Native	7.1%	9.6%	8.1%	Percentage of ED Visits	American Indian or Alaska Native	1.5%	1.7%	2.9%	
	Asian or Pacific Islander	1.3%	1.1%	1.2%		Asian or Pacific Islander	2.4%	1.6%	1.9%	
	Black or African American	3.3%	3.5%	3.3%		Black or African American	3.2%	3.5%	2.9%	
	White	6.2%	6.7%	6.4%		White	3.8%	4.3%	3.9%	
	Other	1.6%	1.5%	1.2%		Other	1.6%	1.3%	0.9%	
						Unknown				

Counts < 5 are excluded.

Figure 4.4: Tabular Example of Grouping Data by Stratification and then Count/Rate/Percentage

Statewide ED Visit Trends by Ethnicity: Asthma					ED Visit Trends by Ethnicity: Asthma							
Ethnicity		2017	2018	2019	2020			2017	2018	2019	2020	
Hispanic	ED Visit Count	10,533	12,089	11,203	8,317	Alamance	Hispanic	ED Visit Count	340	449	536	3
	Crude Rate	109.6	121.5	109.2	81.1		Crude Rate	166.8	210.2	242.2	16	
	ED Visit %	3.4%	3.8%	3.4%	3.2%		ED Visit %	5.6%	6.9%	7.6%	5.4	
Not Hispanic	ED Visit Count	181,613	176,728	150,387	112,666	Not Hispanic	ED Visit Count	6,134	8,156	7,599	5,5	
	Crude Rate	195.1	188.3	158.9	119.1		Crude Rate	429.3	561.9	515.6	37	
	ED Visit %	4.5%	4.6%	3.9%	3.6%		ED Visit %	9.3%	11.5%	10.8%	9.7	
Unknown/Missing	ED Visit Count	20,774	25,848	30,036	23,550	Unknown/Missing	ED Visit Count	107	134	129	1	
	Crude Rate						Crude Rate					
	ED Visit %	3.5%	3.9%	3.9%	3.7%		ED Visit %	1.8%	2.1%	1.8%	1.1	
						Ashe	Hispanic	ED Visit Count	5	11	6	
							Crude Rate	38.4	79.8	43.2	7	
							ED Visit %	1.6%	2.6%	1.6%	3.2	
						Not Hispanic	ED Visit Count	293	502	494	3	
							Crude Rate	115.0	195.2	191.4	14	

Counts < 5 are excluded.

Data vs. Storytelling

Semi-structured interview participants overwhelmingly favored a dashboard more focused on data than storytelling. While several participants mentioned the importance of providing contextual information as described earlier such as data limitations, data quality issues and other caveats, they stated a preference to allow local health departments to use the data to make their own interpretations and to tell their own stories.

Downloads

Participants reported different approaches to downloading data and images from dashboards. They reported preferences for using the Tableau® Crosstab, Image, and PowerPoint features, as well as using browser screenshot functionality to download specific sections of a dashboard.

ZIP Code Maps

All participants stated that the ZIP maps were useful inclusions in the dashboard. One participant stated, “Census tract would be great, but ZIP is helpful for social determinants of health and health equity and being able to dig down deeper.” They requested better grouping of

outliers to allow for more color differentiation among the ZIP code areas with lower rates, and reference points for the map, e.g., large cities, when the statewide view is shown.

Sex vs. Gender

The mental health dashboard used a Gender heading for data shown for males and females and the asthma & COPD dashboard used Sex. Participants commented that the use of Sex is more appropriate given that the ED visit data most likely reflect biological sex rather than the patient's gender identity.

Age Groups

All participants requested more granular age groups on the Mental Health dashboard rather than just under 18 and over 18. Users stated that the six age groups included for COPD (0-17, 18-44, 45-54, 55-64, 65-74, 75+) were not too granular and that a similar approach should be taken to the greatest extent possible for asthma, with the understanding that suppression requirements for ED visit counts under five would be limiting for smaller counties. Several participants specifically requested age group breakouts for elementary, middle school and high school students across all conditions to provide information that could assist in programmatic efforts and resource allocation.

In addition to the display of age group data shown in Figure 4.2, participants also reviewed a tab showing an Age Group highlight table (Figure 4.5) on the Asthma & COPD Dashboard. They remarked that the color coding provided an at-a-glance way to identify age groups with higher crude rates, but participants generally preferred the standard data display template used across the dashboard as shown in Figure 4.2.

Figure 4.5: NC DETECT Asthma & COPD Dashboard Age Group Highlight Table



Race & Ethnicity Data

On both dashboards, race and ethnicity data were shown on separate dashboard pages. We asked participants how they reported on race and ethnicity data in their health department and their preference for the dashboard. Responses were mixed. Some health departments combined race and ethnicity into categories such as Non-Hispanic Black and Non-Hispanic White and preferred this approach, while others preferred to keep them separate. Several participants reported that when self-identifying race and ethnicity, many Hispanic and Latino residents leave race blank or select the “other” option.

On the Mental Health Dashboard, we presented race data in two different ways: one using bar graphs (Figure 4.6) and one following the template of other dashboard tabs showing statewide and county-level time series trends along with statewide and county-level tabular data (Figure 4.7). Participants preferred to keep the displays consistent across the different stratifications, and, therefore, preferred the time series with tabular data over the bar graphs, provided the time series graphs were corrected to use the same colors to designate race when comparing statewide trends to county-level trends.

Figure 4.6: NC DETECT Mental Health Dashboard Race Tab with Horizontal Bar Graphs

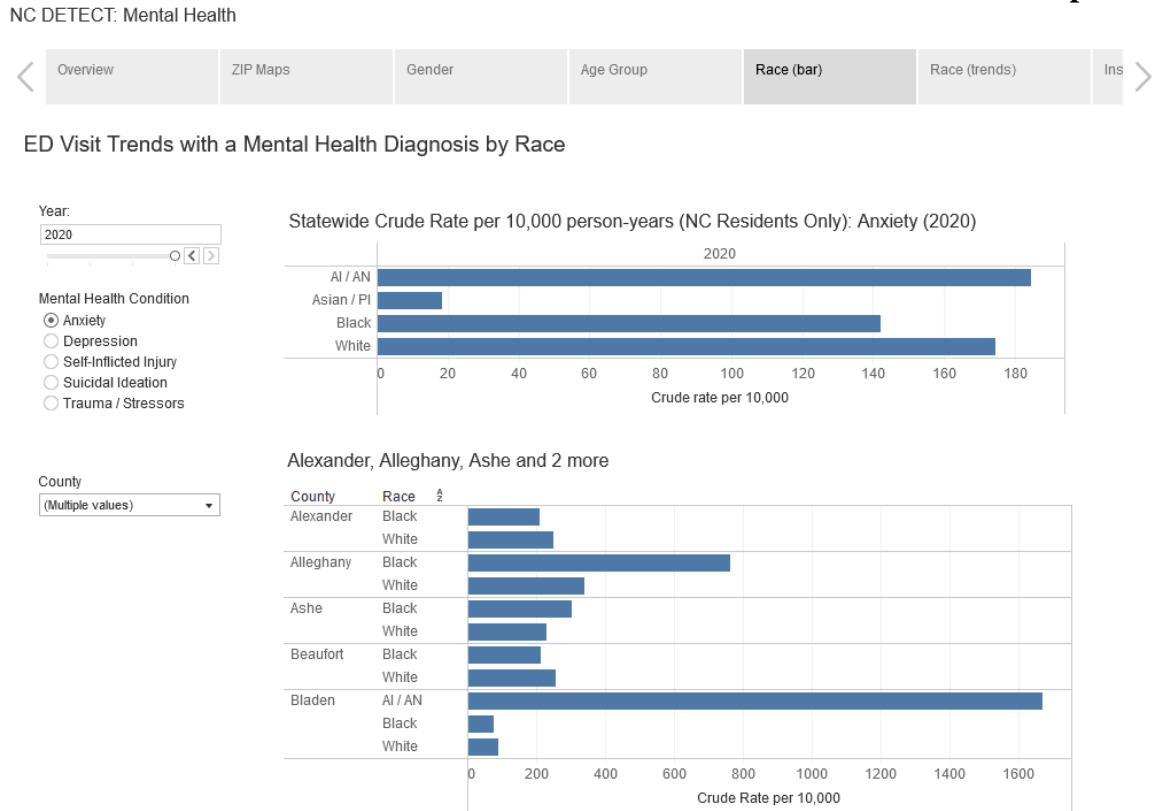
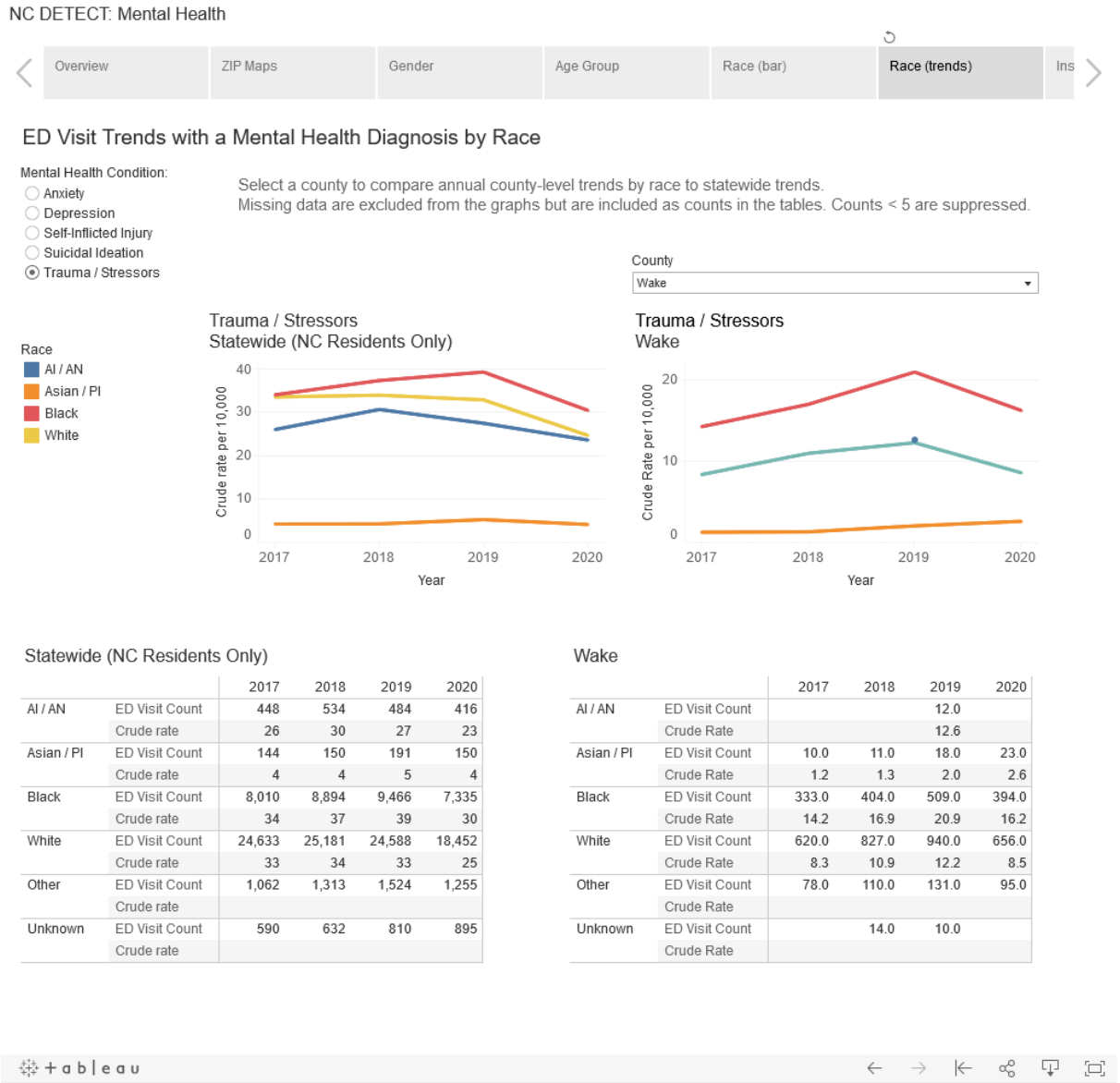


Figure 4.7: NC DETECT Mental Health Dashboard Race Tab with Time Series and Tabular Data



Insurance Coverage

We presented insurance coverage information slightly differently for the Mental Health dashboard and Asthma & COPD dashboard (Figures 8 & 9). Users responded positively to both displays but noted that the insurance coverage types were not ordered the same way for the statewide and county data on the Mental Health dashboard. On the asthma and COPD dashboard

they appreciated the at-a-glance comparisons available but suggested a different color scheme that was more muted.

Figure 4.8: Insurance Coverage Tab on the NC DETECT Mental Health Dashboard

NC DETECT: Mental Health

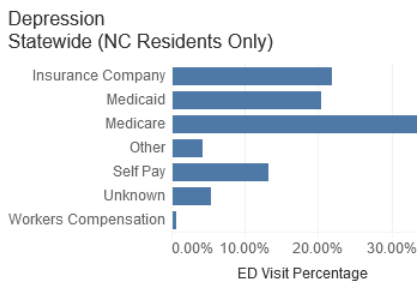


ED Visit Trends with a Mental Health Diagnosis by Insurance Coverage

Insurance coverage trends vary by county and by mental health condition. Change the year and mental health condition shown by using the selectors on the left. Select county(ies) using the county drop down just above the county-level bar graph. Counts < 5 are suppressed.

Year
2019

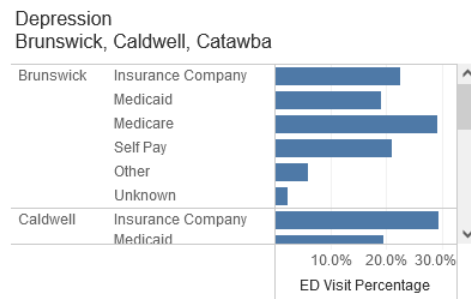
- Mental Health Condition:
- Anxiety
 - Depression
 - Self-Inflicted Injury
 - Suicidal Ideation
 - Trauma / Stressors



Depression
Statewide (NC Residents Only)

Insurance Company	Count	%
Insurance Company	39,743	21.86%
Medicaid	37,230	20.48%
Medicare	61,939	34.06%
Other	7,750	4.26%
Self Pay	24,182	13.30%
Unknown	9,788	5.38%
Workers Compensation	1,199	0.66%

Select County(ies)
(Multiple values)



Depression
Brunswick, Caldwell, Catawba

County	Insurance Company	Count	%
Brunswick	Insurance Company	148	22.53%
	Medicaid	125	19.03%
	Medicare	191	29.07%
	Self Pay	138	21.00%
	Other	40	6.09%
Caldwell	Insurance Company	764	29.32%
	Medicaid	508	19.49%
	Medicare	807	30.97%
	Self Pay	411	15.77%
	Workers Compensation	8	0.31%
Catawba	Insurance Company	1,257	21.49%
	Medicaid	1,080	18.47%
	Medicare	1,262	21.58%

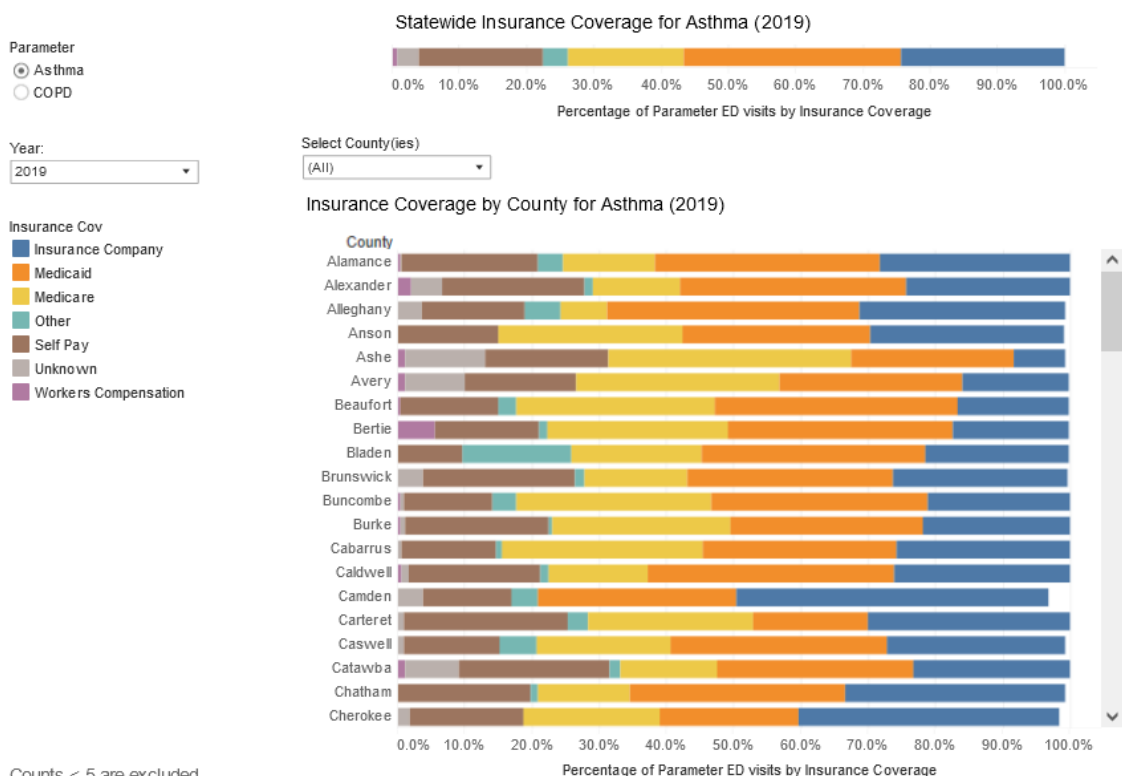
Figure 4.9: Insurance Coverage Tab on the Asthma & COPD Dashboard

NC DETECT: Asthma & COPD



Insurance Coverage Breakdown for Asthma & COPD

Select the parameter, year and county(ies) of interest to view the insurance coverage breakdown for ED visits.



County Profile

Two participants who provided feedback on the mental health dashboard expressed appreciation for the tab-specific stratifications for sex, age group, race, and insurance coverage with ability to compare to state and peer county trends, but they requested an additional tab that provided all of this information for a selected county on one dashboard page. To solicit qualitative feedback on this data presentation request, we added a County Profile tab to the Asthma & COPD dashboard before the semi-structured interviews took place (Figure 4.10).

Feedback on the County Profile tab was positive, and participants stated that this display would be helpful to provide an at-a-glance view of specific county trends for a specific condition by all of the available stratifications. They had mixed feedback on the use of color; some preferred the display as is, but others suggested a more monochromatic look. Two participants suggested combining race and ethnicity into one graph, and one participant suggested changing the County Profile to show just one year at a time rather than trends over multiple years. Participants also pointed out the error in the overlapping legends for race and ethnicity.

