Analysis of "Estimates of Emergency Department Visits in the United States from 2016-2022"

[Aya A Saad]

[23/08/2025]

Table of Contents

1. Executive summary

This report provides a data-driven analysis of Emergency Department (ED) visits in the United States from 2016 to 2022, using a dataset titled "Estimates of Emergency Department Visits in the United States from 2016–2022." The analysis reveals a complex and shifting landscape of healthcare utilization, with **2018 standing out as the only year with a statistically significant difference** in overall visit counts when compared to the 2022 baseline. Beyond this primary finding, the data highlights a clear and escalating **mental and behavioral health crisis**, evidenced by large and sustained increases in visits across multiple demographics. The report also notes a sharp rise in visits for acute symptoms like respiratory and gastrointestinal issues, particularly in 2020, suggesting the direct and indirect impact of the pandemic. These trends disproportionately affected certain subgroups, including **children (0-17), male patients, and individuals with private insurance**. A major anomaly was identified in the "Other Payment Sources" category, which saw a dramatic and unprecedented spike. These findings not only underscore the need for targeted public health interventions for at-risk populations but also warrant further investigation into the systemic drivers behind these trends and potential healthcare disparities, as evidenced by the lack of statistically significant increases among certain minority groups.

2. Introduction

2.1 Background

The dataset used in this analysis is titled **"Estimates of Emergency Department Visits in the United States from 2016–2022."** It includes national counts and rates of emergency department (ED) visits across a seven-year period, focusing on the ten leading **primary diagnoses** and **reasons for visit**. This analysis aims to highlight trends in ED utilization and understand patterns in ambulatory care delivery across key demographic, regional, and insurance-based subgroups.

2.2 Objective

The purpose of this report is to:

- **Identify trends** in ED utilization taken 2022 as baseline year, especially around the COVID-19 pandemic period.
- **Detect condition-specific surges or declines**, such as increases in respiratory or mental health-related visits.
- **Pinpoint disproportionately affected subgroups** (e.g., by age, gender, race/ethnicity, insurance status, or region).

- **Support data-driven interventions** by informing targeted public health strategies, resource allocation, and equitable policy development based on who is visiting the ED, for what reasons, and when.

3. Dataset Description

3.1 Source

The dataset was obtained from the **Centers for Disease Control and Prevention (CDC)** and is publicly available through HealthData.gov.

3.2 Summary

The original dataset consists of **6,777 rows** and **12 variables**. After data cleaning (e.g., removing null or redundant values), the final analysis was conducted on **5,913 rows**.

Each row represents a **combination of year, diagnosis/reason for visit, demographic subgroup, and estimated type** (count or rate was normalized for proportional comparison). The data spans from **2016 to 2022** and covers the **10 leading primary diagnoses** and **10 leading reasons for ED visits** in the United States.

3.3 Variables Included

- Year: 2016–2022
- Measure Type:
    - *By primary diagnosis- see 3.3.1*
    - *By reason for visit- see 3.3.2*
- Leading 10 Ranking: Rank 1 to 10
- Measure: The clinical condition or symptom category (see full list below)
- Group & Subgroup: Stratified by demographic and contextual variables:
    - Sex: Male, Female
    - Age: 0–17, 18–44, 45–64, 65+
    - Race/Ethnicity: Non-Hispanic White, Non-Hispanic Black, Hispanic, Non-Hispanic Other
    - Region: Northeast, Midwest, South, West
    - MSA Status: MSA, Non-MSA
    - Primary Payer: Private Insurance, Medicare, Medicaid, Uninsured, Other
- Estimate Type:
    - *Visit count*

- ○ *Visit rate per 1,000 population(rate was normalized for comparison)*
- Estimate: Numerical value
- Standard Error, 95% Confidence Interval(low/upper): Included for statistical reliability
- Reliable: Yes/No flag indicating statistical robustness

3.3.1 Primary Diagnoses (Top 10 Categories)

1. Symptoms, signs, and abnormal findings
2. Injury and poisoning
3. Respiratory system diseases
4. Musculoskeletal diseases
5. Digestive system diseases
6. Genitourinary diseases
7. Mental, behavioral, and neurodevelopmental disorders
8. Circulatory system diseases
9. Infectious and parasitic diseases
10. Skin and subcutaneous tissue diseases

3.3.2.Leading Reasons for Visit (Top 10 Symptoms)

1. Abdominal pain/cramps/spasms
2. Chest pain (non-specific)
3. Cough
4. Shortness of breath
5. Fever
6. Headache
7. Non-specific pain
8. Back symptoms
9. Vomiting
10. Psychological/mental symptoms

4. Methodology

4.1 Tools Used

All analyses were conducted using **Python 3** within the **Google Colab** environment. Key libraries included pandas, numpy, matplotlib, seaborn, and scipy for data manipulation, visualization, and statistical testing.

4.2 Data Cleaning

The dataset was cleaned by **removing rows flagged as unreliable**, specifically those where the **"Reliable"** column was marked as **"No"**. This step ensured that only statistically robust estimates were included in the analysis.

4.3 Analysis Techniques

4.3.1 Confidence Interval Width Analysis

To assess the **precision of each estimate**, we calculated the relative width of its 95% confidence interval (CI). This metric indicates how tight or wide the interval is in relation to the estimate itself.

- **Formulas Used:**
    - **CI Width** = Upper CI – Lower CI
    - **Relative Width (%)** = (CI Width / Estimate) × 100
- **Interpretation:**
    - A **lower percentage** suggests a **more precise** estimate (e.g., 5–10%).
    - A **higher percentage** indicates a **less precise** estimate (e.g., >15%), where the estimate may be less reliable.

This method helped assess data quality across subgroups and determine the robustness of key trends.

4.3.2 Statistical Significance Testing: Overlapping Confidence Intervals

To identify **statistically significant differences** between subgroups or time periods, a two-sample **z-test** was applied to compare means using their respective confidence intervals.

- The method was implemented via a custom Python function: `compare_with_ci()`, which compares CIs taking 2022 as baseline year to flag statistically significant differences.
- If confidence intervals **did not overlap**, the result was treated as a **"green flag"** for statistical significance.