Figure 4.10: NC DETECT Asthma & COPD Dashboard County Profile Tab



Incorporation of Additional Data Sources

We asked participants if additional data sources should be added to the NC DETECT dashboards to provide additional, complementary data and information. All participants recommended the inclusion of links to additional resources or data sources rather than incorporation of additional data into the dashboard itself. One participant explained her rationale: “It’s a lot of information to process and as you start to add other data elements it may just be that tipping point where people are like, I can’t process it anymore.” Another participant remarked that “...there is something nice about saying this is what we are focused on ... we’re looking at this particular health condition in relation to this metric - ED visits. There is no need to move back and forth mentally between am I looking at ED visits or something else like absentee visits. And so, you are able to do a lot more with the data.”

Additional Dashboard Features

Suggestions for other changes to the dashboard other than those described earlier were minimal. One participant suggested the incorporation of monthly trends and another participant suggested additional data on ED visits related to disordered eating and bullying. Two participants requested inclusion of age groups in the breakdowns by sex.

Dashboard Revisions based on Semi-Structured Interviews

The second versions of the dashboards corrected typos, color-coding errors, and overlapping legends, and standardized layouts. We renamed Gender page on the mental health dashboard to Sex, updated the Insurance Coverage layout on the mental health dashboard to match that of the Asthma & COPD dashboard with a slightly more muted color scheme, and added a County Profile Tab to the mental health dashboard. For both dashboards we updated the age group tabs to incorporate more granular age groups. More specifically, the Age Group pages

display annual trends for children (< 18) and adults (18+) in time series graphs and more granular age groups in the tabular displays: 0-4, 5-9, 10-14, 15-17, 18-24, 25-44, 45-64 and 65+ for asthma, and 0-9, 10-14, 15-17, 18-24, 25-44, 45-64 and 65+ for the mental health conditions. We kept separate pages for race and ethnicity and for the tabular displays we grouped the data by stratification and then by counts, rates, and percentage of ED visits. We updated all county level graphs and tables on the sex, age group, race, and ethnicity pages to allow one or more counties to be selected. Finally, we renamed the Overview tab to Welcome and updated the county map to interact with the tabular and trend data included on the same screen. We added a monthly trend time series to show percentage of ED visits to this tab. We also included additional text to this first tab to provide contextual information. We added these updated versions of the dashboards to the NC DETECT website: <https://ncdetect.org/dashboard/> (Appendix 4.4).

Web-based Questionnaire

To solicit broader feedback on these revised dashboards, we emailed three announcements about the Web-based questionnaire to active NC DETECT users with an LHD affiliation on September 21, 2021, September 28, 2021, and October 4, 2021, and collected survey responses from September 21, 2021, through October 6, 2021. Thirty-three respondents answered at least one question on the Web-based questionnaire, a response rate of 14.7%. Respondents represented diverse LHD roles, years in those roles, and years of experience working with NC DETECT ED visit data.

Table 4.2: Respondent Characteristics

Question	Number (Percent) N=33
Position Title	
Health Director / Assistant Health Director	5 (15.15%)
Epidemiologist / Surveillance Manager	6 (18.18%)
Health Educator	6 (18.18%)
Preparedness Coordinator	5 (15.15%)
Community Health Assessment Coordinator	3 (9.09%)
Other	8 (24.24%)

Years in Current Position	
less than 1 year	11 (33.33%)
1-3 years	10 (30.30%)
4-9 years	11 (33.33%)
10+	1 (3.03%)
Experience Using NC DETECT ED Visit Data (for any reason)	
< 1 year	9 (27.27%)
1-3 years	6 (18.18%)
4-9 years	13 (39.39%)
10+ years	4 (12.12%)
I have not used NC DETECT to view emergency department visit data.	1 (3.03%)

System Usability Scale Results

Thirty respondents answered all SUS questions about the mental health dashboard and 26 respondents answered all questions about the asthma & COPD dashboard. The mental health dashboard scored slightly higher than the asthma & COPD dashboard. Using the Curved Grading Scale approach for the SUS developed by Sauro and Lewis (2016), both dashboards received a usability grade of A+ (SUS range of 84.1 to 100) based on the average SUS scores.²⁸

Table 4.3: SUS Results

SUS Scores	Mental Health Dashboard	Asthma & COPD Dashboard
Average	86	85
Median	86	88
Minimum	60	56
Maximum	100	100

Qualitative Questionnaire Feedback

Twenty-one respondents provided free text feedback across the survey questions that asked, “These dashboards would be more helpful if they...” and “Please share any additional feedback that you have.” Four responses stated that the dashboards should have easier download functionality for data and/or images. One respondent requested a training video, and another respondent requested more detail on the ICD-10-CM definitions used. Other feedback included requests for additional data, such as including primary city for each ZIP code (n=1), locations of psychiatric EDs (n=1), inclusion of overdose and substance use data (n=1), inclusion of

additional socioeconomic status indicators, data on the number of county residents visiting EDs out of county (n=1), data on residents visiting EDs out of state (n=1), and five-year rates in addition to annual rates (n=2). Remaining feedback included requests for additionally stratifications by age group and sex, age group and race, etc. (n=1), combining race and ethnicity (n=1), and easier selection of preferred county (n=3).

Expected Dashboard Data Use

Twenty-eight respondents provided free text comments regarding how they might use the data from the dashboards, which we sorted into general themes (Table 4.4). A comment may have been counted more than once if it identified more than one use of the data. Respondents stated that the data could be used for reporting and grant applications, informing stakeholders and decision-making, as well as trend monitoring and informing specific public health programs. As one respondent noted, the data could be used to “[a]ssist our Epi program as they prepare for the community health assessment process, assist our depression screening program on current, available data, show our BH [Behavioral Health] taskforce how to navigate/interpret this resource.”

Table 4.4: Dashboard Data Use by Local Health Departments

Dashboard Data Use	Number
Use data in Reports, e.g., Community Health Assessment	8
Inform community health prioritization; target strategies to the most impacted segments of our county population; equitable decision-making	7
Trend monitoring	6
Support programmatic efforts	5
Share data with stakeholders	4
Grant applications	4

Discussion

We tested and refined two dashboards showcasing ED visit data for a local health department audience. We used semi-structured interview feedback to refine the dashboards,

which led to high usability scores in follow-up surveys. Feedback on some specific design choices remain mixed and will continue to be modified as needed based on additional feedback. Future research will further assess the extent and ways in which the dashboard is used by LHD users.

While the COVID-19 pandemic presented innumerable challenges to LHDs, it also increased awareness and use of Tableau® dashboards. During several of the semi-structured interviews, participants referenced the NC DHHS COVID-19 dashboard when remarking on dashboard functionality and expectations, and familiarity with this dashboard may have influenced interviewee ability to select counties, years, and parameters of interest on the NC DETECT dashboards, as witnessed during the interviews. The feedback on the Overview tab revealed interesting insights on the challenges of comparing tabular data to data that appears via mouseover on graphical or map-based data. This finding influenced our approach to allow users to compare statewide trends on a time series to county-level trends on a time series and statewide tabular trends to county-level tabular trends. More work is also needed to ensure that users can download the data and images they need with ease. We may need to provide additional dashboard pages with just tabular data, for example, to facilitate more efficient data downloads using the Tableau® Crosstab feature.

Interview participants commented on the value of ZIP code maps to identify disparities in health conditions in particular areas of the county. One interviewee noted that “[c]ensus tract would be great, but ZIP is helpful for social determinants of health and health equity and being able to dig down deeper.” Another interviewee stated that providing data on mental health conditions and chronic diseases at the ZIP code level is a helpful guidepost and “... gives a general idea ...at a glance instantly almost ... as to these major health issues about where to start.

It may not be perfect or exactly precise, but I don't know that precision is needed when you at first need an idea as to where do I look." While the incorporation of ZIP code maps into NC DETECT dashboards is a promising feature, more research is needed to ensure best practices when displaying these data, especially addressing outliers that result primarily from ZIP codes with very small populations.

Both dashboards scored well on overall usability based on the SUS questions answered in the Web-based questionnaire. Even though the survey response rate was low (14.7%), prior research has found that SUS scores are reliable even with just five responses.²⁹ This feedback suggests that the relatively simple data displays available on these dashboards are still tremendously useful and usable for this LHD audience.

Qualitative feedback collected via the Web-based survey suggested the need for training on how to use the dashboards. For example, while users in the semi-structured interviews were familiar with how the "All" option in a Tableau® drop down menu can be used to select all and deselect all, a survey respondent requested a county "deselect" button. Additionally, another user requested "more county focused" dashboards. This comment was somewhat confusing given that each dashboard page provides customizable county-level data, but a training overview may improve understanding on how to best to use the available functionality.

Survey respondents identified a variety of uses for the dashboard data including inclusion in annual reports and community health assessments. Future analysis of community health assessments can determine if LHDs actually incorporate the data from these and other NC DETECT dashboards into these reports. Number of views of the dashboards can also be used to monitor overall trends in access.

Limitations

The 10 interviewees who provided feedback on the initial versions of the dashboards responded to an email invitation sent to all NC DETECT LHD users. This convenience sample may not reflect the entire NC DETECT LHD user base. Interview participants may also have been reluctant to be highly critical of the dashboards, reflecting a social desirability bias.³⁰ While studies suggest that SUS usability data are reliable with even as few as five responses, the low response rate to the Web-based questionnaire may not reflect the opinions of all prospective users of the dashboards.²⁹

Policy and Practice Recommendations

Tableau® and other graphical user interface-based software like Microsoft's PowerBI® have improved the ability to develop and share user-friendly data dashboards. This research demonstrated that public-facing dashboards showcasing ZIP code level, county level and statewide NC DETECT ED visit data for a variety of chronic disease and mental health conditions are a promising mechanism to provide annual trends to NC LHD staff and provide a useful complement to the near real time focused surveillance tools available in the NC DETECT Web application. The dashboards can provide an efficient mechanism to share information on ED visit trends that can be downloaded and repurposed for LHD community health assessments and other reports. Resources should be allocated to maintain and improve these dashboards and develop additional dashboards focused on other conditions of interest, based on user feedback.

Conclusion

This study focused on the development and evaluation of two public facing dashboards providing primarily annual ED visit trends for select mental health conditions as well as asthma and COPD. We received positive feedback on the usability and usefulness of the dashboards, but additional training would be beneficial for some users. Public-facing dashboards showcasing ED

visit data at the ZIP and county-level and facilitating comparisons to statewide and peer county trends can address help to address data gaps identified by LHD users and improve identification of health disparities, decision making and resource allocation.

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CHAPTER 5: CONCLUSION

Our research demonstrates the value of developing dashboards for a local health department audience to provide timely, efficient access to syndromic surveillance emergency department (ED) visit data for select mental health conditions, asthma, and chronic obstructive pulmonary disease (COPD). These surveillance tools can address the need for timely county and subcounty level data to identify health disparities, assist with identification of priorities, and inform decision making. More research is needed to determine if surveillance for additional mental health and chronic conditions can be conducted using this approach, to identify additional data limitations, to determine the most appropriate case definitions to use for accurate trend monitoring, and to identify best practices for optimal engagement with and use of syndromic surveillance ED visit data by local health departments (LHDs) to inform policy and practice for mental health and chronic disease.

While North Carolina LHDs receive guidance from the NC Division of Public Health and national accreditation bodies on how to conduct community health assessments, there were no previously published studies documenting the secondary data sources used by NC LHDs for describing mental health and chronic disease burden in their communities.^{1,2} We began our research, therefore, by conducting a descriptive content analysis of the 100 most recent local health department community health assessments (CHAs) in order to quantify the data sources typically used by NC LHDs to document mental health and chronic disease burden. The most common data sources referenced in these CHAs for mental health and chronic disease included data from death certificates (n=100), the NC Central Cancer Registry/National Cancer Institute

(n=67), hospital inpatient settings (n=56), County Health Rankings (CHR) (n=49), Behavioral Risk Factor Surveillance System (BRFSS) (n=36), and Medicare (n=35). The average latency between these data sources and the CHA publication date was over two years. Very few CHAs included data from North Carolina's statewide syndromic surveillance system, NC DETECT, for chronic disease or mental health. Two CHAs included NC DETECT data on asthma, two included data for self-inflicted injury, one had data on suicidal ideation, one had data on anxiety, and one had data on chronic obstructive pulmonary disease (COPD). Across these CHAs, however, the date of the NC DETECT data was the same as the CHA publication date, highlighting the timeliness and potential value of NC DETECT ED visit data as a data source for local health department reporting needs.

In addition to documenting the chronic disease and mental health data sources used, we also abstracted information on any documented data gaps. Previous studies have collected data on LHD data gaps, but these were not specific to North Carolina.³⁻⁵ Fifty-five CHAs included mention of data limitations and/or data gaps in their CHAs, which included an inability to measure subpopulation disparities, limitations on data timeliness, and challenges in obtaining county-level data, among others.

One additional component of the content analysis documented the public health priority areas for each county. Fifty-four LHDs identified mental health / behavioral health as a priority area of focus for programming and intervention efforts in their CHAs and 40 LHDs listed chronic disease. Given the interest in these particular health conditions as well as identified data gaps, further evaluation of NC DETECT ED visit data for mental health and chronic disease was needed.

The second aim of our research focused on analyzing NC DETECT ED visit data from 2017 to 2020 and comparing these data to the data sources most used in the CHAs, namely death certificate data, Medicare data, and CHR data. Previous studies have compared BRFSS and other local survey data to emergency department claims data, but we did not identify any previous studies that compared statewide syndromic surveillance ED visit data to death certificate, CHR, or Medicare data.^{6,7}

Our analysis showed that NC DETECT ED visit data capture healthcare seeking behaviors of NC residents who are more likely to be very young (under 5), elderly (70 or older), female, Black or African American, utilizing Medicare or Medicaid, or have no documented insurance compared to the overall NC population. We also documented significant variation in ED visit trends by age group, sex, and race for diagnoses of anxiety-related disorders, depression, self-inflicted injury, suicidal ideation, trauma and stressor-related disorders, asthma, and COPD based on ICD-10-CM based definitions from the Centers for Medicare & Medicaid Services, the Agency for Healthcare Research and Quality, and the Council of State and Territorial Epidemiologists.⁸⁻¹⁰ For example, statewide ED visit rates for self-inflicted injury are higher for children (0-17) compared to adults (18 and older), while rates for anxiety, depression, suicidal ideation and trauma and stressor-related disorders are all higher for adults. Females had higher ED visit crude rates with a diagnosis of depression, anxiety-related disorders, self-inflicted injury, or trauma and stressor-related disorders, while males had higher rates for suicidal ideation. The mental health issues and chronic conditions contributing to ED visits are multi-faceted and require tailored public health response efforts to reach the populations in highest need. LHD access to syndromic surveillance ED visit data enables useful insights into subpopulation trends that can inform local decision making.

We also analyzed the chief complaints of the ED visits that received diagnoses of anxiety-related disorders, depression, self-inflicted injury, suicidal ideation, trauma- and stressor-related disorders, asthma, or COPD. The frequencies of single-word terms (unigrams) revealed some commonalities across these conditions. For example, *pain* was the most common unigram for anxiety, asthma, COPD, depression and trauma and stressor-related disorders. This analysis also identified unigrams, e.g., *fall*, that appear to be unrelated to the primary conditions of interest, suggesting that the ICD-10-CM definitions used, and the inclusion of all diagnosis codes assigned to the ED visit in the analysis are identifying mental health conditions, asthma, and COPD documented as co-morbid conditions as well as the primary reason for the ED visit. While understanding trends in co-morbidities at the county and sub-county level provides value to LHDs, more research is needed to understand hospital coding differences that may be impacting the rates and trends seen for these conditions at the local level.

Our comparisons of NC DETECT ED visit data to data from death certificates, CHR, and Medicare identified low correlation at the county level for asthma, COPD, and mental health conditions (0.00 to 0.46). However, county-level ED visit crude rates, regardless of reason for visit, have a relatively high correlation with CHR county-level health outcome rankings (0.73), suggesting that high ED visit rates in a county reflect poorer health in a community, and/or higher challenges with accessing non-acute healthcare compared to those counties with lower ED visit rates. NC DETECT ED visit data provide additional community-level insights that can be informative to LHDs, but ED visit data may not reflect the health or the health-seeking behavior of the county's population.

The final component of this research developed and evaluated two publicly accessible dashboards using Tableau® software: one focused on ED visits with diagnoses of anxiety-related

disorders, depression, self-inflicted injury, suicidal ideation, or trauma and stressor-related disorders and one focused on ED visits with diagnoses of asthma or COPD. The dashboards include annual statewide and county-level data from 2017 through 2020 with additional breakdowns by ZIP code, sex, age group, race, ethnicity, and insurance coverage.

We received feedback on the initial versions of the dashboards through 10 semi-structured interviews conducted via Web conference with prospective LHD users. We incorporated suggestions for improvements into revised dashboards, and then conducted a broader evaluation from LHD users via a Web-based questionnaire. While the response rate to the questionnaire was low (14.7%), we received sufficient feedback to calculate reliable usability scores for the dashboards using the System Usability Scale (SUS).^{11,12} Both dashboards received high usability scores, with the average SUS scores of 86 and 85 for the mental health dashboard and asthma and COPD dashboard, respectively. Survey responses also provided insights into how the dashboard data would be used, including reports for a variety of stakeholders, grant applications, informing LHD priorities, and monitoring trends. We also received recommendations for additional improvements, including the need for training on how best to use the dashboards. More research is needed to improve the utility of these existing dashboards for LHD users who may not have been represented in the semi-structured interviews or survey, as well as to identify priority areas for additional dashboards that provide efficient access to annual NC DETECT ED visit data.

We conducted the entirety of this research during the COVID-19 pandemic which may have impacted our findings. For example, the content analysis identified the commonly used secondary data sources for mental health and chronic disease among NC LHDs but semi-structured interviews about current data limitations and data gaps may have been more

informative; this method, however, was infeasible during the summer of 2020. Active response efforts to the pandemic by those in LHDs may have contributed to the low response rate of our dashboard surveys. The NC ED visit data for 2020 clearly display the impacts of the pandemic on ED utilization, with a decline of roughly 20% for the year. Additional research is needed to document fully the impacts of this decline and strategies to account for it while monitoring annual trends.

The overarching focus of this research was to determine if syndromic surveillance ED visit data could assist NC LHDs in monitoring chronic disease and mental health trends in their communities as well as identifying health disparities and target populations for interventions. Our research on the use of secondary data for chronic disease and mental health in NC CHAs documented components of the current data use practices of NC LHDs and noted data gaps. Our analysis of NC DETECT ED visit data for anxiety-related disorders, depression, suicidal ideation, self-inflicted injury, trauma and stressor-related disorders, asthma and COPD provided new insights into the county-level trends and demographic variation in these conditions. Our initial dashboards provide access to four years of ED visit data for these conditions and provide a strong foundation on which to continue to research best practices in disseminating multi-year syndromic surveillance ED visit data on mental health and chronic diseases to LHDs, with the ultimate goal of improving the health of North Carolinians.

APPENDIX 2.1: Content Analysis Codebook

Codebook Item	Description	Answer Options
County	County conducting the CHA	Drop down of 100 NC Counties
CHADate	CHA Date	Year (2015 – 2020) (radio buttons)
Priorities	Priorities	Free text
Mortality	Does the CHA include mortality data from death certificates for chronic disease and/or mental health indicators?	Chronic Disease, Mental Health, Neither (check boxes)
MortalityGeographic	What is the most granular geographic variable used for the mortality data presented?	NC, Regional, County, City/ZIP, Census Tract, N/A (radio buttons)
MortalityDate	What is the most recent date for the mortality data presented?	2012-2019 as well as N/A (radio buttons)
MortalityChronic	Chronic Disease Indicators of interest described with mortality data: select all that apply	Asthma, Cancer, Chronic Kidney Disease, COPD / Chronic Lower Respiratory Disease, Diabetes, Heart-related, Hypertension, Stroke / cerebrovascular, Oral Health, Other (check boxes)
MortalityChronicOther	If other, chronic disease indicators for mortality, list here	Free text
MortalityMentalHealth	Mental health indicators of interest described with mortality data: select all that apply	Suicide, Alzheimer's / Dementia, Other (check boxes)
MortalityMentalHealthOther	Other mental health indicators included with mortality data.	Free text
Medicare	Does the CHA include Medicare data for chronic disease or mental health?	Chronic Disease, Mental Health, Neither (check boxes)
MedicareGeographic	What is the most granular geographic variable used for the Medicare data presented?	NC, Regional, County, City/ZIP, Census Tract, N/A (radio buttons)
MedicareDate	What is the most recent date for the Medicare data presented?	2012-2019 as well as N/A (radio buttons)
MedicareChronic	Chronic Disease Indicators of interest described with Medicare data: select all that apply	Asthma, Cancer, Chronic Kidney Disease, COPD / Chronic Lower Respiratory Disease, Diabetes, Heart-related, Hypertension, Stroke / cerebrovascular, Oral Health, Other (check boxes)
MedicareChronicOther	If other chronic disease indicators for Medicare data, list here:	Free text
MedicareMentalHealth	Mental health indicators of interest described with Medicare data: select all that apply	Suicide, Alzheimer's / Dementia, Depression, Anxiety, Suicidal Ideation, Suicide Attempts, Other (check boxes)
MedicareMentalHealthOther	Other mental health indicators included with Medicare data.	Free text
Inpatient	Does the CHA include hospital inpatient data for chronic disease or mental health?	Chronic Disease, Mental Health, Neither (check boxes)

Codebook Item	Description	Answer Options
InpatientGeographic	What is the most granular geographic variable used for the hospital inpatient data presented?	NC, Regional, County, City/ZIP, Census Tract, N/A (radio buttons)
InpatientDate	What is the most recent date for the hospital inpatient data presented?	2012-2019 as well as N/A (radio buttons)
InpatientChronic	Chronic Disease Indicators of interest described with hospital inpatient data: select all that apply	Asthma, Cancer, Chronic Kidney Disease, COPD / Chronic Lower Respiratory Disease, Diabetes, Heart-related, Hypertension, Stroke / cerebrovascular, Oral Health, Other (check boxes)
InpatientChronicOther	If other chronic disease indicators for hospital inpatient data, list here:	Free text
InpatientMentalHealth	Mental health indicators of interest described with hospital inpatient data: select all that apply	Suicide, Alzheimer's / Dementia, Depression, Anxiety, Suicidal Ideation, Suicide Attempts, Other (check boxes)
InpatientMentalHealthOther	Other mental health indicators included with hospital inpatient data.	Free text
NCDETECT	Does the CHA include NC DETECT ED data for chronic disease or mental health?	Chronic Disease, Mental Health, Neither (check boxes)
NCDETECTGeographic	What is the most granular geographic variable used for the NC DETECT ED data presented?	NC, Regional, County, City/ZIP, Census Tract, N/A (radio buttons)
NCDETECTDate	What is the most recent date for the NC DETECT ED data presented?	2012-2019 as well as N/A (radio buttons)
NCDETECTChronic	Chronic Disease Indicators of interest described with NC DETECT ED data: select all that apply	Asthma, Cancer, Chronic Kidney Disease, COPD / Chronic Lower Respiratory Disease, Diabetes, Heart-related, Hypertension, Stroke / cerebrovascular, Oral Health, Other (check boxes)
NCDETECTChronicOther	If other chronic disease indicators for NC DETECT ED data, list here:	Free text
NCDETECTMentalHealth	Mental health indicators of interest described with NC DETECT ED data: select all that apply	Suicide, Alzheimer's / Dementia, Depression, Anxiety, Suicidal Ideation, Suicide Attempts, Other (check boxes)
NCDETECTMentalHealthOther	Other mental health indicators included with NC DETECT ED data.	Free text
ED	Does the CHA include other / non-NC DETECT ED data for chronic disease or mental health?	Chronic Disease, Mental Health, Neither (check boxes)
EDSource	What is the source of this other non-NC DETECT ED data, e.g., directly from the community's hospital, etc.	Free text
EDGeographic	What is the most granular geographic variable used for the other / non-NC DETECT ED data presented? If at the facility level, select ZIP/city.	NC, Regional, County, City/ZIP, Census Tract, N/A (radio buttons)
EDDate	What is the most recent date for the non-NC DETECT ED data presented?	2012-2019 as well as N/A (radio buttons)

Codebook Item	Description	Answer Options
EDChronic	Chronic Disease Indicators of interest described with other / non-NC DETECT ED data: select all that apply	Asthma, Cancer, Chronic Kidney Disease, COPD / Chronic Lower Respiratory Disease, Diabetes, Heart-related, Hypertension, Stroke / cerebrovascular, Oral Health, Other (check boxes)
EDChronicOther	If other chronic disease indicators for the other / non-NC DETECT ED data, list here:	Free text
EDMentalHealth	Mental health indicators of interest described with the other / non-NC DETECT ED data: select all that apply	Suicide, Alzheimer's / Dementia, Depression, Anxiety, Suicidal Ideation, Suicide Attempts, Other (check boxes)
EDMentalHealthOther	Other mental health indicators included with the other / non-NC DETECT ED data	Free text
BRFSS	Does the CHA include BRFSS data for chronic disease or mental health?	Chronic Disease, Mental Health, Neither (check boxes)
BRFSSGeographic	What is the most granular geographic variable used for the BRFSS data presented?	NC, Regional, County, City/ZIP, Census Tract, N/A (radio buttons)
BRFSSDate	What is the most recent date for the BRFSS data presented?	2012-2019 as well as N/A (radio buttons)
BRFSSChronic	Chronic Disease Indicators of interest described with BRFSS data: select all that apply	Asthma, Cancer, Chronic Kidney Disease, COPD / Chronic Lower Respiratory Disease, Diabetes, Heart-related, Hypertension, Stroke / cerebrovascular, Oral Health, Other (check boxes)
BRFSSChronicOther	If other chronic disease indicators for BRFSS data, list here:	Free text
BRFSSMentalHealth	Mental health indicators of interest described with BRFSS data: select all that apply	Suicide, Alzheimer's / Dementia, Depression, Anxiety, Suicidal Ideation, Suicide Attempts, Other (check boxes)
BRFSSMentalHealthOther	Other mental health indicators included with BRFSS data.	Free text
YRBS	Does the CHA include YRBS data for chronic disease or mental health?	Chronic Disease, Mental Health, Neither (check boxes)
YRBSGeographic	What is the most granular geographic variable used for the YRBS data presented?	NC, Regional, County, City/ZIP, Census Tract, N/A (radio buttons)
YRBSDate	What is the most recent date for the YRBS data presented?	2012-2019 as well as N/A (radio buttons)
YRBSChronic	Chronic Disease Indicators of interest described with YRBS data: select all that apply	Asthma, Cancer, Chronic Kidney Disease, COPD / Chronic Lower Respiratory Disease, Diabetes, Heart-related, Hypertension, Stroke / cerebrovascular, Oral Health, Other (check boxes)
YRBSChronicOther	If other chronic disease indicators for YRBS data, list here:	Free text

Codebook Item	Description	Answer Options
YRBSMentalHealth	Mental health indicators of interest described with YRBS data: select all that apply	Suicide, Alzheimer's / Dementia, Depression, Anxiety, Suicidal Ideation, Suicide Attempts, Other (check boxes)
YRBSMentalHealthOther	Other mental health indicators included with YRBS data.	Free text
OtherDataSources	If the CHA includes other secondary data sources for chronic disease or mental health, please list them here	Free text
OtherGeographic	What is the most granular geographic variable used for the other secondary data presented?	NC, Regional, County, City/ZIP, Census Tract, N/A (radio buttons)
OtherDate	What is the most recent date for the other secondary data presented?	2012-2019 as well as N/A (radio buttons)
OtherChronic	Chronic Disease Indicators of interest described with the other secondary data: select all that apply	Asthma, Cancer, Chronic Kidney Disease, COPD / Chronic Lower Respiratory Disease, Diabetes, Heart-related, Hypertension, Stroke / cerebrovascular, Oral Health, Other (check boxes)
OtherChronicOther	If other chronic disease indicators for other secondary data, list here:	Free text
OtherMentalHealth	Mental health indicators of interest described with other secondary data: select all that apply	Suicide, Alzheimer's / Dementia, Depression, Anxiety, Suicidal Ideation, Suicide Attempts, Other (check boxes)
OtherMentalHealthOther	Other mental health indicators included with other secondary data.	Free text
DataGaps	Data gaps identified in the community health assessment	Free text

APPENDIX 4.1: INITIAL DASHBOARD SCREENSHOTS

Mental Health Dashboard

NC DETECT: Mental Health

ED Visit Trends with a Mental Health Diagnosis

This dashboard provides trends in emergency department (ED) visits for select mental health conditions based on ICD-10-CM diagnosis codes. Use the slider to change the year shown on the map and click the button next to the mental health condition of interest to view ED visit rates for that mental health diagnosis on the map.

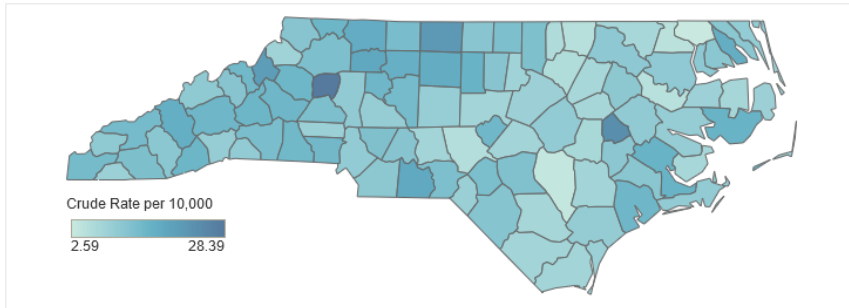
Year:

- Mental Health Condition:
- Anxiety
 - Depression
 - Self-Inflicted Injury
 - Suicidal Ideation
 - Trauma / Stressors

Use the county drop down selector to change the county(ies) shown on the trend lines. The left graph shows trends in crude rates while the right graph shows trends as a percentage of total ED visits. During the COVID-19 pandemic the overall number of ED visits dropped significantly. As ED visits for several mental health conditions remained stable during the pandemic, the percentage of ED visits for these conditions increased in some counties.

- Parameter
- Anxiety
 - Depression
 - Self-Inflicted Injury
 - Suicidal Ideation
 - Trauma / Stressors

Annual Crude Rates per 10,000 person-years: Self-Inflicted Injury (2018)

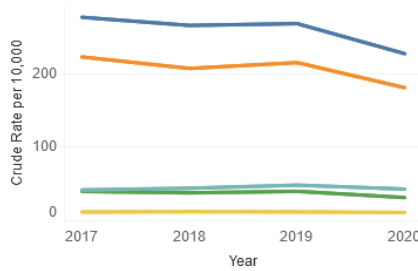


Statewide: Self-Inflicted Injury (2018)

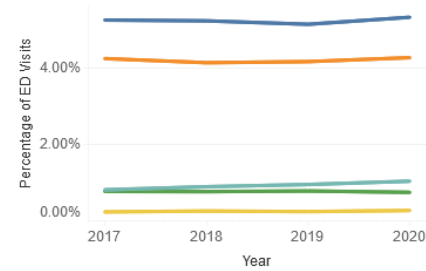
	Crude Rate	ED Visit Count
	11.60	12,044

Select County(ies):

Crude Rates: All



ED Visit Percentage: All



+ a b l e a u

ED Visit Trends with a Mental Health Diagnosis by ZIP of Residence

Mental Health Condition: Depression
 Year: 2020
 Primary County(ies): (Multiple values)

Statewide (NC Residents Only)

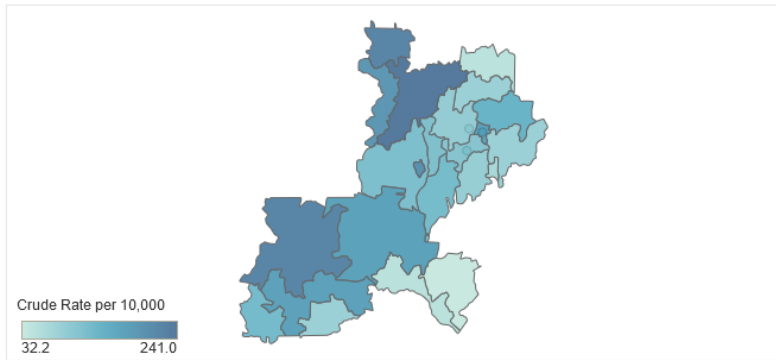
% of ED Visits	3.62%
Crude Rate	139.2

ED visit data at the ZIP level can provide sub-county insights. The first map shows ED visits for the selected mental health condition as a crude rate (divided by the population for that ZIP). The second map shows ED visits as a percentage of total ED visits for that ZIP.

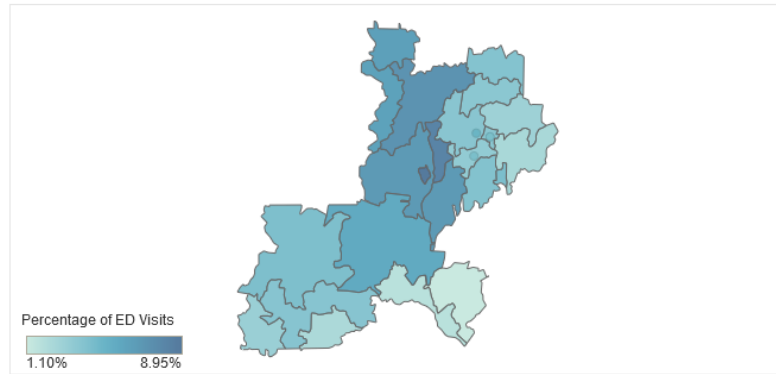
The population data by ZIP is an approximation based on census data. ZIP codes do not represent precise geographic areas, and population data is not available for some of the ZIP codes received in NC DETECT. In addition, ZIP codes can cross county lines but in this dataset are affiliated with a primary county only. Please select a neighboring county to view a ZIP code of interest if it does appear for your county.

Map color coding may change based on the county(ies) selected. Statewide rates are available for comparison.

Annual Crude Rates per 10,000 person-years by ZIP



Percentage of Total ED Visits by ZIP



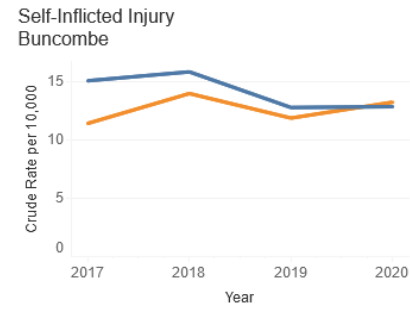
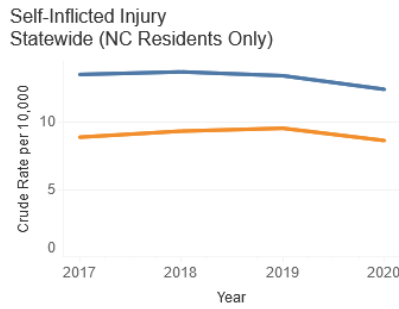
ZIP	Count	Percentage	Crude Rate
27207	65	3.88%	170.8
27208	21	3.07%	124.2
27231	45	6.38%	219.7
27243	88	6.26%	188.6
27252	19	2.29%	83.9
27278	655	7.21%	241.0
27312	376	5.71%	169.3
27344	423	4.28%	219.3
27503	34	4.04%	47.1
27510	291	8.95%	200.1
27514	376	8.21%	114.5
27516	512	6.78%	116.1
27517	354	6.81%	122.8
27559	14	1.73%	48.7
27562	9	1.10%	32.2
27701	447	3.74%	168.7

ED Visit Trends with a Mental Health Diagnosis by Gender

- Mental Health Condition
- Anxiety
 - Depression
 - Self-Inflicted Injury
 - Suicidal Ideation
 - Trauma / Stressors

- Sex
- Female
 - Male

County
Buncombe



Statewide (NC Residents Only)

		2017	2018	2019	2020
Female	ED Visit Count	7,127	7,313	7,235	6,689
	Crude Rate	14	14	13	12
Male	ED Visit Count	4,423	4,698	4,853	4,387
	Crude Rate	9	9	10	9
Unknown	ED Visit Count	32	33	8	12
	Crude Rate				

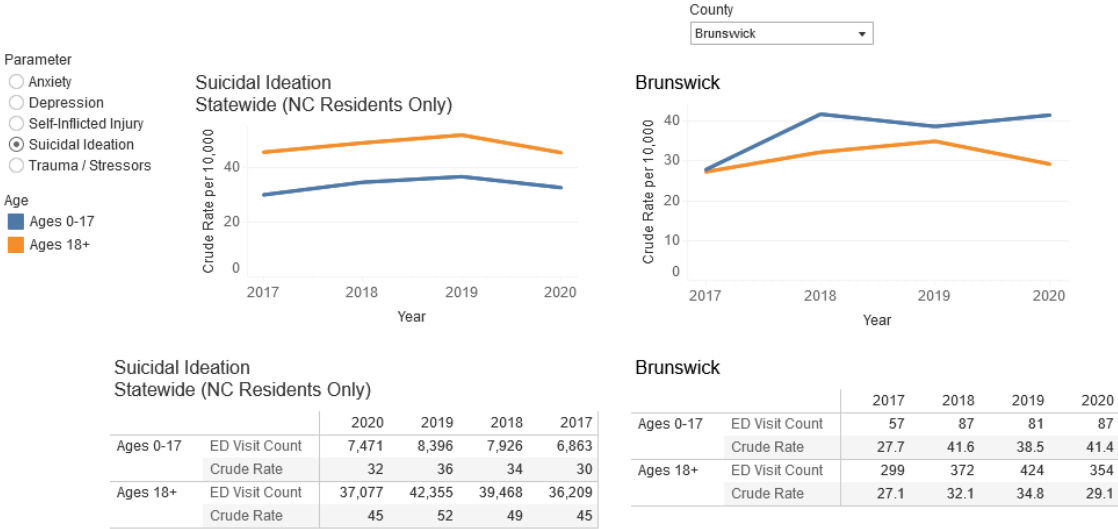
Buncombe

		2017	2018	2019	2020
Female	ED Visit Count	201	213	173	174
	Crude Rate	15.0	15.8	12.7	12.8
Male	ED Visit Count	140	173	148	165
	Crude Rate	11.4	13.9	11.8	13.2