This approach was used consistently across condition categories and subgroups to highlight meaningful trends in ED visit rates and counts.

5. Limitations

Limitation-1: Inability to Compare within subgroups in all diagnosis/all visit reasons

This analysis does not include comparisons between intersecting subgroups (e.g., males aged 65+, or Medicare users within Non-Hispanic white populations) due to the lack of cross-tabulated data. Since the dataset provides group-level breakdowns independently (e.g., by age, sex, or race/ethnicity), we cannot reliably determine the overlap between multiple dimensions. Attempting to do so would risk introducing inaccurate or misleading conclusions due to unknown denominator overlap and sample sizes within intersections.

Limitation-2: CI-width above the threshold

A key limitation of this analysis is the high relative width of confidence intervals across most subgroups. Specifically, CI width percentages often exceeded 15%, which is generally considered the threshold for a stable estimate. In our dataset, they ranged from 23% to 55%, indicating potential unreliability of individual point estimates. While group-to-group comparisons using overlapping CIs were conducted, the instability of base estimates may influence the precision of both descriptive and inferential findings. As such, interpretation should prioritize overall trends and statistically significant changes rather than absolute values.

6. Findings and Visualizations

6.1. Overall ED Utilization Trends

Due to the complexity of the dataset, the data was separated into subtables based on the stratification outlined in **Section 4.3 – Variables Included**. For analyzing overall trends in emergency department (ED) visits, the analysis focused on two primary categories:

- **Primary Diagnoses**
- **Reasons for Visit**

Each of these categories included both **visit counts** and **visit rates**, which were analyzed independently. Using **confidence interval (CI) comparison techniques** (specifically, the two-sample z-test), we identified statistically significant differences across subgroups and time periods.

Based on the confidence interval analysis, the only statistically significant difference in Emergency Department (ED) visits between 2016-2022 was found in **2018**, when compared to the 2022 baseline. While the data shows visual fluctuations in visit counts and a cyclical trend, the wide confidence intervals for all years indicate a high degree of uncertainty, making most year-to-year differences not statistically significant.

The one robust finding is that ED visits in **2018 were significantly lower** than in 2022. This suggests a notable, nationwide change in healthcare-seeking behavior that year, a finding that is supported across both visit rates and total counts.
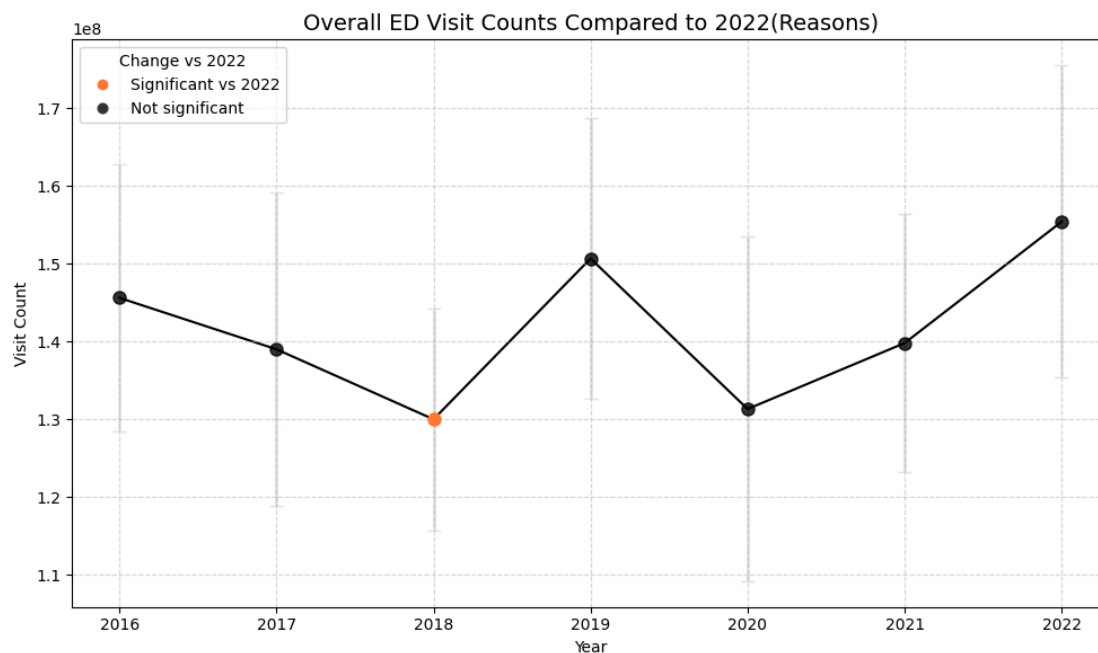
From this comparative analysis, several demographic groups emerged consistently across **all subtables** (diagnosis counts(all/detailed), diagnosis rates(all/detailed), reason counts(all/detailed), and reason rates(all/detailed)) as having statistically significant differences:

- 65+ years old(2018 and 2017) 28.7% and 29.3%
- Male(2018) 19%
- Non-Hispanic White(2018) 25.3%
- 0–17 years old(2020) 39.2%
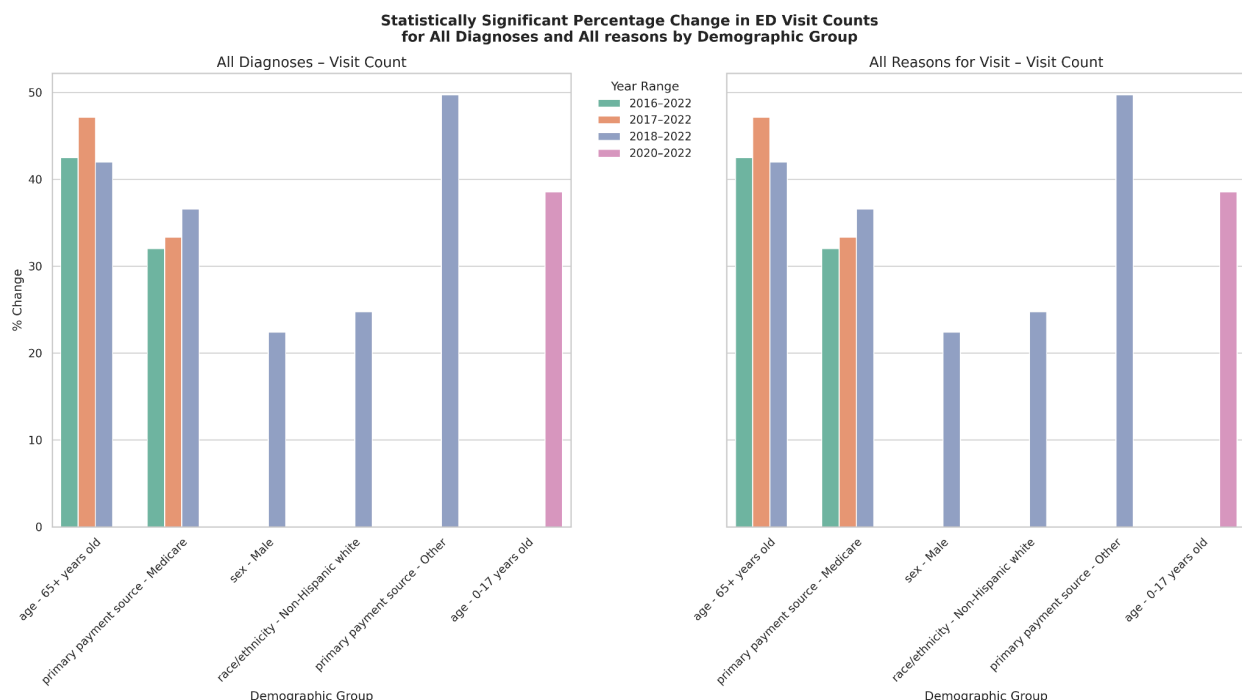- Other Payment Providers(2018) 80.5%

These repeated appearances suggest these subgroups experienced notable shifts in ED utilization over the 2016–2022 period.
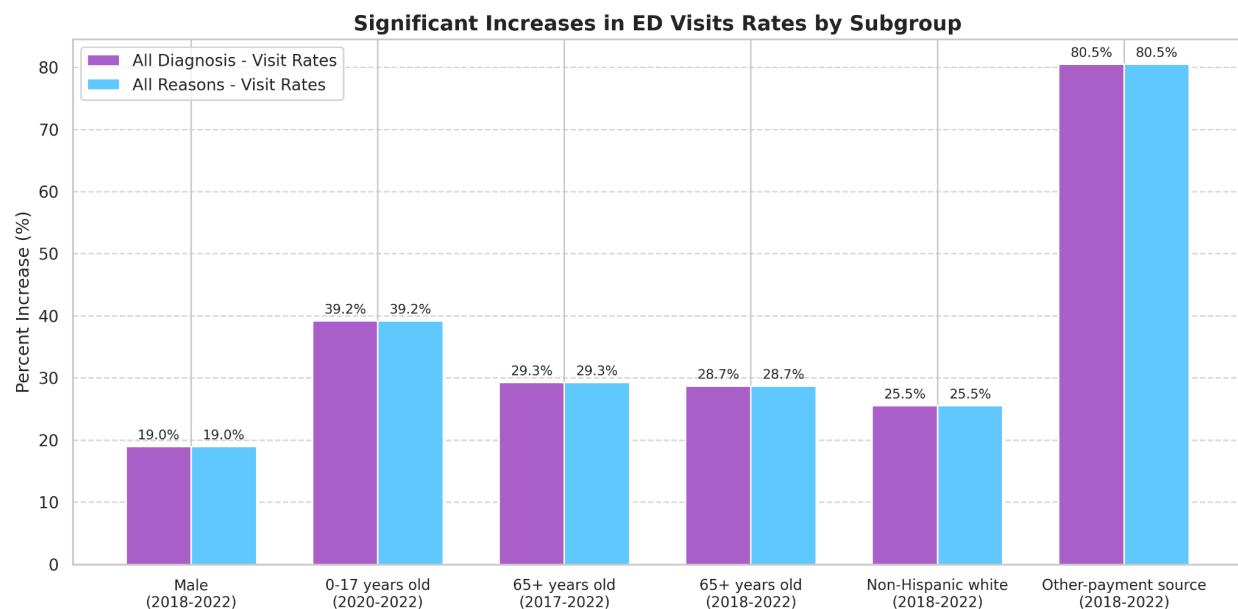
Demographic Trends in ED Utilization

- The most notable shifts in ED utilization were observed when comparing **demographic subgroups** using **visit rate data**, which offers a standardized measure to detect national-level trends.
- **Year 2018** stood out across multiple dimensions, showing statistically significant increases in the following subgroups:
  - **Male patients**: Visit rates increased by **19%**
  - **Age 65+**: Increased by **28%**
  - **Non-Hispanic White individuals**: Increased by **25%**
  - **Other payment sources**: Showed the most dramatic increase, rising by **80%**

- The sharp rise in the "**Other Payment Sources**" category in 2018 suggests a **potential shift in how emergency care is being accessed or financed**, outside of the more traditional systems such as Medicaid, Medicare, private insurance, or self-pay. This anomaly warrants **further investigation** to identify what factors contributed to this surge. Understanding this trend could help inform future **policy decisions, outreach campaigns, or support programs** to strengthen or replicate this shift where beneficial.
- In **2020**, the most prominent increase was seen in the **0–17 age group**, which experienced a **39% rise in visit rates**. Given the context of the pandemic, this spike may indicate **unique pediatric healthcare needs or access changes** during that time, and it should be explored in more depth.
- For **senior citizens (65+)**, a steady increase was observed in visit rates from **2016 through 2018**, with the **most consistent rise in 2017**, suggesting a prolonged trend in increased ED use among older adults.
- Supporting the findings from **Figure 3**, **Figure 4** illustrates that these same subgroups (male, 65+, non-Hispanic White, and other payment sources) also show increases in both **primary diagnosis** and **reason for visit counts**, reinforcing the idea that these trends are **system-wide and not isolated to a specific diagnostic category**. This dual increase in **both counts and rates** highlights a broader shift in how and by whom emergency care is being utilized.