NC DETECT: Mental Health

- Overview
- ZIP Maps
- Gender
- Age Group
- Race (bar)
- Race (trends)
- Ins

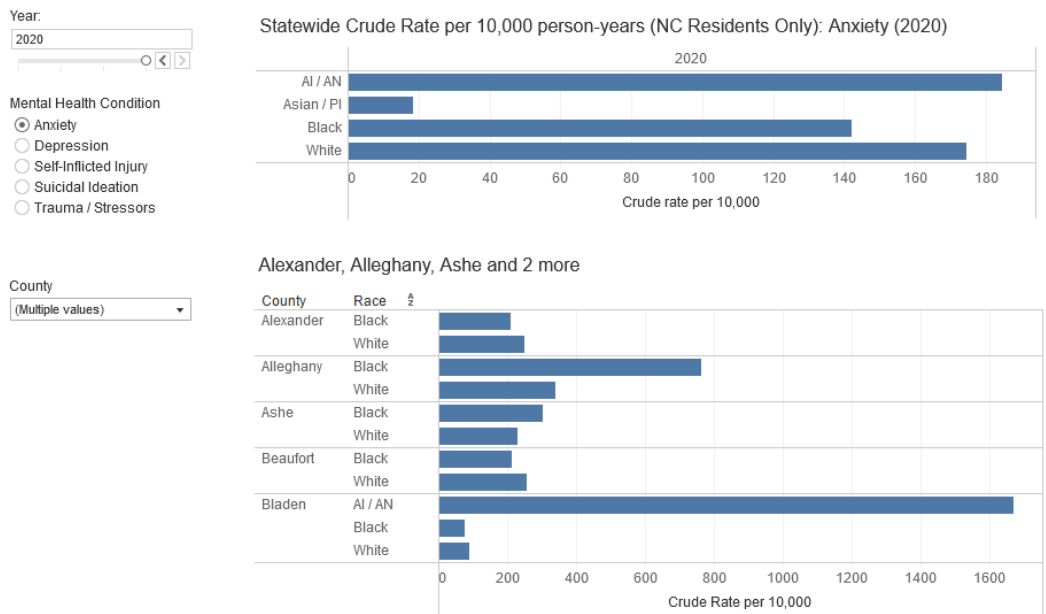
ED Visit Trends with a Mental Health Diagnosis by Age Group



NC DETECT: Mental Health

- Overview
- ZIP Maps
- Gender
- Age Group
- Race (bar)
- Race (trends)
- Ins

ED Visit Trends with a Mental Health Diagnosis by Race



ED Visit Trends with a Mental Health Diagnosis by Race

Mental Health Condition:

- Anxiety
- Depression
- Self-Inflicted Injury
- Suicidal Ideation
- Trauma / Stressors

Select a county to compare annual county-level trends by race to statewide trends.
Missing data are excluded from the graphs but are included as counts in the tables. Counts < 5 are suppressed.

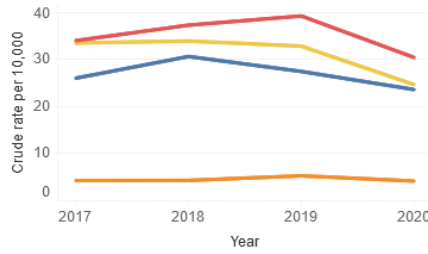
Race

- AI / AN
- Asian / PI
- Black
- White

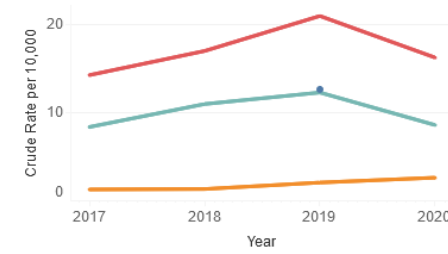
County

Wake

Trauma / Stressors
Statewide (NC Residents Only)



Trauma / Stressors
Wake



Statewide (NC Residents Only)

		2017	2018	2019	2020
AI / AN	ED Visit Count	448	534	484	416
	Crude rate	26	30	27	23
Asian / PI	ED Visit Count	144	150	191	150
	Crude rate	4	4	5	4
Black	ED Visit Count	8,010	8,894	9,466	7,335
	Crude rate	34	37	39	30
White	ED Visit Count	24,633	25,181	24,588	18,452
	Crude rate	33	34	33	25
Other	ED Visit Count	1,062	1,313	1,524	1,255
	Crude rate				
Unknown	ED Visit Count	590	632	810	895
	Crude rate				

Wake

		2017	2018	2019	2020
AI / AN	ED Visit Count			12.0	
	Crude Rate			12.6	
Asian / PI	ED Visit Count	10.0	11.0	18.0	23.0
	Crude Rate	1.2	1.3	2.0	2.6
Black	ED Visit Count	333.0	404.0	509.0	394.0
	Crude Rate	14.2	16.9	20.9	16.2
White	ED Visit Count	620.0	827.0	940.0	656.0
	Crude Rate	8.3	10.9	12.2	8.5
Other	ED Visit Count	78.0	110.0	131.0	95.0
	Crude Rate				
Unknown	ED Visit Count		14.0	10.0	
	Crude Rate				

Navigation tabs: ZIP Maps, Gender, Age Group, Race (bar), Race (trends), **Insurance**

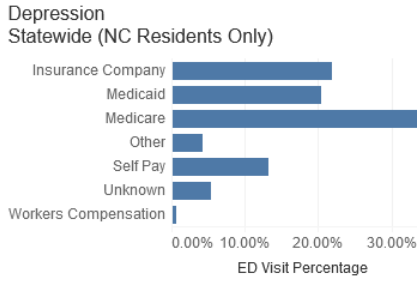
ED Visit Trends with a Mental Health Diagnosis by Insurance Coverage

Insurance coverage trends vary by county and by mental health condition. Change the year and mental health condition shown by using the selectors on the left. Select county(ies) using the county drop down just above the county-level bar graph. Counts < 5 are suppressed.

Select County(ies)
 (Multiple values)

Year
 2019

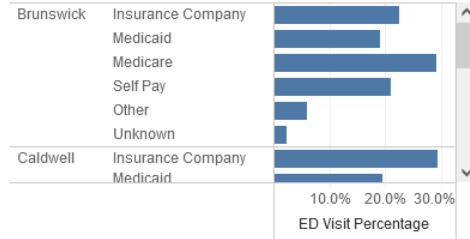
- Mental Health Condition:
- Anxiety
 - Depression
 - Self-Inflicted Injury
 - Suicidal Ideation
 - Trauma / Stressors



Depression Statewide (NC Residents Only)

Insurance Company	Count	%
Insurance Company	39,743	21.86%
Medicaid	37,230	20.48%
Medicare	61,939	34.06%
Other	7,750	4.26%
Self Pay	24,182	13.30%
Unknown	9,788	5.38%
Workers Compensation	1,199	0.66%

Depression Brunswick, Caldwell, Catawba



Depression Brunswick, Caldwell, Catawba

County	Insurance Company	Count	%
Brunswick	Insurance Company	148	22.53%
	Medicaid	125	19.03%
	Medicare	191	29.07%
	Self Pay	138	21.00%
	Other	40	6.09%
Caldwell	Insurance Company	764	29.32%
	Medicaid	508	19.49%
	Medicare	807	30.97%
	Self Pay	411	15.77%
	Workers Compensation	8	0.31%
Catawba	Insurance Company	1,257	21.49%
	Medicaid	1,080	18.47%
	Medicare	1,262	21.58%

Asthma & COPD Dashboard

NC DETECT: Asthma & COPD

<
Overview
County Profile
ZIP Maps
Sex
Age Group
Age Group Table
Race
Ethnicity
Insurance
>

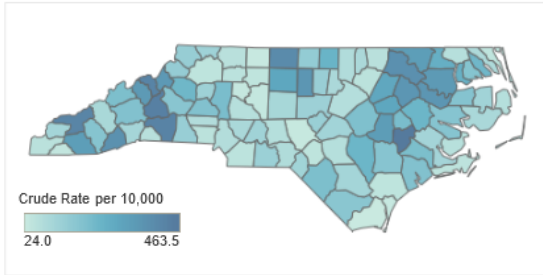
ED Visit Trends for Asthma and COPD

This dashboard provides an overview of emergency department (ED) visit trends for asthma and COPD. An ED visit is included if it receives any ICD-10-CM diagnosis code for asthma or COPD (diagnosis code order is not used). Please select the tab of interest to view trends by patient sex, race, ethnicity, age group and insurance coverage. Counts < 5 are excluded from the dashboard.

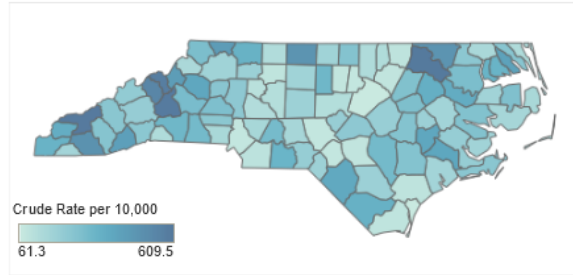
Crude rates are calculated by dividing the ED visit count by the population and multiplying by 10,000. Population data are from CDC Wonder NCHS Bridged Race population. Trends shown may be impacted by data quality issues. Please contact us with any questions.

Year

Annual Crude Rates per 10,000 person-years: Asthma (2020)

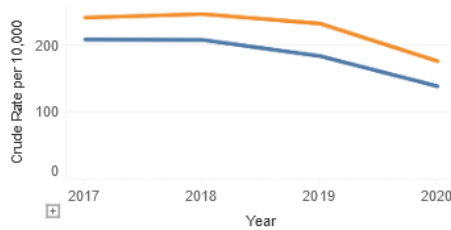


Annual Crude Rates per 10,000 person-years: COPD (2020)

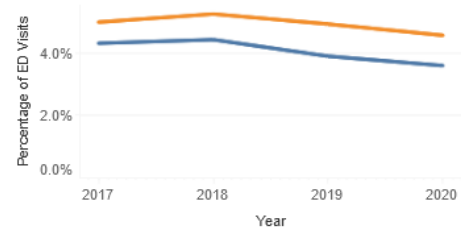


Parameter
■ Asthma
■ COPD

Statewide Crude Rates per 10,000 person-years



Statewide Percentage of Total ED Visits



Tableau

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County Profile

Parameter

- Asthma
- COPD

County

Wake

- Crude Rate per 10,000
- ED Visit Percentage

Sex

- Female
- Male

Race

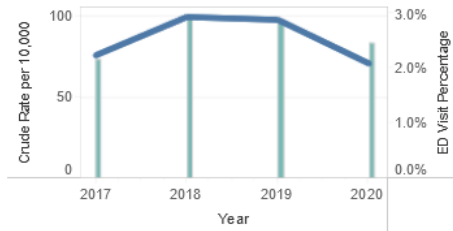
- American Indian or Alaska Nat
- Asian or Pacific Islander
- Black or African American
- Other
- Unknown
- White
- Hispanic
- Not Hispanic
- Unknown/Missing

Insurance Coverage

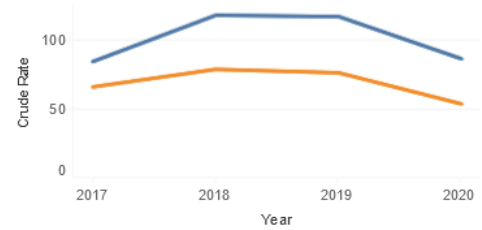
- Insurance Company
- Medicaid
- Medicare
- Other
- Self Pay
- Unknown
- Workers Compensati

Counts < 5 are excluded.

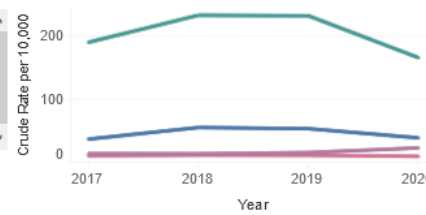
Overall Annual Trends for Asthma: Wake



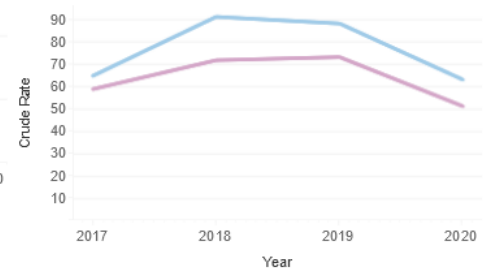
Crude Rate by Patient Sex for Asthma: Wake



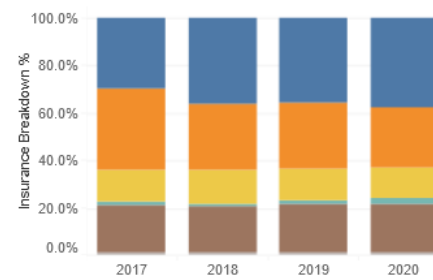
Crude Rate by Race for Asthma: Wake



Crude Rate by Ethnicity for Asthma: Wake



Insurance Breakdown for Asthma: Wake



Crude Rate by Age Group for Asthma: Wake

Age	2017	2018	2019	2020
Ages 0-17	85.5	88.4	81.1	41.1
Ages 18+	72.1	102.2	102.1	79.4

Navigation tabs: Overview, County Profile, **ZIP Maps**, Sex, Age Group, Age Group Table, Race, Ethnicity, Insurance

ED Visit Trends by ZIP of Residence

Select the parameter, year and county(ies) of interest to update the maps. Statewide crude rates and percentage of total ED visits for your selections are shown for comparison.

Statewide (NC Residents Only): Asthma (2020)

Crude Rate per 10,000	137.8
Percentage of ED Visits	3.58%

Parameter: Asthma COPD

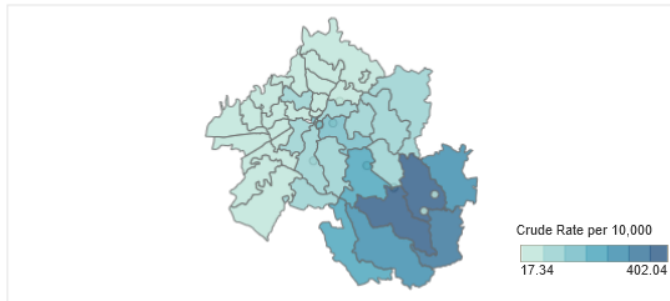
Year:

Primary County(ies):

ED visit data at the ZIP level can provide sub-county insights. The top map shows ED visits as a crude rate (divided by the total ZIP population). The bottom map shows ED visits as a percentage of total ED visits from that ZIP.

The ZIP population data are an approximation based on census data. ZIP codes do not represent precise geographic areas. Population data are not available for some of the ZIPs in NC DETECT, e.g., ZIP codes for post office boxes. ZIP codes can cross county lines but are affiliated with a primary county only in this display. Please select a neighboring county to view a ZIP code of interest if it does

Annual Crude Rates per 10,000 person-years by ZIP for Asthma (2020) in Johnston County & Wake County



	Count	Crude Rate	% of ED Visits	Pop	Total ED Visits
27502	104	23.77	1.30%	43,747	7,973
27504	366	224.26	4.99%	16,320	7,336
27511	124	36.43	1.63%	34,041	7,595
27513	161	32.86	2.17%	49,003	7,413
27518	50	21.96	1.50%	22,765	3,337
27519	104	17.34	1.46%	59,960	7,108
27520	820	186.54	5.19%	43,958	15,808
27523	54	42.25	1.91%	12,782	2,830
27524	361	266.78	6.21%	13,532	5,817
27526	220	40.72	1.65%	54,027	13,369
27527	340	112.46	4.62%	30,234	7,361
27528	17		6.18%		275
27529	553	102.69	2.70%	53,854	20,468
27539	77	28.98	1.68%	26,567	4,590
27540	140	35.83	1.86%	39,075	7,533
27542	248	246.94	5.59%	10,043	4,437
27545	---	---	---	---	---

Percentage of Total ED Visits by ZIP for Asthma (2020) in Johnston County & Wake County



- Overview
- County Profile
- ZIP Maps
- Sex
- Age Group
- Age Group Table
- Race
- Ethnicity
- Insurance

ED Visit Trends for Asthma and COPD by Patient Sex

Select a parameter and county(ies) of interest to update the data displayed. The statewide trends and tabular data are included for comparison.

Parameter:

- Asthma
- COPD

The trend graphs display the crude rate per 10,000 person-years by sex (ED visit count / population * 10,000). The tabular data include the visit count, crude rate and the count of ED visits for asthma or COPD as a percentage of total ED visits for that sex.

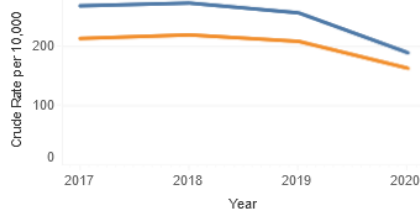
County(ies):

Chatham

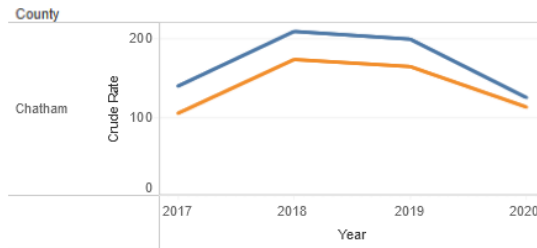
Patient Sex:

- Female
- Male

Statewide Trends for COPD by Sex



County-level Trends for COPD by Sex



Statewide: COPD

		2017	2018	2019	2020
ED Visit Count	Female	140,113	144,202	136,906	101,076
	Male	105,693	109,818	105,412	82,596
	Unknown/Missing	592	561	31	14
Crude Rate	Female	265.82	270.48	254.10	187.60
	Male	211.50	217.45	206.68	161.94
	Unknown/Missing				
ED Visit %	Female	4.99%	5.24%	4.91%	4.53%
	Male	4.94%	5.22%	4.92%	4.58%
	Unknown/Missing	6.22%	3.73%	2.53%	1.26%

County-level: COPD

		2018	2019	2017	2020
Chatham ED Visit Count	Female	797.0	773.0	515.0	483.0
	Male	605.0	584.0	356.0	400.0
Chatham Crude Rate	Female	208.85	198.96	138.98	124.31
	Male	173.03	163.97	104.30	112.31
Chatham ED Visit %	Female	6.79%	5.56%	4.63%	4.47%
	Male	6.34%	5.46%	4.08%	4.28%

Counts < 5 are excluded.