Statistically Significant Percentage Change in ED Visit Counts for All Diagnoses and All reasons by Demographic Group

6.2.Condition-Specific Trends in Emergency Department Visits

6.2.1 Trends in Specific Medical Conditions.

A- Symptoms, signs, and abnormal clinical and laboratory findings

- For cases with abnormal findings, the highest increase in rates was observed in 2018 under the "Other Payments" category, with a rise of **112.02%**. In 2017, the **Northeast region** showed a significant increase in both count and rate, with a **60.57%** rise. Among racial groups, **non-Hispanic individuals of other races** experienced increases in both 2016 (**47.86%**) and 2017 (**59.51%**). The **0–17 age group** saw a **42.8%** increase in 2020, while **senior citizens (65+ years old)** had a notable **40.1%** increase in 2017, accompanied by a corresponding rise in counts. for gender wise, a consistent statically different was seen for Males in visit rates for this condition in years 2017 and 2018

Pre-Pandemic Trends (2016–2019):

Before the onset of the pandemic, notable increases in both **counts and rates** of abnormal clinical findings were observed across several subgroups:
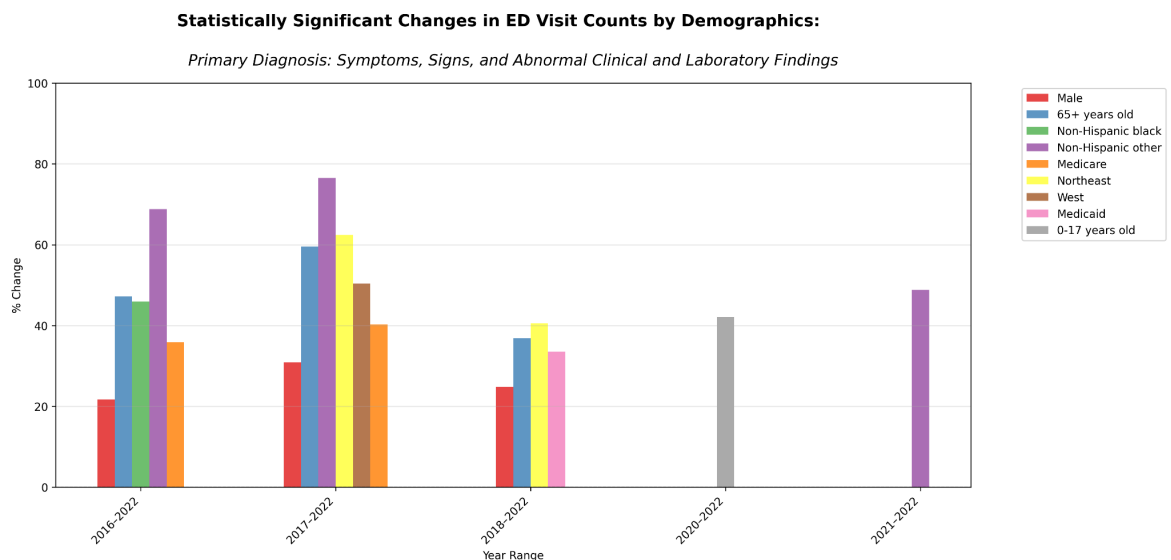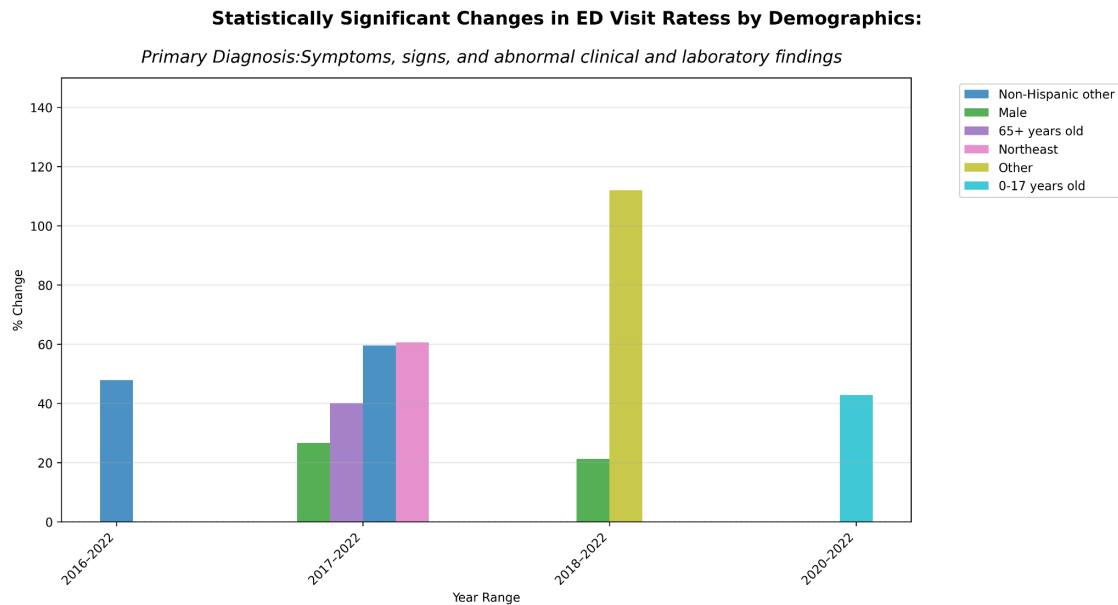
- Among the **non-Hispanic Other** racial group, a significant rise in **counts** occurred in **2016 (68.83%)** and **2017 (76.5%)**, with a corresponding increase in **rates** in **2016 (47.86%)** and **2017 (59.51%)**.
- The **Northeast region** also showed consistent growth, with **counts increasing by 62.45% in 2017** and **40.57% in 2018**, and **rates rising by 60.57% in 2017**.
- A substantial spike in **rates** was seen in **2018** for those using **"Other" payment types**, with a **112.02% increase**, indicating a sharp rise in this payment subgroup even prior to COVID-19.
- for male patients, it is seen a consistent presence in years 2016 (21.71%), 2017(30.86%) and 2018(24.82%) in counts while it is seen 2017 (26.63%)
- **Senior citizens** 65+ years old also showed a marked increase in **rates by 40.1%** in **2017**, with a corresponding rise in **counts**, highlighting a vulnerable population already at risk prior to the pandemic.