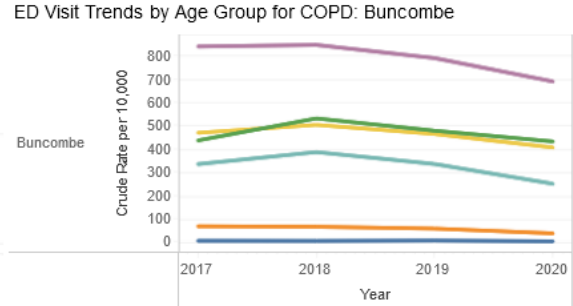
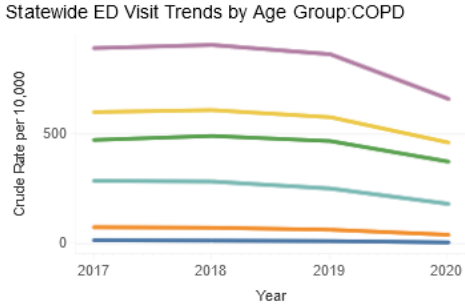
- Overview
- County Profile
- ZIP Maps
- Sex
- Age Group
- Age Group Table
- Race
- Ethnicity
- Insurance

ED Visit Trends by Age Group

- Parameter
- Asthma
 - COPD

- Age Group
- Ages 0-17
 - Ages 18-44
 - Ages 45-54
 - Ages 55-64
 - Ages 65-74
 - Ages 75+

County



Statewide ED Visit Trends by Age Group: COPD

Age Group		2017	2018	2019	2020
Ages 0-17	ED Visit Count	3,005	2,656	2,174	722
	Crude Rate	13.1	11.5	9.4	3.1
	ED Visit %	0.35%	0.33%	0.26%	0.14%
Ages 18-44	ED Visit Count	26,308	25,733	22,621	14,121
	Crude Rate	72.4	70.1	61.0	38.1
	ED Visit %	1.36%	1.37%	1.21%	0.88%
Ages 45-54	ED Visit Count	39,222	38,563	33,862	24,341
	Crude Rate	283.4	280.0	248.2	178.4
	ED Visit %	6.10%	6.19%	5.50%	4.66%
Ages 55-64	ED Visit Count	61,965	65,427	63,207	50,443
	Crude Rate	469.2	487.4	464.0	370.3
	ED Visit %	11.05%	11.51%	10.74%	9.80%
Ages 65-74	ED Visit Count	58,413	61,111	59,951	47,839
	Crude Rate	596.3	605.2	572.9	457.1
	ED Visit %	12.93%	13.18%	12.29%	11.20%
Ages 75+	ED Visit Count	57,482	61,088	60,533	46,217
	Crude Rate	887.0	901.4	859.1	655.9
	ED Visit %	11.40%	11.81%	11.13%	10.02%

ED Visit Trends by Age Group for COPD: Buncombe

Age Group		2017	2018	2019	2020
Ages 0-17	ED Visit Count	32	29	36	21
	Crude Rate	6.63	6.05	7.59	4.43
	ED Visit %	0.34%	0.30%	0.36%	0.34%
Ages 18-44	ED Visit Count	617	603	538	352
	Crude Rate	68.83	66.57	58.82	38.48
	ED Visit %	1.85%	1.66%	1.53%	1.21%
Ages 45-54	ED Visit Count	1,110	1,282	1,109	829
	Crude Rate	334.73	386.16	335.15	250.53
	ED Visit %	10.26%	11.13%	9.80%	9.34%
Ages 55-64	ED Visit Count	1,572	1,902	1,707	1,542
	Crude Rate	436.04	530.59	477.88	431.69
	ED Visit %	15.98%	17.35%	15.25%	16.50%
Ages 65-74	ED Visit Count	1,390	1,544	1,474	1,290
	Crude Rate	468.68	502.90	463.70	405.81
	ED Visit %	17.48%	17.81%	15.58%	16.13%
Ages 75+	ED Visit Count	1,702	1,775	1,712	1,495
	ED Visit %	17.48%	17.81%	15.58%	16.13%

Counts < 5 are excluded.

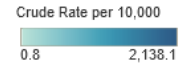
- Overview
- County Profile
- ZIP Maps
- Sex
- Age Group
- Age Group Table**
- Race
- Ethnicity
- Insurance

Age Group Highlight Table

- Parameter
- Asthma
 - COPD

This highlight table shows trends in crude rates per 10,000 person-years (ED visit count / population *10,000) by Age Group for asthma or COPD. Select the parameter and county(ies) of interest to update the table. The darker the color, the higher the crude rate.

County



ED Visit Trends by Age Group for COPD

County	Year of Year	Age					
		Ages 0-17	Ages 18-44	Ages 45-54	Ages 55-64	Ages 65-74	Ages 75+
Alamance	2017	11.2	109.4	451.7	702.8	895.9	1,305.7
	2018	16.2	119.6	556.5	857.2	1,053.2	1,542.9
	2019	13.6	106.8	522.4	853.0	982.1	1,512.3
	2020	1.6	66.7	407.3	660.7	829.9	1,043.9
Alexander	2017	9.2	92.9	294.9	518.9	770.6	1,090.2
	2018		73.3	294.2	564.9	759.0	944.9
	2019	9.4	67.1	379.1	455.4	775.5	928.5
	2020		48.2	221.4	451.7	550.0	863.5
Alleghany	2017	46.9	244.3	363.8	659.3	586.5	1,040.1
	2018	82.4	234.9	315.7	676.3	783.9	1,185.2
	2019	31.8	189.2	388.6	652.9	606.9	1,060.6
	2020		154.2	416.4	691.0	701.6	1,060.6
Anson	2017		106.4	518.3	901.3	1,078.9	989.8
	2018	14.3	136.3	651.4	1,032.9	1,125.5	1,340.1
	2019		112.2	535.2	714.3	866.3	1,057.5
	2020		87.1	398.2	851.2	665.0	734.1
Ashe	2017		72.7	331.7	501.5	652.7	1,068.7
	2018	21.0	95.3	498.5	553.9	552.7	1,044.8
	2019		100.9	449.1	593.5	654.4	1,129.6
	2020		54.6	301.3	436.0	468.5	826.4
Avery	2017	48.6	166.0	630.9	802.2	910.3	2,026.8
	2018	34.4	118.8	694.6	1,069.7	1,111.1	2,072.3
	2019		112.3	562.4	1,119.6	1,127.1	1,674.7
	2020		66.0	454.9	755.9	923.7	1,331.3
Beaufort	2017		79.3	294.9	605.6	652.7	947.8
	2018		70.0	357.3	503.0	648.0	784.2

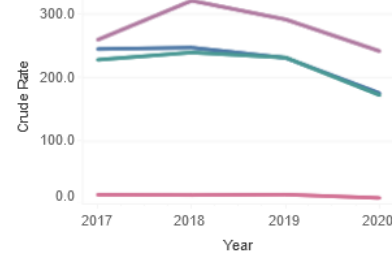
- Overview
- County Profile
- ZIP Maps
- Sex
- Age Group
- Age Group Table
- Race
- Ethnicity
- Insurance

ED Visit Trends by Race

Select a county from the county drop down menu to update the graph and tabular data. Statewide data are provided for comparison.

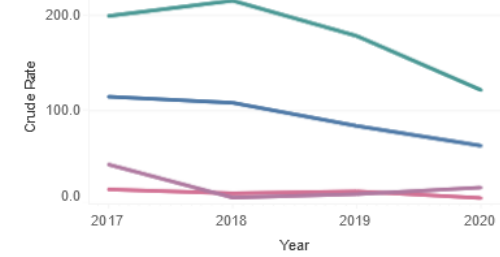
- Parameter
- Asthma
 - COPD
- Race
- American Indian or Alaska Native
 - Asian or Pacific Islander
 - Black or African American
 - Other
 - Unknown
 - White

Statewide Trends by Race: COPD



County

ED Visit Trends by Race for COPD: Mecklenburg



Statewide ED Visit Trends by Race: COPD

		2017	2018	2019
ED Visit Count	American Indian or Alaska Native	4,488	5,623	5,111
	Asian or Pacific Islander	531	534	511
	Black or African American	53,940	57,346	56,011
	White	180,856	184,209	173,711
	Other	4,024	4,160	3,911
	Unknown	2,559	2,709	2,811
Crude Rate	American Indian or Alaska Native	259.4	321.1	291.1
	Asian or Pacific Islander	15.4	14.9	14.1
	Black or African American	228.0	239.5	231.1
	White	244.9	247.1	231.1
	Other			
	Unknown			
Percentage of ED Visits	American Indian or Alaska Native	7.1%	9.6%	8.1%
	Asian or Pacific Islander	1.3%	1.1%	1.2%
	Black or African American	3.3%	3.5%	3.3%
	White	6.2%	6.7%	6.4%
	Other	1.6%	1.5%	1.2%
	Unknown			

ED Visit Trends by Race for COPD: Mecklenburg

		2017	2018	2019	2020
ED Visit Count	American Indian or Alaska Native	40	7	11	
	Asian or Pacific Islander	113	87	103	
	Black or African American	7,223	7,958	6,701	
	White	7,221	6,883	5,387	
	Other	382	415	423	
	Unknown	134	133	166	
Crude Rate	American Indian or Alaska Native	42.2	7.3	10.9	
	Asian or Pacific Islander	15.9	11.8	13.9	
	Black or African American	199.1	215.3	178.0	
	White	113.9	107.4	82.9	
	Other				
	Unknown				
Percentage of ED Visits	American Indian or Alaska Native	1.5%	1.7%	2.9%	
	Asian or Pacific Islander	2.4%	1.6%	1.9%	
	Black or African American	3.2%	3.5%	2.9%	
	White	3.8%	4.3%	3.9%	
	Other	1.6%	1.3%	0.9%	
	Unknown				

Counts < 5 are excluded.

- Overview
- County Profile
- ZIP Maps
- Sex
- Age Group
- Age Group Table
- Race
- Ethnicity
- Insurance

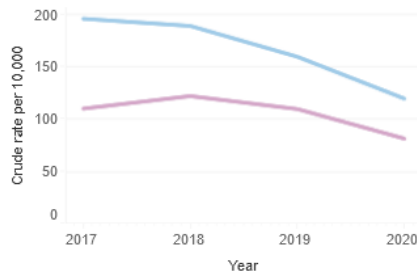
ED Visit Trends by Ethnicity

- Parameter
- Asthma
 - COPD

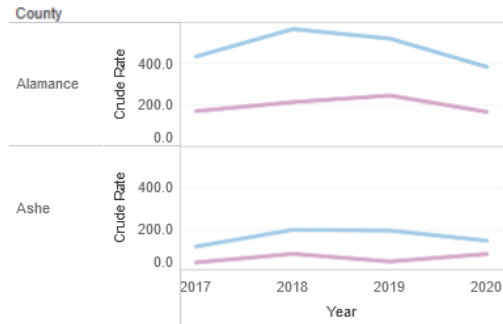
- Ethnicity:
- Hispanic
 - Not Hispanic
 - Unknown/Missing

County

Statewide ED Visit Trends by Ethnicity: Asthma



ED Visit Trends by Ethnicity: Asthma



Statewide ED Visit Trends by Ethnicity: Asthma

Ethnicity		2017	2018	2019	2020
Hispanic	ED Visit Count	10,533	12,089	11,203	8,317
	Crude Rate	109.6	121.5	109.2	81.1
	ED Visit %	3.4%	3.8%	3.4%	3.2%
Not Hispanic	ED Visit Count	181,613	176,728	150,387	112,666
	Crude Rate	195.1	188.3	158.9	119.1
	ED Visit %	4.5%	4.6%	3.9%	3.6%
Unknown/Missing	ED Visit Count	20,774	25,848	30,036	23,550
	Crude Rate				
	ED Visit %	3.5%	3.9%	3.9%	3.7%

ED Visit Trends by Ethnicity: Asthma

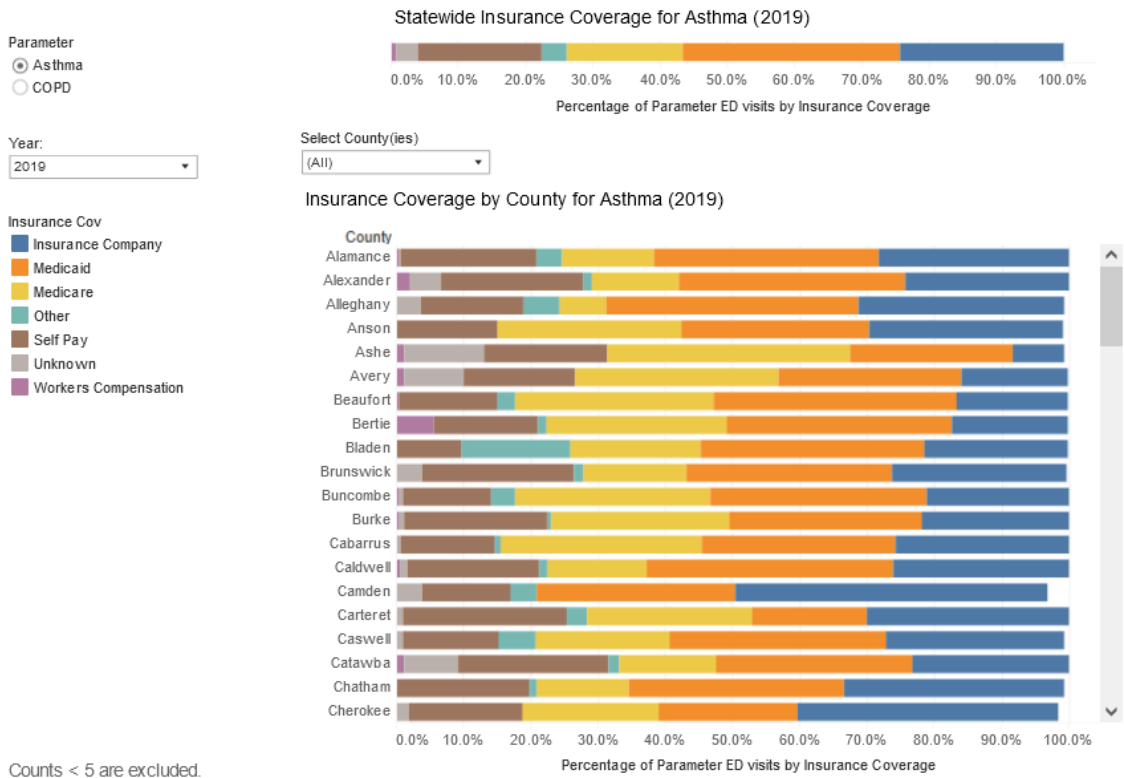
			2017	2018	2019	2020
Alamance	Hispanic	ED Visit Count	340	449	536	311
		Crude Rate	166.8	210.2	242.2	166.8
		ED Visit %	5.6%	6.9%	7.6%	5.4%
	Not Hispanic	ED Visit Count	6,134	8,156	7,599	5,500
		Crude Rate	429.3	561.9	515.6	377.0
		ED Visit %	9.3%	11.5%	10.8%	9.7%
Unknown/Missing	ED Visit Count	107	134	129	111	
	Crude Rate					
	ED Visit %	1.8%	2.1%	1.8%	1.1%	
Ashe	Hispanic	ED Visit Count	5	11	6	3
		Crude Rate	38.4	79.8	43.2	7.7
		ED Visit %	1.6%	2.6%	1.6%	3.0%
	Not Hispanic	ED Visit Count	293	502	494	311
		Crude Rate	115.0	195.2	191.4	141.0
		ED Visit %				

Counts < 5 are excluded.

- Overview
- County Profile
- ZIP Maps
- Sex
- Age Group
- Age Group Table
- Race
- Ethnicity
- Insurance

Insurance Coverage Breakdown for Asthma & COPD

Select the parameter, year and county(ies) of interest to view the insurance coverage breakdown for ED visits.



Counts < 5 are excluded.

APPENDIX 4.2: NC DETECT MENTAL HEALTH DASHBOARD INTERVIEW GUIDE

Overview Tab

1. Make sure you are viewing the **Overview** Tab of the Dashboard
 - a. Select a mental health condition for the map and county of interest for the trend graphs:
 - i. Is the rate for this mental health condition for your county higher or lower than the NC rate?
 - b. Of the mental health conditions included on the dashboard, which mental health condition has the highest overall rates statewide and in your county?
 - c. Any additional feedback on the Overview Tab

ZIP Maps

2. Make sure you are viewing the **ZIP** Tab of the Dashboard.
 - a. Select a mental health condition, year, and county(ies) of interest.
 - b. What do the two maps show? How are they different?
 - c. Any additional feedback on the ZIP maps.

Gender Tab

3. Make sure you are viewing the **Gender** Tab of the Dashboard.
 - a. For the mental health conditions shown in the dashboard, females most often have higher ED visit rates compared to males except for one of the mental health conditions included on the dashboard: Which one?
 - b. Any other feedback on the Gender tab?

Age Group Tab

4. Make sure you are viewing the **Age Group** Tab of the Dashboard
 - a. For the mental health conditions shown in the dashboard, those aged 18+ most often have higher ED visit rates compared to those under age 18 except for one mental health condition: which one?
 - b. Any other feedback on the Age Group tab? Are there additional age groups that we should include (keeping in mind that we want to minimize the number of small counts)?

Race Tabs

5. Make sure you are viewing the **Race (bar)** Tab of the Dashboard.
 - a. This tab provides bar graphs to show trends in ED visit rates for mental health conditions by race.
 - b. Select a year and mental health condition of interest
 - c. In the county drop down, select county(ies) of interest.
6. Make sure you are viewing the **Race (trends)** Tab of the Dashboard.

- a. How does this dashboard differ from the Race (bar) Tab?
- b. Do you prefer the Race (bar) Tab or the Race (trends) Tab? Why?

(Note that based on feedback the Ethnicity Tab will be set up similarly to the Race Tab)

Insurance Tab

7. Make sure that you are on the **Insurance** Tab.
 - a. Select a year, mental health condition and county(ies) of interest. How do the insurance coverage trends for the selected county(ies) compare to the statewide trends?
 - b. Additional feedback on the **Insurance** Tab

Download / Screenshot

8. What is your preferred method for downloading data / images from the dashboard?

Overall Feedback / Additional Questions

9. What is missing? What should be added?
10. What is your preference in terms of guidance on data interpretation? Include narratives or focus on data?
11. Include additional data sources?