Pandemic Surge Trends (2020–2021):

During the pandemic years, the increases remained notable, though not as extreme as some of the pre-pandemic shifts:

- The **children age group (0–17)** experienced a significant increase in **counts by 42.15%** and **rates by 42.8%** in **2020**, suggesting greater vulnerability during the pandemic.

- In **2021**, there was a **48.86% increase in counts** among the **non-Hispanic Other** group, continuing the trend from prior years.

Statistically Significant Changes in ED Visit Ratess by Demographics:

Primary Diagnosis:Symptoms, signs, and abnormal clinical and laboratory findings

Statistically Significant Changes in ED Visit Counts by Demographics:

Primary Diagnosis: Symptoms, Signs, and Abnormal Clinical and Laboratory Findings

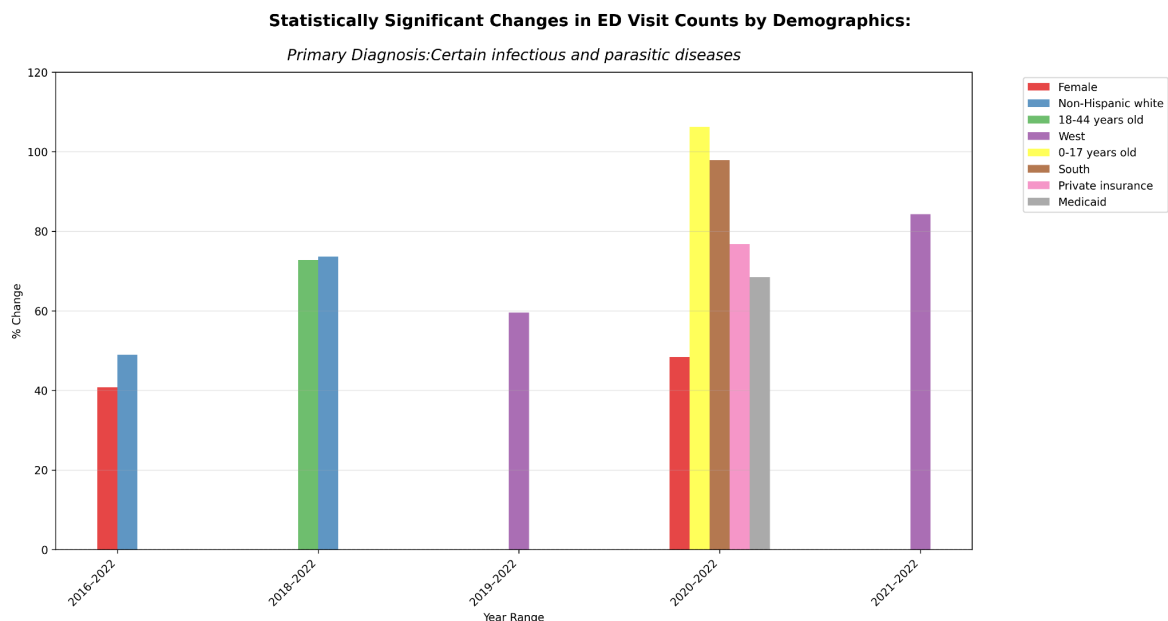# B- Certain infectious and parasitic diseases

Pre-Pandemic Trends (2016–2019):

An overall increase in infection diagnoses counts and rates was observed across several demographic groups even before the onset of the pandemic.
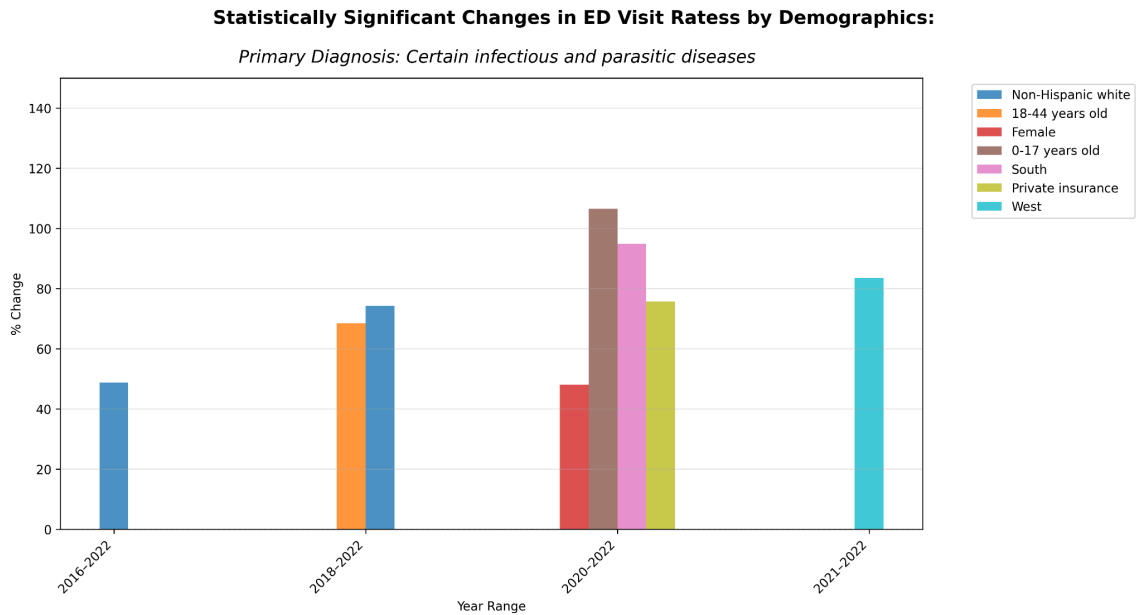
- The **non-Hispanic White** population showed consistent growth, with notable increases in **2016 (48.96%)** and **2018 (73.63%)** in counts, and similarly in **2016 (48.78%)** and **2018 (74.29%)** in rates.
- The **18–44 age group** experienced a substantial rise in infection counts, increasing by **72.79% in 2018**.
- Gradual increases were also seen across various subgroups and regions during these years, indicating a rising trend in certain infections before COVID-19 emerged.

Pandemic Surge Trends (2020–2021):

The most statistically significant increases occurred during the **pandemic years**, particularly in **2020 and 2021**, with sharp spikes across multiple subgroups.

- In 2020, the 0–17 age group showed the most dramatic increase in both counts (106.29%) and rates (106.52%) of infections.
- The South region also saw a comparable surge, with a 97.84% increase in counts and 94.87% in rates.
- Other affected subgroups in 2020 included those with private insurance (counts: 76.75%, rates: 75.68%), Medicaid recipients (68.5%), and female patients (counts: 48.41%, rates: 48.11%).
- In 2021, the West region experienced a significant increase in infection rates, rising by 83.56%, continuing the upward trend that began during the first year of the pandemic.

Statistically Significant Changes in ED Visit Counts by Demographics:

Primary Diagnosis:Certain infectious and parasitic diseases

Statistically Significant Changes in ED Visit Ratess by Demographics:

Primary Diagnosis: Certain infectious and parasitic diseases

C- Diseases of the Respiratory System

Respiratory Diseases: Pre-Pandemic vs. Pandemic Trends

Pre-Pandemic Trends (2019 and earlier):

Respiratory disease patterns showed **mixed fluctuations** before the pandemic, with notable **declines** in some subgroups.

- Among **Hispanic patients**, there was a **39.44% decrease in counts** and a corresponding **42.39% decrease in rates** in **2019**, indicating a significant pre-pandemic drop in respiratory disease cases for this group.
- **Medicare recipients** also showed a **30.87% decrease in rates** in 2019, further reflecting this downward trend before COVID-19 disrupted health patterns.
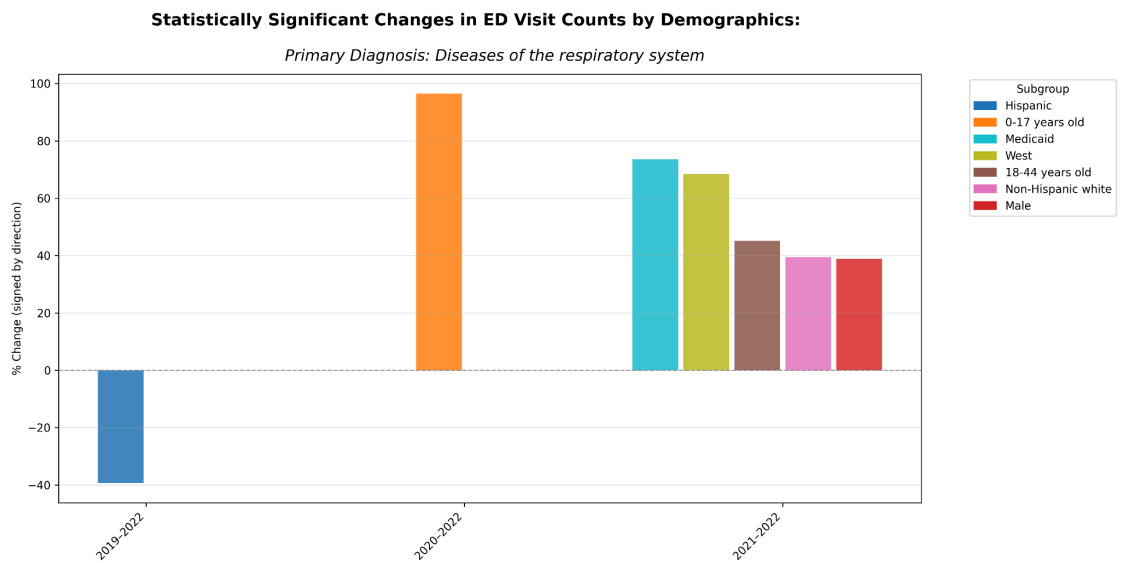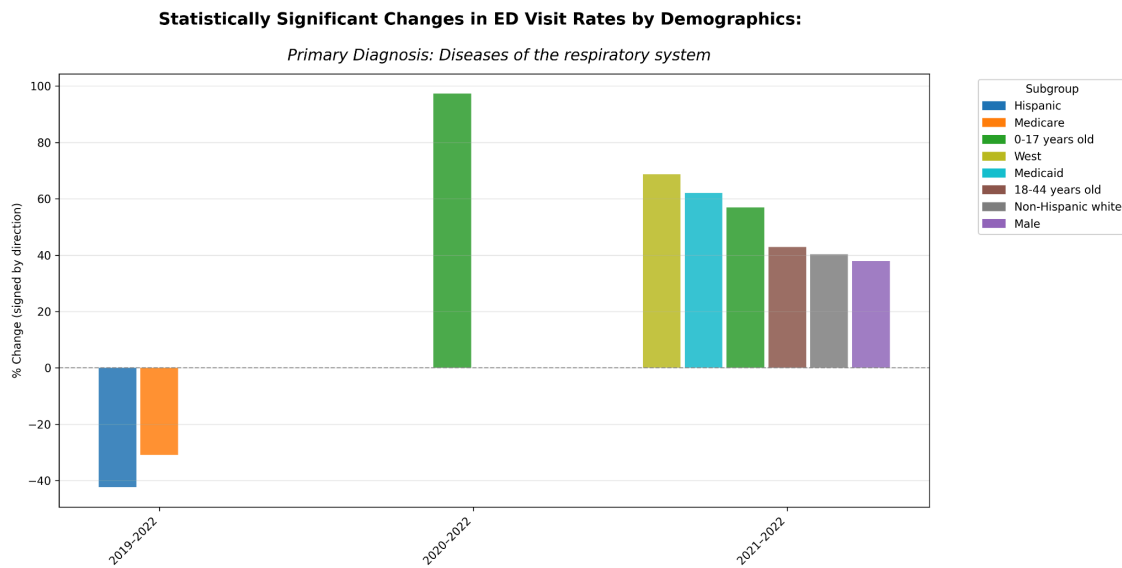
Pandemic Surge Trends (2020–2021):