APPENDIX 4.3: NC DETECT ASTHMA / COPD DASHBOARD INTERVIEW GUIDE

1. Access the Dashboard:

https://public.tableau.com/app/profile/ncdetect/viz/Asthma_COPD_NC_DETECT/Asthma_COPD_NC_DETECT?publish=yes

Overview Tab

2. Make sure you are viewing the **Overview** Tab of the Dashboard
 - a. Select a year for the map.
 - b. Overall feedback on the Overview Tab

County Profile

3. Select a parameter and county of interest using the selection tools on the left.
 - a. You can mouse over the graphs and tables for more information.
 - b. Overall feedback on the county profile tab
 - c. Feedback and suggestions for improvements on the color choices
 - d. Seek specific feedback on the age group highlight table

ZIP Maps

4. Make sure you are viewing the **ZIP** Tab of the Dashboard.
 - a. Select a parameter, year, and county(ies) of interest.
 - b. Is it clear why there are two maps?
 - c. Any additional feedback on the ZIP maps.

Sex

5. Make sure you are viewing the **Sex** Tab of the Dashboard.
 - c. Select a parameter and county(ies) of interest.
 - d. General feedback on the **Sex** tab?

Age Group Tab

6. Make sure you are viewing the **Age Group** Tab of the Dashboard
 - a. Select a county and parameter of interest.
 - b. Are there additional age groups that we should include (keeping in mind that we want to minimize the number of small counts)?
 - c. Any other feedback on the Age Group tab?

Age Group Highlight Table Tab

7. This is a highlight table that shows crude rates and the higher rates have darker colors.
 - a. General feedback on utility of this vs. the other tab

Race Tab

8. Make sure you are viewing the **Race** Tab of the Dashboard.
 - a. Select a parameter of interest

- b. In the county drop down, select county of interest.
- c. Feedback on tabular output

Ethnicity Tab

9. Make sure you are viewing the Ethnicity tab of the dashboard.
 - a. Select a parameter and county(ies) of interest.
 - b. Do you prefer the tabular layout on this tab or the layout on the Race tab?

Insurance Tab

10. Make sure that you are on the **Insurance** Tab.
 - a. Select a year, parameter, and county(ies) of interest.
 - b. Additional feedback on the **Insurance** Tab

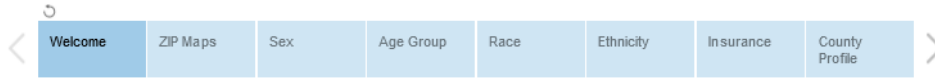
Overall Feedback / Suggestions for Improvement

11. What is missing? What should be added?
12. What is your preference in terms of guidance on data interpretation? Include narratives or focus on data?
13. Include additional data sources?

APPENDIX 4.4: REVISED DASHBOARD SCREENSHOTS

Mental Health Dashboard

NC DETECT: Mental Health



Emergency Department Visits for Mental Health Conditions

This dashboard provides an overview of emergency department (ED) visit trends for select mental health conditions based on ICD-10-CM codes. We include ED visits with the ICD-10-CM code of interest in any diagnosis position.

Crude rates are calculated by dividing the ED visit count by the population and multiplying by 10,000. Population data are from the CDC Wonder NCHS Bridged Race Population. County and ZIP in the ED data are based on patient residence. Crude rates based on counts under 10 should be interpreted with caution.

ED visit percentages are calculated by dividing the ED visit count by the total ED visits. Total ED visits dropped significantly in 2020, especially at the start of the COVID-19 pandemic.

Any count under 5 is excluded from the dashboard.

Trends shown may be impacted by data quality issues.

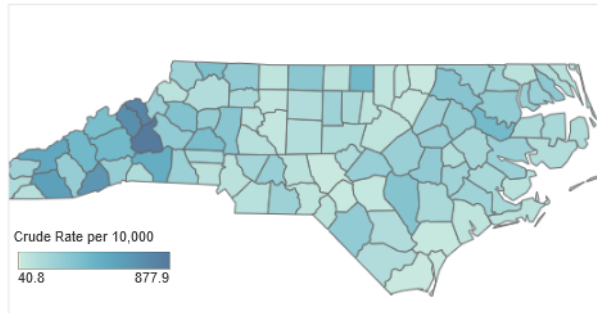
Mental Health Condition:

- Anxiety
- Depression
- Self-Inflicted Injury
- Suicidal Ideation
- Trauma / Stressors

Year:

2020

Annual Crude Rates per 10,000 person-years: Anxiety (2020)



Annual Anxiety ED Visit Trends for All

	2017	2018	2019	2020
ED Visit Count	226,133	224,924	220,663	181,156
Crude Rate	276.1	265.0	267.5	226.5
ED Visit Percentage	5.2%	5.2%	5.1%	5.3%

Monthly Anxiety ED Visit Percentages in All



tableau



Welcome |
 ZIP Maps |
 Sex |
 Age Group |
 Race |
 Ethnicity |
 Insurance |
 County Profile

ED Visit Trends with a Mental Health Diagnosis by ZIP of Residence

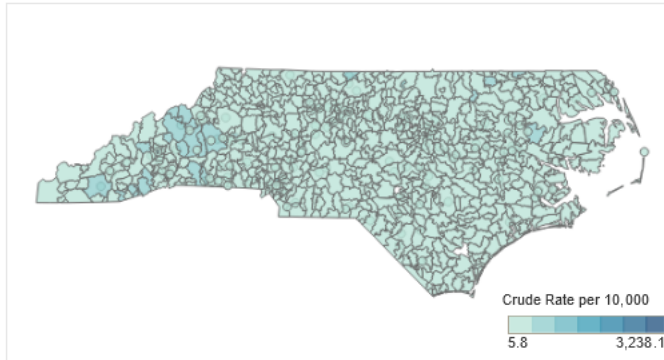
Parameter: Anxiety Depression Self-Inflicted Injury Suicidal Ideation Trauma / Stressors

Year: 2019

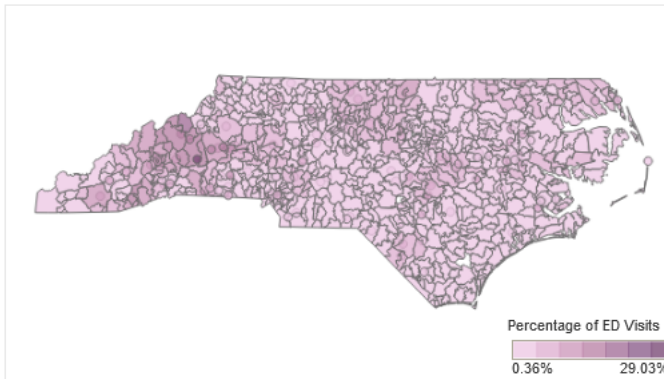
Primary County(ies): (All)

Statewide (NC Residents Only): Depression (2019)
 Crude Rate per 10,000: 173.4
 Percentage of ED Visits: 3.68%

Annual Crude Rates per 10,000 person-years by ZIP for Depression (2019) in All



Percentage of Total ED Visits by ZIP for Depression (2019) in All



The top map shows ED visits for the selected mental health condition as a crude rate (divided by the population for that ZIP). The second map shows ED visits as a percentage of total ED visits for that ZIP. Population-based maps are available for 2019 and 2020 only. Mouse over the map to view details.

The ZIP population data are an approximation as ZIP codes do not represent precise geographic areas. Population data are not available for some of the ZIP codes in NC DETECT, e.g., ZIP codes for P.O. boxes. ZIP codes can cross county lines but are affiliated with a primary county only in this display. Please select a neighboring county to view a ZIP code of interest if it does appear for your county.

Counts < 5 are excluded from the maps and table below. Please note that rates and percentages based on counts < 10 should be interpreted with caution. In addition, please note that rates and percentages may be impacted by low denominators. For example, some ZIPs have recorded populations < 100.

Count	Crude Rate	% of ED Visits	Pop	Total ED Visits	
27006	177	119.0	3.14%	14,872	5,645
27007	19	89.0	1.95%	2,136	973
27009	37	126.0	4.01%	2,937	923
27010	5		4.90%		102
27011	114	210.7	4.30%	5,411	2,649
27012	300	103.6	3.25%	28,954	9,236
27013	133	204.8	3.94%	6,495	3,377
27014	18	188.1	2.80%	957	642
27016	16	95.1	2.21%	1,682	724
27017	168	176.9	3.40%	9,499	4,947
27018	97	118.0	3.18%	8,221	3,050
27019	35	82.7	2.39%	4,234	1,463
27020	111	181.8	3.75%	6,104	2,958
27021	271	150.7	3.99%	17,979	6,797

Welcome
ZIP Maps
Sex
Age Group
Race
Ethnicity
Insurance
County Profile

ED Visit Trends with a Mental Health Diagnosis by Sex

Select a mental health condition and county(ies) of interest to update the data displayed. The statewide trends and tabular data are included for comparison.

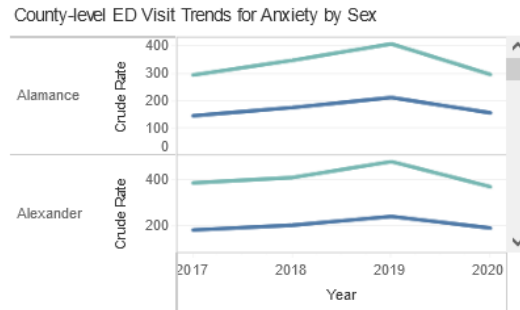
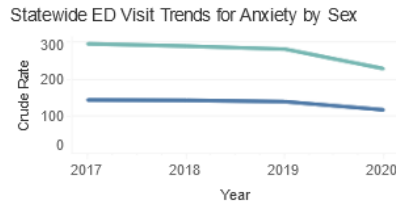
The trend graphs display the crude rate per 10,000 person-years by sex (ED visit count / population *10,000). The tabular data include the ED visit count, crude rate and the percentage of total ED visits. For NC and most counties, females have higher rates than males for all mental health conditions included in the dashboard except for suicidal ideation.

Parameter:

- Anxiety
- Depression
- Self-Inflicted Injury
- Suicidal Ideation
- Trauma / Stressors

County(es):

- Sex:**
- Female
 - Male



Statewide: Anxiety

		2017	2018	2019	2020
Female	ED Visit Count	154,517	153,024	150,314	122,057
	Crude Rate	293.1	287.0	279.0	226.5
	ED Visit Percentage	5.5%	5.6%	5.4%	5.5%
Male	ED Visit Count	71,157	71,360	70,311	59,077
	Crude Rate	142.4	141.3	137.9	115.8
	ED Visit Percentage	3.3%	3.4%	3.3%	3.3%
Unknown	ED Visit Count	459	540	38	22
	Crude Rate				
	ED Visit Percentage				

County-level: Anxiety

County	Sex		2017	2018	2019	2020
Alamance	Female	ED Visit Count	2,491	3,015	3,606	2,605
		Crude Rate	290.9	344.7	405.3	292.8
		ED Visit Percentage	5.4%	6.2%	7.5%	6.5%
	Male	ED Visit Count	1,099	1,355	1,678	1,224
		Crude Rate	141.5	171.4	208.4	152.0
		ED Visit Percentage	3.4%	3.9%	4.7%	4.0%
Alexander	Female	ED Visit Count	697	743	872	673
		Crude Rate	382.7	405.5	474.2	366.0
		ED Visit Percentage	9.4%	9.5%	11.1%	10.7%
	Male	ED Visit Count	342	382	456	361
		Crude Rate	180.6	201.0	238.6	188.9
		ED Visit Percentage	5.1%	5.7%	6.5%	6.1%
Alleghany	Female	ED Visit Count	140	132	185	305
		Crude Rate	253.7	234.9	329.3	542.9
		ED Visit Percentage	3.5%	3.2%	4.4%	8.8%

Counts < 5 are excluded.

- Welcome
- ZIP Maps
- Sex
- Age Group
- Race
- Ethnicity
- Insurance
- County Profile

ED Visit Trends with a Mental Health Diagnosis by Age Group

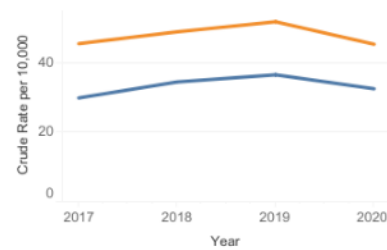
While the graphs show ED visit rate trends for children (ages <17) and adults (ages 18+), the tables provide more detailed age group counts, rates, and percentage of ED visits. Change the parameter and county(ies) shown using the selection tools on the left. Counts < 5 are excluded so data for some age groups may not be available. Rates based on counts < 10 should be interpreted with caution.

- Parameter:**
- Anxiety
 - Depression
 - Self-Inflicted Injury
 - Suicidal Ideation
 - Trauma / Stressors

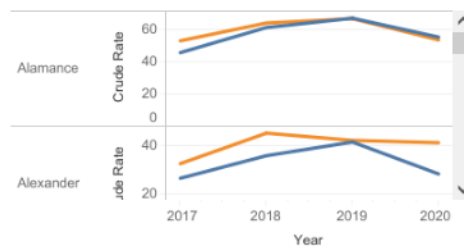
County(ies):
 (All) ▼

- Age Group**
- Ages 0-17
 - Ages 18+

Statewide Child & Adult ED Visit Rates: Suicidal Ideation



County-level Child & Adult ED Visit Rates: Suicidal Ideation



Statewide ED Visit Trends by Detailed Age Groups: Suicidal Ideation

		2017	2018	2019	2020
Ages 10-14	ED Visit Count	2,975	3,708	4,109	3,735
	Crude Rate	45.2	55.8	61.7	56.1
	ED Visit %	1.7%	2.3%	2.4%	3.5%
Ages 15-17	ED Visit Count	3,520	3,724	3,859	3,482
	Crude Rate	87.9	93.6	97.3	87.8
	ED Visit %	2.6%	2.9%	3.0%	3.8%
Ages 18-24	ED Visit Count	6,467	7,096	7,557	6,563
	Crude Rate	66.1	71.9	76.3	66.3
	ED Visit %	1.2%	1.4%	1.5%	1.6%
Ages 25-44	ED Visit Count	16,129	17,541	18,824	16,701
	Crude Rate	60.7	65.3	69.2	61.4
	ED Visit %	1.1%	1.3%	1.4%	1.4%
Ages 45-64	ED Visit Count	11,840	12,720	13,581	11,654
	Crude Rate	43.8	46.8	49.8	42.7

County-level ED visit trends by Detailed Age Group: Suicidal Ideation

		2017	2018	2019	2020	
Alamance	Ages 10-14	ED Visit Count	78	116	135	133
	Crude Rate	74.6	109.0	126.1	124.3	
	ED Visit %	2.9%	4.3%	4.8%	7.3%	
Ages 15-17	ED Visit Count	78	97	107	73	
	Crude Rate	118.8	148.5	165.4	112.8	
	ED Visit %	3.5%	4.4%	5.1%	4.8%	
Ages 18-24	ED Visit Count	98	154	163	108	
	Crude Rate	57.9	87.7	91.1	60.4	
	ED Visit %	1.3%	1.8%	2.0%	1.6%	
Ages 25-44	ED Visit Count	294	361	364	323	
	Crude Rate	75.5	90.7	89.0	79.0	
	ED Visit %	1.4%	1.5%	1.6%	1.6%	
Ages 45-64	ED Visit Count	244	269	303	228	
	Crude Rate	55.6	60.9	68.4	51.5	
	ED Visit %	1.2%	1.2%	1.4%	1.2%	

Counts < 5 are excluded so data for some age groups may not be available. Rates based on counts < 10 should be interpreted with caution.

Welcome
ZIP Maps
Sex
Age Group
Race
Ethnicity
Insurance
County Profile

ED Visit Trends with a Mental Health Diagnosis by Race

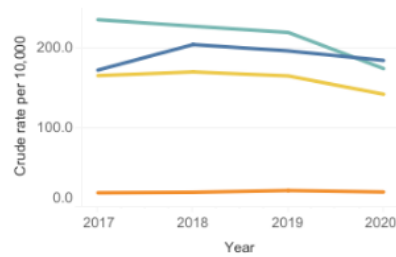
Select one or more counties to compare annual county-level trends by race to statewide trends.
 ED visits with unknown/missing race or Other race are excluded from the graphs but are included as counts in the tables.
 Counts < 5 are excluded so data may not be available for all race categories.

- Parameter:**
- Anxiety
 - Depression
 - Self-inflicted Injury
 - Suicidal Ideation
 - Trauma / Stressors

County(ies):
 (All)

- Race**
- AI / AN
 - Asian / PI
 - Black
 - White

Statewide ED Visit Trends by Race:
Anxiety



County-level ED Visit Trends by Race:
Anxiety



Statewide ED Visit Trends by Race:
Anxiety

		2017	2018	2019	2020
AI / AN	ED Visit Count	2,984	3,585	3,485	3,272
	Crude rate	172.5	204.7	196.7	184.7
	ED Visit Percentage	4.7%	6.2%	5.5%	6.6%
Asian / PI	ED Visit Count	604	649	750	683
	Crude rate	17.5	18.1	20.3	18.5
	ED Visit Percentage	1.5%	1.4%	1.5%	1.2%
Black	ED Visit Count	39,147	40,752	39,973	34,375
	Crude rate	165.5	170.2	165.1	142.0
	ED Visit Percentage	2.4%	2.5%	2.4%	2.5%
White	ED Visit Count	174,400	169,866	165,435	131,135
	Crude rate	236.2	227.9	220.0	174.4
	ED Visit Percentage	6.0%	6.2%	6.1%	6.0%
Other	ED Visit Count	5,224	6,328	6,627	6,331
	Crude rate				
	ED Visit Percentage	2.1%	2.2%	2.1%	2.3%
Unknown	ED Visit Count	3,774	3,744	4,393	5,360
	Crude rate				

County-level ED Visit Trends by Race:
Anxiety

		2017	2018	2019	2020
Alamance AI / AN	ED Visit Count	17	66	22.4%	
	Crude Rate				
	ED Visit %				
Asian / PI	ED Visit Count	8	8	9	6
	Crude Rate	25	24	26	18
	ED Visit %	2.5%	2.5%	2.8%	2.1%
Black	ED Visit Count	567	706	954	708
	Crude Rate	164	198	259	192
	ED Visit %	2.3%	2.6%	3.5%	3.1%
White	ED Visit Count	2,870	3,448	4,077	2,857
	Crude Rate	233	276	322	225
	ED Visit %	6.3%	7.2%	8.5%	7.3%
Other	ED Visit Count	135	189	227	230
	Crude Rate				
	ED Visit %	1.8%	2.4%	2.7%	3.0%
Unknown	ED Visit Count	11	20	13	11
	Crude Rate				

ED Visit Trends by Ethnicity

Select one or more counties from the county drop down menu to update the graph and tabular data. Statewide data are provided for comparison. Counts <5 are excluded so ethnicity data for some categories may not be available for all counties. Please also note the high degree of unknown/missing ethnicity data for some counties.