The pandemic period brought a clear **resurgence in both counts and rates** of respiratory diseases across multiple demographic groups:

- The **0–17 age group** was the most affected, with a **96.47% increase in counts** and a **97.31% rise in rates** in **2020**, followed by an additional **57% increase in rates** in **2021**, marking a sustained impact on children during the pandemic.
- In **2021**, several groups experienced sharp increases:
  - West region: 68.46% increase in counts, 68.66% in rates
  - Medicaid patients: 73.63% increase in counts, 62.14% in rates

- 18–44 age group: 45.13% increase in counts, 42.86% in rates
- Non-Hispanic White individuals: 39.51% increase in counts, 40.3% in rates
- Male patients: 38.84% increase in counts, 37.91% in rates

These findings highlight the **disproportionate impact** of the pandemic on younger populations, low-income individuals (Medicaid), and residents in the West region, with most of the surge concentrated in **2020 and 2021**.

Statistically Significant Changes in ED Visit Rates by Demographics:

Primary Diagnosis: Diseases of the respiratory system

Statistically Significant Changes in ED Visit Counts by Demographics:

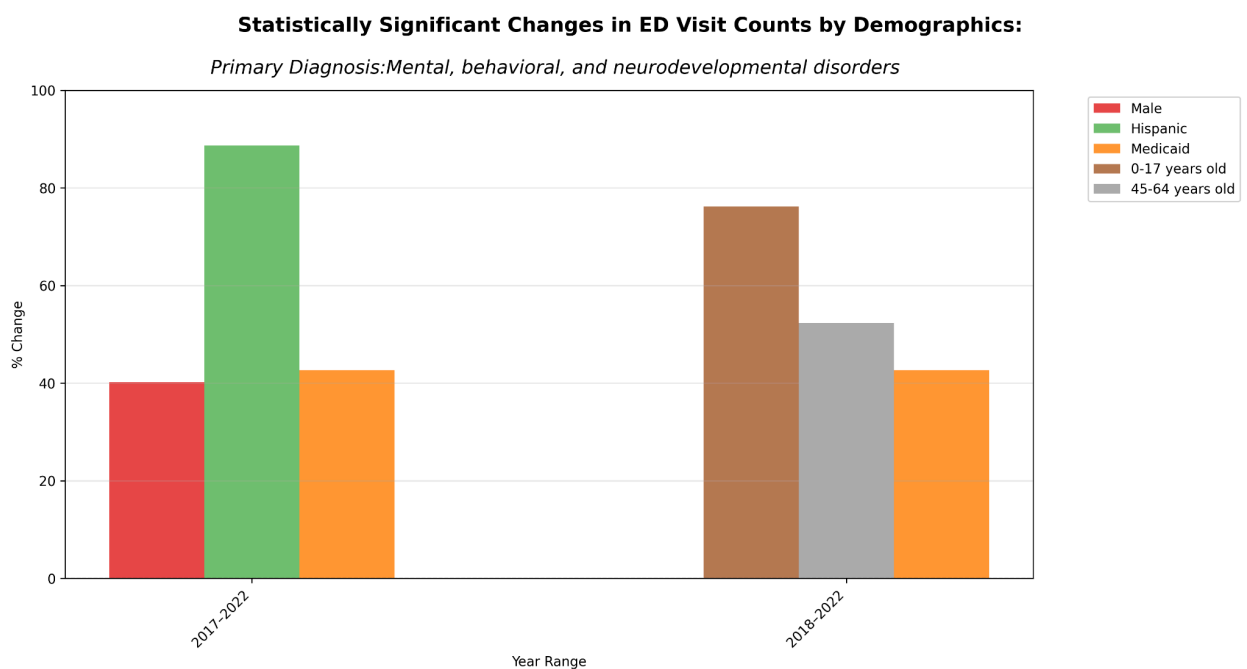*Primary Diagnosis: Diseases of the respiratory system*

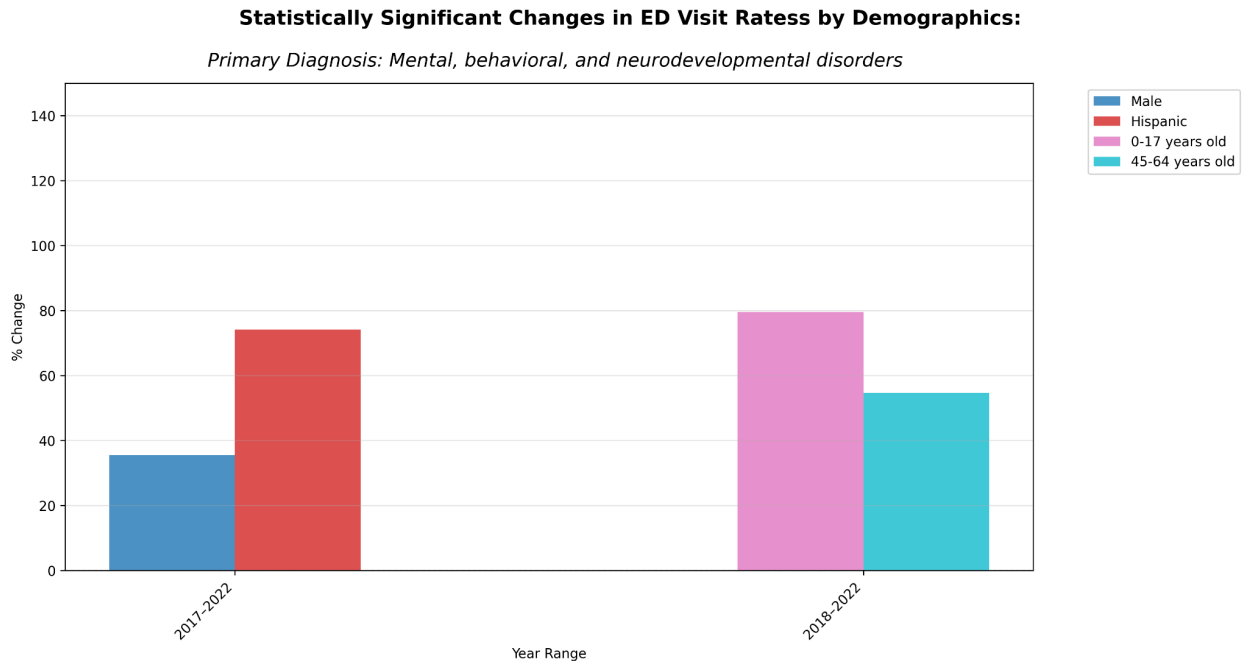## 6.2.2.The Escalating Mental and Behavioral Health Crisis