Parameter:

- Anxiety
- Depression
- Self-Inflicted Injury
- Suicidal Ideation
- Trauma / Stressors

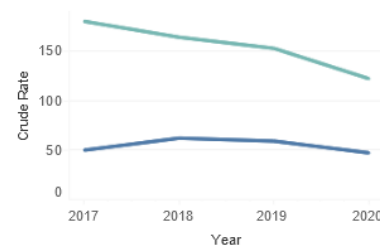
County(ies):

(All)

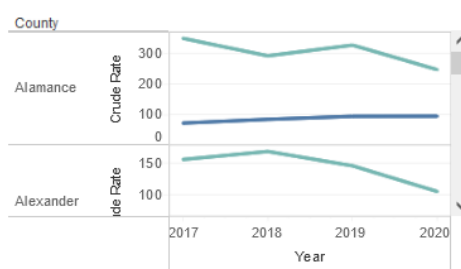
Ethnicity:

- Hispanic
- Not Hispanic

Statewide ED Visit Trends by Ethnicity: Depression



County-level ED Visit Trends by Ethnicity: Depression



Statewide ED Visit Trends by Ethnicity: Depression

		2017	2018	2019	2020
Hispanic	ED Visit Count	4,749	6,117	6,004	4,790
	Crude Rate	49	62	59	47
	ED Visit Percentage	1.5%	1.9%	1.8%	1.8%
Not Hispanic	ED Visit Count	167,217	153,607	144,250	115,278
	Crude Rate	180	164	152	122
	ED Visit Percentage	4.1%	4.0%	3.8%	3.7%
Unknown	ED Visit Count	21,910	23,923	31,577	25,945
	Crude Rate				
	ED Visit Percentage	3.7%	3.6%	4.1%	4.1%

County-level ED Visit Trends by Ethnicity: Depression

		2017	2018	2019	2020
Alamance	Hispanic ED Visit Count	142	175	203	204
	Crude Rate	70	82	92	92
	ED Visit %	2.3%	2.7%	2.9%	3.3%
Not Hispanic	ED Visit Count	4,943	4,195	4,775	3,596
	Crude Rate	346	289	324	244
	ED Visit %	7.5%	5.9%	6.8%	6.2%
Unknown	ED Visit Count	168	154	179	171
	Crude Rate				
	ED Visit %	2.8%	2.4%	2.6%	2.6%
Alexander	Hispanic ED Visit Count	10	11	11	6
	Crude Rate	58	61	62	34
	ED Visit %	3.3%	2.9%	3.0%	2.5%
Not Hispanic	ED Visit Count	549	596	518	373
	Crude Rate	155	168	145	104
	ED Visit %	5.7%	6.3%	6.6%	6.3%
Unknown	ED Visit Count	230	269	478	419
	Crude Rate				

Counts <5 are excluded so ethnicity data for some categories may not be available for all counties. Please also note the high degree of missing/unknown ethnicity data for some counties.

ED Visit Trends with a Mental Health Diagnosis by Insurance Coverage

Insurance coverage trends vary by county and by mental health condition. Change the year, mental health condition, and county(ies) shown by using the selectors on the left. Mouse over the bars to get detailed percentage information by insurance coverage type.

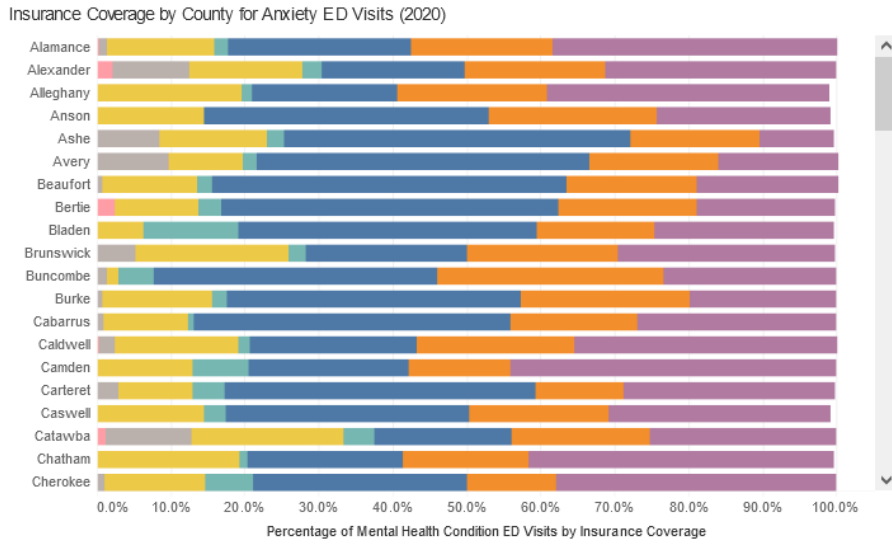
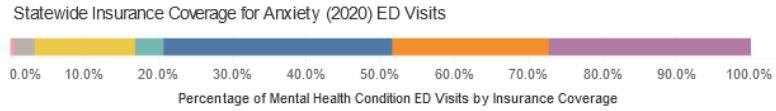
Counts < 5 are excluded so the insurance percentages for some counties may not add up to 100%

Year:

- Mental Health Condition:
- Anxiety
 - Depression
 - Self-Inflicted Injury
 - Suicidal Ideation
 - Trauma / Stressors

County(ies):

- Insurance Coverage
- Insurance Company
 - Medicaid
 - Medicare
 - Other
 - Self Pay
 - Unknown
 - Workers Compensation

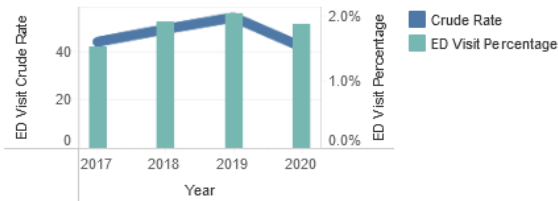


Counts < 5 are excluded so the insurance percentages for some counties may not add up to 100%

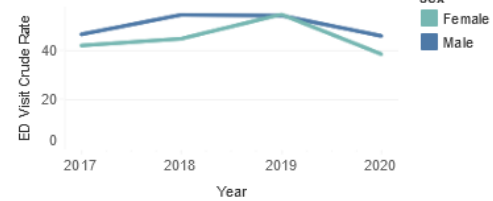
County Profile

Parameter:
 County:

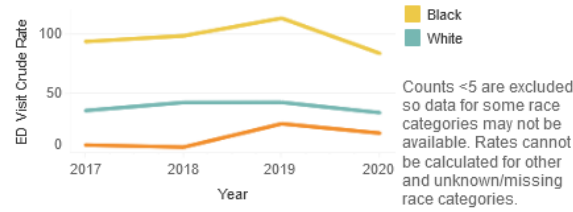
Annual Trends for Suicidal Ideation: Orange



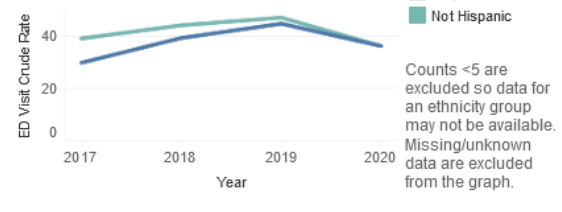
Trends by Patient Sex for Suicidal Ideation: Orange



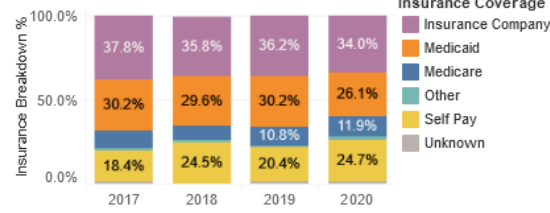
Trends by Race for Suicidal Ideation: Orange



Trends by Ethnicity for Suicidal Ideation: Orange



Insurance Breakdown for Suicidal Ideation: Orange



Trends by Age Group for Suicidal Ideation: Orange

	2017	2018	2019	2020
Ages 10-14	62.6	83.4	117.0	93.2
Ages 15-17	134.2	128.1	156.4	106.7
Ages 18-24	45.1	45.2	58.1	34.3
Ages 25-44	57.8	66.1	70.0	53.5
Ages 45-64	43.4	52.0	45.1	43.2
Ages 65+	13.4	15.2	19.4	19.4

Counts <5 are excluded for rates may not be available for all age groups.

Asthma & COPD Dashboard

NC DETECT: Asthma & COPD

Welcome
ZIP Maps
Sex
Age Group
Race
Ethnicity
Insurance
County Profile

ED Visits for Asthma & COPD

This dashboard provides an overview of emergency department (ED) visit trends for asthma and COPD. Asthma is defined as any ICD-10-CM J45 code and COPD is defined as any J40, J41, J42, J43, J44 or J47 code. An ED visit is included if it receives any ICD-10-CM diagnosis code for asthma or COPD (diagnosis code order is not used).

Crude rates are calculated by dividing the ED visit count by the population and multiplying by 10,000. Population data are from CDC Wonder NCHS Bridged Race population. County and ZIP in the ED data are based on patient residence.

ED visit percentages are calculated by dividing the ED visit count for asthma or COPD by the total ED visits. Total ED visits dropped significantly in 2020, especially at the start of the COVID-19 pandemic

Any count under 5 is excluded from the dashboard.

Trends shown may be impacted by data quality issues.

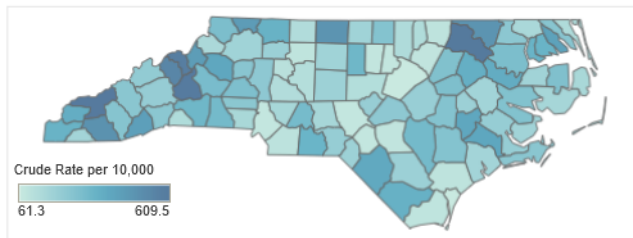
Click on a county on the map to view county-specific information in the tables and graphs below. Click on the selected county again to revert to statewide trends.

Parameter: Asthma COPD
 Year:

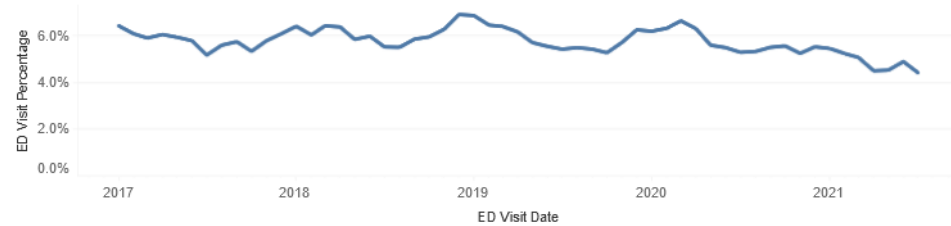
Annual COPD ED Visit Trends for All

	2017	2018	2019	2020
ED Visit Count	246,398	254,581	242,349	183,682
Crude Rate	312.9	313.5	312.8	250.0
ED Visit Percentage	5.8%	6.0%	5.9%	5.7%

Annual COPD ED Visit Rates: (2020)



COPD Monthly ED Visit Percentages in All



+ a b | e a u
←
→
↶
↷
🔍
📄

ED Visit Trends by ZIP of Residence

Select the parameter, year and county(ies) of interest to update the maps. Statewide crude rates and percentage of total ED visits for your selections are shown for comparison.

Parameter: Asthma COPD
Year: 2020
Primary County(ies): (Multiple values)

Statewide (NC Residents Only): Asthma (2020)

Crude Rate per 10,000	137.8
Percentage of ED Visits	3.58%

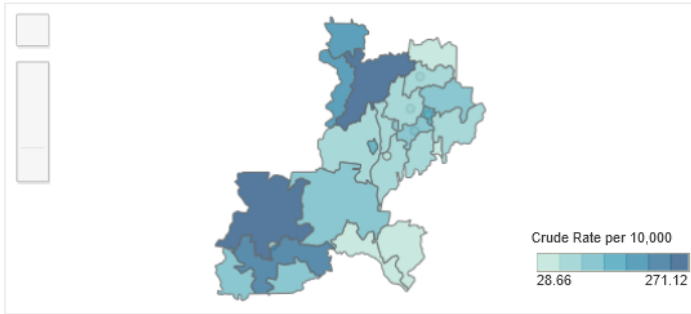
The top map shows ED visits as a crude rate (divided by the total ZIP population). The bottom map shows ED visits as a percentage of total ED visits from that ZIP. Population-based maps are available for 2019 and 2020 data only.

The ZIP population data are an approximation as ZIP codes do not represent precise geographic areas. Population data are not available for some of the ZIPs in NC DETECT, e.g., ZIP codes for post office boxes. ZIP codes can cross county lines but are affiliated with a primary county only in this display. Please select a neighboring county to view a ZIP code of interest if it does not appear for your county.

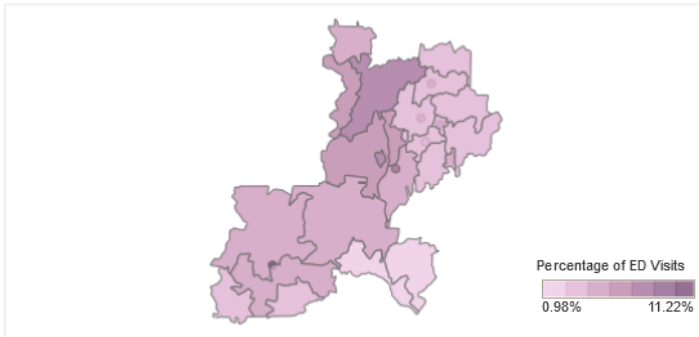
Counts < 5 are excluded from the maps and table below. Please note that rates and percentages based on counts < 10 should be interpreted with caution. In addition, please note that rates and percentages may be impacted by low denominators. For example, some NC ZIPs have recorded

Count	Crude Rate	% of ED Visits	Pop	Total ED Visits	
27207	79	207.57	4.71%	3,806	1,677
27208	17	100.53	2.49%	1,691	683
27213	11		11.22%		98
27231	35	170.90	4.96%	2,048	705
27243	94	201.50	6.69%	4,665	1,406
27252	29	128.09	3.50%	2,264	829
27278	653	240.24	7.19%	27,181	9,080
27312	269	121.14	4.09%	22,205	6,580
27344	523	271.12	5.29%	19,290	9,886
27503	24	33.23	2.85%	7,222	843
27510	226	155.40	6.95%	14,543	3,251
27514	276	84.03	6.02%	32,847	4,581
27515	11		8.21%		134
27516	421	95.43	5.58%	44,117	7,548
27517	256	88.79	4.92%	28,831	5,198
27559	18	62.63	2.23%	2,874	807

Annual Crude Rates per 10,000 person-years by ZIP for Asthma (2020) in Chatham County, Durham County, Orange County



Percentage of Total ED Visits by ZIP for Asthma (2020) in Chatham County, Durham County, Orange County



ED Visit Trends for Asthma and COPD by Patient Sex

Select a parameter and county(ies) of interest to update the data displayed. The statewide trends and tabular data are included for comparison.

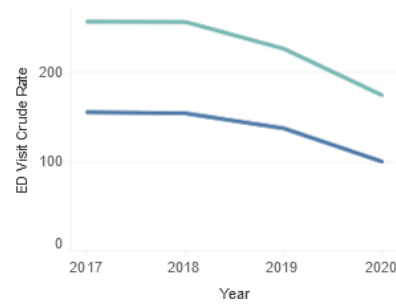
The trend graphs display the crude rate per 10,000 person-years by sex (ED visit count / population * 10,000). The tabular data include the visit count, crude rate and the count of ED visits for asthma or COPD as a percentage of total ED visits for that sex. For NC and most counties, females have higher rates of asthma and COPD compared to males.

Parameter:
 Asthma
 COPD

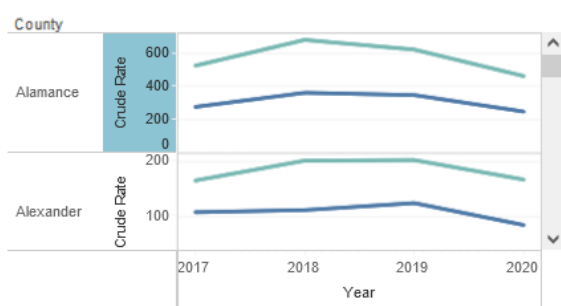
County(ies):
 (All)

Patient Sex
 Female
 Male

Statewide ED Visit Trends for Asthma by Sex



County-level ED Visit Trends for Asthma by Sex



Statewide: Asthma

		2017	2018	2019	2020
Female	ED Visit Count	135,178	136,590	121,862	93,856
	Crude Rate	256.45	256.20	226.18	174.20
	ED Visit %	4.81%	4.97%	4.37%	4.20%
Male	ED Visit Count	77,549	77,773	69,965	50,984
	Crude Rate	155.18	154.00	137.18	99.96
	ED Visit %	3.63%	3.70%	3.26%	2.83%
Missing	ED Visit Count	300	523	24	14
	Crude Rate				
	ED Visit %	3.15%	3.48%	1.96%	1.26%

County-level: Asthma

			2017	2018	2019	2020
Alamance	Female	ED Visit Count	4,455	5,904	5,489	4,078
		Crude Rate	520.23	675.02	616.91	458.33
		ED Visit %	9.73%	12.07%	11.34%	10.23%
Alamance	Male	ED Visit Count	2,126	2,834	2,775	1,978
		Crude Rate	273.82	358.51	344.58	245.61
		ED Visit %	6.63%	8.16%	7.78%	6.49%
Alexander	Female	ED Visit Count	300	367	370	306
		Crude Rate	164.74	200.28	201.22	166.41
		ED Visit %	4.03%	4.67%	4.69%	4.87%
Alexander	Male	ED Visit Count	205	213	238	163
		Crude Rate	108.28	112.06	124.55	85.30
		ED Visit %	3.08%	3.17%	3.39%	2.77%
Alleghany	Female	ED Visit Count	73	72	86	105
		Crude Rate	132.27	128.14	153.08	186.90
		ED Visit %	1.85%	1.76%	2.06%	3.04%

Counts < 5 are excluded.

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ED Visit Trends for Asthma & COPD by Age Group

Parameter:

- Asthma
- COPD

While the graphs show ED visit rate trends for children (ages <17) and adults (ages 18+), the tables provide more detailed age group counts, rates and percentage of ED visits. Change the parameter and county(ies) shown using the selection tools on the left.

County:

(All)

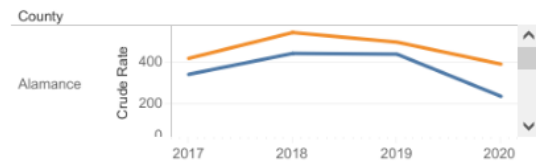
Age Group:

- Ages 0-17
- Ages 18+

Statewide Child and Adult ED Visit Rates for Asthma



County-level Child and Adult ED Visit Rates for Asthma



Statewide ED Visit Trends by Detailed Age Groups for Asthma

Age Group	ED Visit Count	Crude Rate	ED Visit %	2017	2018	2019	2020
Ages 0-4	ED Visit Count	188.0	3.29%	11,449	11,312	9,527	4,356
	Crude Rate	185.1	3.36%	11,312	11,312	9,527	4,356
	ED Visit %	251.4	208.3	2.81%	2.18%		
Ages 5-9	ED Visit Count	251.4	8.12%	15,921	14,901	13,102	5,980
	Crude Rate	237.0	8.28%	14,901	13,102	5,980	
	ED Visit %	8.12%	7.01%	5.50%			
Ages 10-14	ED Visit Count	12,976	7.52%	12,999	11,938	6,468	
	Crude Rate	197.2	195.7	179.4	97.2		
	ED Visit %	7.52%	6.97%	6.02%			
Ages 15-17	ED Visit Count	8,090	5.87%	7,955	7,125	4,578	
	Crude Rate	202.0	199.9	179.7	115.5		
	ED Visit %	5.87%	6.17%	5.57%	5.05%		
Ages 18-24	ED Visit Count	25,525	260.8	26,595	23,356	19,669	
	Crude Rate	269.4	235.8	198.6			
	ED Visit %	4.93%	4.77%	4.79%			
Ages 25-44	ED Visit Count	63,018	237.2	66,077	59,319	49,988	
	Crude Rate	246.0	218.1	183.8			
	ED Visit %	4.43%	4.28%	4.19%			
Ages 45-64	ED Visit Count	49,235	182.0	48,609	42,836	34,761	
	Crude Rate	178.8	157.1	127.5			
	ED Visit %	4.09%	3.56%	3.35%			
Ages 65+	ED Visit Count	26,811	164.7	26,433	24,647	19,053	
	Crude Rate	156.6	140.8	108.8			
	ED Visit %	2.80%	2.70%	2.39%	2.14%		

Counts < 5 are excluded from the dashboard.

County-level ED Visit Trends by Detailed Age Groups for Asthma

County	Age	ED Visit Count	Crude Rate	ED Visit %	2017	2018	2019	2020
Alamance	Ages 0-4	ED Visit Count	334	6.28%	334	373	394	180
		Crude Rate	352.47	6.74%	385.37	396.02	180.92	
		ED Visit %	6.28%	6.74%	6.76%	5.18%		
	Ages 5-9	ED Visit Count	344	342.53	12.13%	515	491	245
		Crude Rate	507.69	479.40	239.21			
		ED Visit %	12.13%	17.98%	16.76%	13.98%		
	Ages 10-14	ED Visit Count	334	319.65	12.53%	448	456	246
		Crude Rate	420.82	426.09	229.86			
		ED Visit %	16.62%	16.10%	13.53%			
Ages 15-17	ED Visit Count	238	362.53	10.81%	311	309	206	
	Crude Rate	476.04	477.52	318.34				
	ED Visit %	14.04%	14.71%	13.41%				
Ages 18-24	ED Visit Count	813	479.93	10.39%	1,141	1,053	828	
	Crude Rate	649.92	588.66	462.88				
	ED Visit %	13.53%	12.93%	11.89%				
Ages 25-44	ED Visit Count	1,995	512.43	9.20%	2,609	2,663	2,085	
	Crude Rate	655.46	650.96	509.67				
	ED Visit %	11.09%	11.55%	10.28%				
Ages 45-64	ED Visit Count	1,549	353.28	7.93%	2,131	1,894	1,466	
	Crude Rate	482.39	427.41	330.83				
	ED Visit %	10.20%	8.97%	7.71%				
Ages 65+	ED Visit Count	974	360.41	6.15%	1,211	1,004	819	
	Crude Rate	432.87	345.79	282.07				
	ED Visit %	6.91%	5.55%	5.28%				

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ED Visit Trends by Race

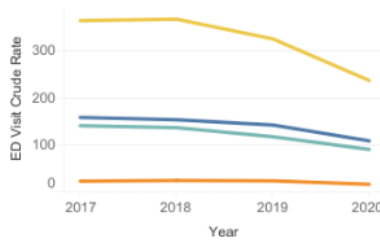
Select one or more counties from the county drop down menu to update the graph and tabular data. Statewide data are provided for comparison. Counts < 5 are excluded so data for some race categories may not be available.

Parameter:
 Asthma
 COPD

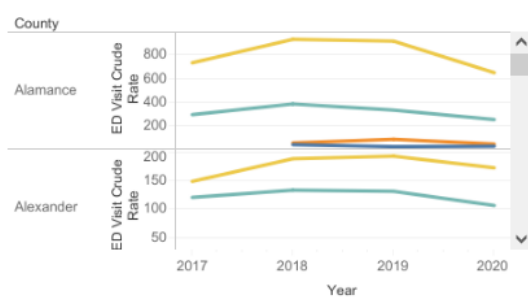
County(ies):
 (All)

Race
 AI / AN
 Asian / PI
 Black or AA
 White

Statewide Asthma Trends by Race



County-level Asthma Trends by Race



Statewide Asthma ED Visit Trends by Race

		2017	2018	2019	2020
AI / AN	ED Visit Count	2,745	2,693	2,525	1,925
	Crude Rate	158.7	153.8	142.5	108.7
	% of ED Visits	4.4%	4.6%	4.0%	3.9%
Asian / PI	ED Visit Count	782	861	860	589
	Crude Rate	22.6	24.1	23.3	16.0
	% of ED Visits	1.9%	1.8%	1.7%	1.1%
Black or AA	ED Visit Count	86,426	88,278	79,039	57,555
	Crude Rate	365.4	368.7	326.4	237.7
	% of ED Visits	5.3%	5.3%	4.7%	4.2%
White	ED Visit Count	104,262	102,044	88,393	67,994
	Crude Rate	141.2	136.9	117.5	90.4
	% of ED Visits	3.6%	3.7%	3.3%	3.1%
Other	ED Visit Count	8,669	10,150	9,845	6,966
	Crude Rate				
	% of ED Visits	3.4%	3.6%	3.1%	2.6%
Unknown	ED Visit Count	10,143	10,860	11,189	9,825
	Crude Rate				
	% of ED Visits	14.2%	13.7%	11.7%	11.1%

County-level Asthma ED Visit Trends by Race

		2017	2018	2019	2020
Alamance AI / AN	ED Visit Count		9	5	6
	Crude Rate		36.3	19.4	23.2
	% of ED Visits		15.0%	7.9%	7.9%
Asian / PI	ED Visit Count		17	28	14
	Crude Rate		50.6	82.0	41.0
	% of ED Visits		5.4%	8.6%	4.8%
Black or AA	ED Visit Count	2,525	3,329	3,374	2,386
	Crude Rate	731.9	931.6	916.5	648.1
	% of ED Visits	10.5%	12.2%	12.4%	10.4%
White	ED Visit Count	3,595	4,773	4,183	3,162
	Crude Rate	291.3	382.3	330.2	249.6
	% of ED Visits	7.9%	10.0%	8.8%	8.1%
Other	ED Visit Count	444	591	659	478
	Crude Rate				
	% of ED Visits	6.1%	7.5%	7.9%	6.2%
Unknown	ED Visit Count	10	20	15	10
	Crude Rate				
	% of ED Visits	2.3%	6.1%	4.9%	3.8%

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ZIP Maps
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County Profile

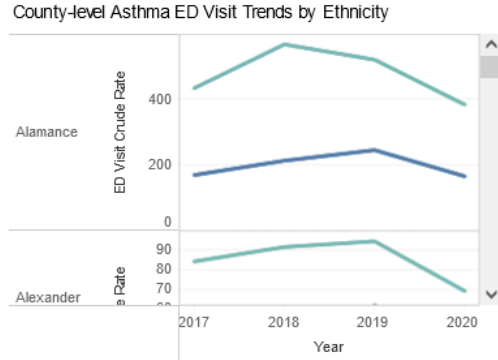
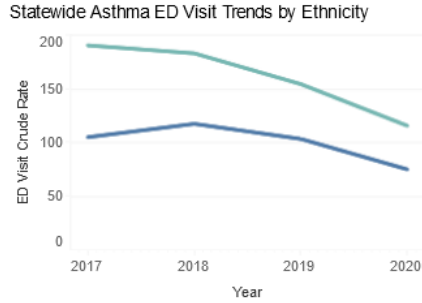
ED Visit Trends by Ethnicity

Select one or more counties from the county drop down menu to update the graph and tabular data. Statewide data are provided for comparison. Counts < 5 are excluded so ethnicity data for some categories may not be available for all counties. Please also note the high degree of missingness for ethnicity for some counties.

Parameter:
 Asthma
 COPD

County(ies):
 (All)

Ethnicity
 Hispanic
 Not Hispanic



Statewide: Asthma

Ethnicity		2017	2018	2019	2020
Hispanic	ED Visit Count	10,075	11,656	10,591	7,697
	Crude Rate	104.8	117.2	103.2	75.0
	ED Visit %	3.3%	3.7%	3.2%	2.9%
Not Hispanic	ED Visit Count	176,628	171,231	145,651	109,184
	Crude Rate	189.8	182.4	153.9	115.4
	ED Visit %	4.4%	4.4%	3.8%	3.5%
Unknown	ED Visit Count	26,324	31,999	35,609	27,973
	Crude Rate				
	ED Visit %	4.5%	4.8%	4.6%	4.4%

County-level: Asthma

			2017	2018	2019	2020
Alameda	Hispanic	ED Visit Count	340	449	536	361
		Crude Rate	166.8	210.2	242.2	163.1
		ED Visit %	5.6%	6.9%	7.6%	5.8%
	Not Hispanic	ED Visit Count	6,134	8,156	7,599	5,593
		Crude Rate	429.3	561.9	515.6	379.5
		ED Visit %	9.3%	11.5%	10.8%	9.7%
Unknown	ED Visit Count	107	134	129	102	
	Crude Rate					
	ED Visit %	1.8%	2.1%	1.8%	1.6%	
Alexander	Hispanic	ED Visit Count	6		11	9
		Crude Rate	34.6		61.5	50.3
		ED Visit %	2.0%		3.0%	3.7%
	Not Hispanic	ED Visit Count	297	324	336	246
		Crude Rate	83.9	91.2	94.1	68.9
		ED Visit %	3.1%	3.4%	4.3%	4.2%
Unknown	ED Visit Count	202	252	261	214	
	Crude Rate					

Counts < 5 are excluded so ethnicity data for some categories may not be available for all counties. Please also note the high degree of missingness for ethnicity for some counties.

Insurance Coverage Breakdown for Asthma & COPD ED Visits

Select the year, parameter, and county(ies) of interest to view the insurance coverage breakdown for ED visits. Mouse over the bars to get detailed percentages for each insurance coverage type. For COPD, Medicare is the most common insurance coverage type for NC and most counties. For asthma, Medicaid is the most common insurance coverage type for NC and

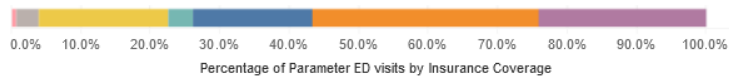
Year:

Parameter:
 Asthma
 COPD

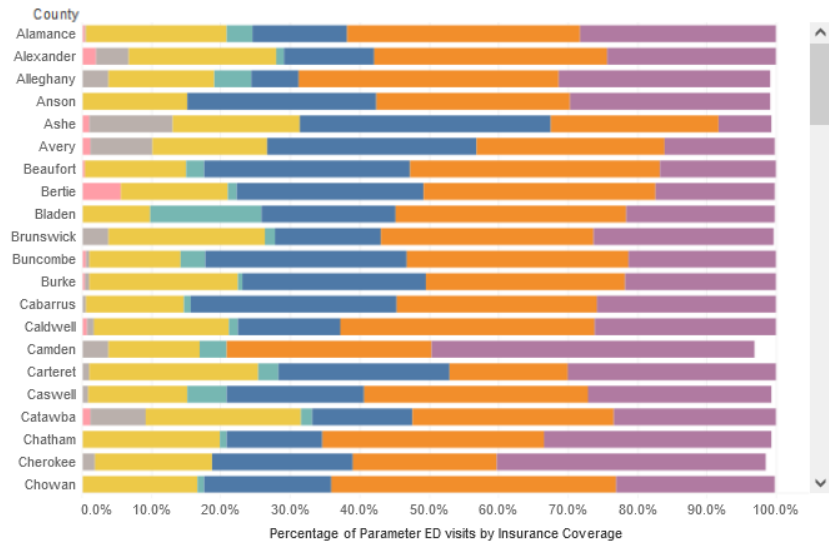
County(ies):

- Insurance Coverage**
- Insurance Company
 - Medicaid
 - Medicare
 - Other
 - Self Pay
 - Unknown
 - Workers Compensation

Statewide Insurance Coverage for Asthma (2019) ED Visits



Insurance Coverage by County for Asthma ED Visits (2019)

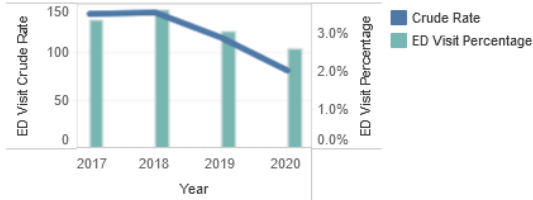


Counts < 5 are excluded so the insurance percentages for some counties may not add up to 100%

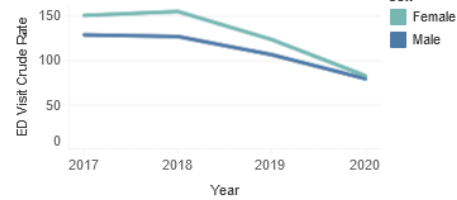
County Profile

Parameter: Asthma COPD
 County:

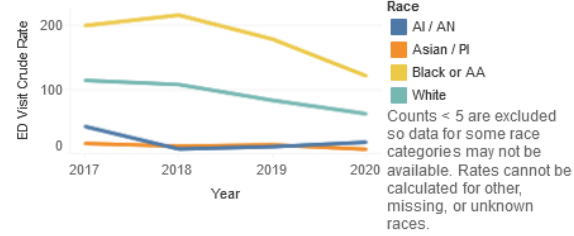
Annual Trends for COPD: Mecklenburg



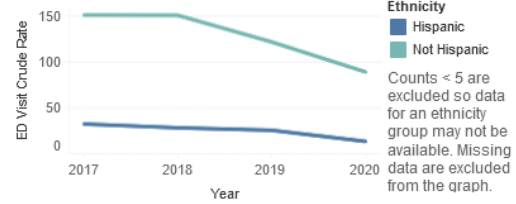
Trends by Patient Sex for COPD: Mecklenburg



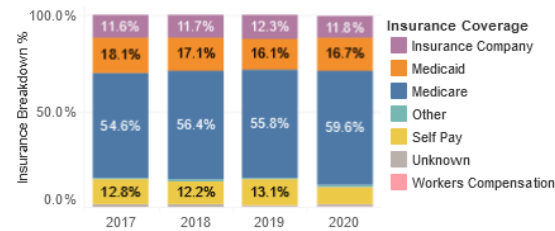
Trends by Race for COPD: Mecklenburg



Trends by Ethnicity for COPD: Mecklenburg



Insurance Breakdown for COPD: Mecklenburg



Trends by Age Group for COPD: Mecklenburg

Age	2017	2018	2019	2020
Ages 0-17	7.6	5.7	4.4	1.3
Ages 18-44	49.4	43.0	34.5	18.8
Ages 45-54	164.6	161.4	126.5	75.0
Ages 55-64	332.2	341.5	273.5	206.2
Ages 65-74	453.4	448.9	360.5	278.7
Ages 75+	700.5	753.0	617.5	455.6

Counts < 5 are excluded so rates may not be available for all age groups.

APPENDIX 4.5: QUALTRICS® WEB-BASED QUESTIONNAIRE



The purpose of this survey is to gather feedback on the **NC DETECT Mental Health and Asthma / COPD dashboards** available at <https://ncdetect.org/dashboard/>. You are being asked to take part in this research study because you may have worked with emergency department data from NC DETECT in your role at a NC local health department.

The survey should take about 10 minutes to complete. You are not required to answer all questions and you can stop taking the survey at any time. You are required to be at least 18 years of age to take this survey.

As with any study involving collection of data, there is the possibility of breach of confidentiality of data. Every precaution will be taken to ensure confidentiality. To protect your identity as a research subject, no identifiable information will be collected. The research data will not be stored with your name and the researcher will not share your information with anyone. In any publication about this research, your name or other private information will not be used. All data collected as part of this research will be stored securely.

At the end of the survey you will have the option to enter a gift card drawing for a \$50 gift card. If you enter the drawing, the contact information you enter will be in a completely different survey and cannot be connected to your survey responses.

If you have any questions about this research, please email Amy Ising at amy_ising@med.unc.edu.

If you have questions or concerns about your rights as a research subject, you may contact the UNC Institutional Review Board at 919-966-3113 or by email to IRB_subjects@unc.edu. This project was determined to be exempt from federal human subjects research regulations.

If you agree to take this survey, please click the arrow below to proceed! Thank you!!



What is your job title? If you have more than one title, please select the one that most closely aligns with your primary job functions.

How long have you been in your current position?

- less than 1 year
- 1-3 years
- 4-9 years
- 10+

What is your role in public health surveillance, data analysis, and/or public health program efforts related to chronic diseases and/or mental health?

How long have you been working with NC DETECT emergency department visit data (for any reason) ?

- < 1 year
- 1-3 years
- 4-9 years
- 10+ years
- I have not used NC DETECT to view emergency department visit data.



The next two question sets ask you to provide feedback on the NC DETECT Mental Health Dashboard and/or the NC DETECT Asthma / COPD Dashboard. Both dashboards are available at <https://ncdetect.org/dashboard>. You can provide feedback on just one or both of the dashboards.

Mental Health Dashboard: Please select the best answer for the following statements:

	Strongly Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
I think that I would like to use the Mental Health dashboard frequently.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the Mental Health dashboard unnecessarily complex.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I thought the Mental Health dashboard was easy to use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think that I would need the support of a technical person to be able to use the Mental Health dashboard.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the various functions in the Mental Health dashboard were well integrated.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I thought there was too much inconsistency in the Mental Health dashboard.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would imagine that most people would learn to use the Mental Health dashboard very quickly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found this Mental Health dashboard very cumbersome to use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt very confident using this Mental Health dashboard.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I needed to learn a lot of things before I could get going on the Mental Health dashboard.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Asthma & COPD Dashboard: Please select the best answer for the following statements:

	Strongly Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
I think that I would like to use the Asthma / COPD dashboard frequently.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the Asthma / COPD dashboard unnecessarily complex.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I thought the Asthma / COPD dashboard was easy to use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think that I would need the support of a technical person to be able to use the Asthma / COPD dashboard.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the various functions in the Asthma / COPD dashboard were well integrated.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I thought there was too much inconsistency in the Asthma / COPD dashboard.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would imagine that most people would learn to use the Asthma / COPD dashboard very quickly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the Asthma / COPD dashboard very cumbersome to use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt very confident using the Asthma / COPD dashboard.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I needed to learn a lot of things before I could get going on the Asthma / COPD dashboard.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



I will use the information provided on these dashboards to:

These dashboards would be more helpful if they:

Please share any additional feedback that you have.



Would you like to be included in the gift card drawing?

Yes

No



CHAPTER 5: REFERENCES

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