Primary Diagnosis: Mental, Behavioral, and Neurodevelopmental Disorders

- Significant increases in **counts** were observed in **2017** among several key subgroups:
    - **Hispanic patients** increased by **88.71%**
    - **Male patients** by **40.19%**
    - Those covered by **Medicaid** by **42.61%**
- In **2018**, further growth occurred in younger and middle-aged groups:
    - Children aged **0–17** rose by **76.23%**
    - Adults aged **45–64** increased by **52.27%**
    - Medicaid patients maintained an increase of **42.61%**
- Corresponding **rates** support these findings, confirming the broader scale of the crisis:
    - In **2017**, rates rose by **74.12%** among Hispanics and **35.53%** among males
    - In **2018**, rates increased by **79.55%** for the 0–17 age group and **54.73%** for the 45–64 age group

These parallel increases in counts and rates underscore a sustained, widespread escalation in mental, behavioral, and neurodevelopmental disorders.
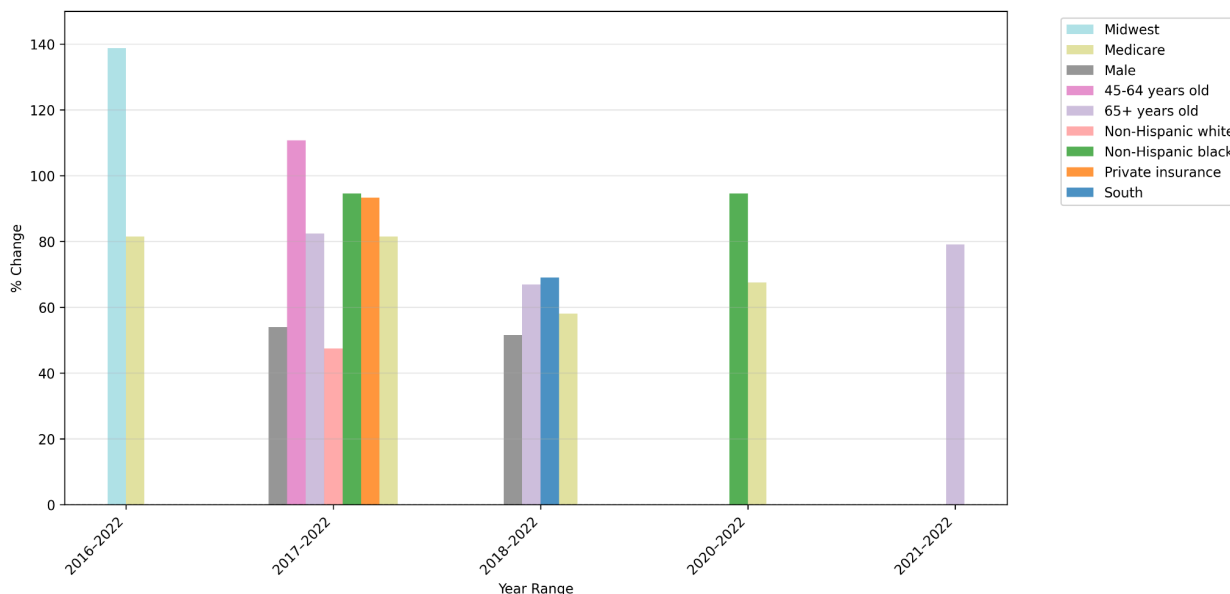

Statistically Significant Changes in ED Visit Counts by Demographics:

Primary Diagnosis:Mental, behavioral, and neurodevelopmental disorders

Primary Diagnosis: Mental, behavioral, and neurodevelopmental disorders

Reason for Visit: Other Symptoms/Problems Related to Psychological Issues

- Counts indicate a consistent upward trend from 2016 through 2019 among multiple subgroups:
    - Medicare-insured patients showed increases of 111.31% (2016), 106.21% (2017), 73.84% (2018), and 69.41% (2019)
    - Male patients had a notable rise of 50.53% in 2016
    - The 65+ age group saw increases of 94.42% (2016), 107.06% (2017), 84.13% (2018), and again 85.67% in 2021
    - Among Non-Hispanic Black patients, counts increased by 67.65% (2016), 103.57% (2017), and 98.66% (2020)
    - The Midwest region experienced the highest surge in 2016, with counts rising 142.94%, while the 45–65 age group had a 104.47% increase in 2017
- Similar patterns are observed in rates, reflecting growing mental health concerns at the population level:
    - The Midwest region's rates soared by 138.78% in 2016
    - Medicare patients showed steady increases in rates over several years: 81.48% (2016 and 2017), 58.06% (2018), and 67.52% (2020)
    - The 65+ age group experienced consistent rate increases: 82.41% (2017), 66.95% (2018), and 79.09% (2021)
    - Among Non-Hispanic Black patients, rates rose sharply by 94.62% in 2017 and 2020

- Male patients also saw increased visits, with rates growing by 53.97% in 2017 and 51.56% in 2018
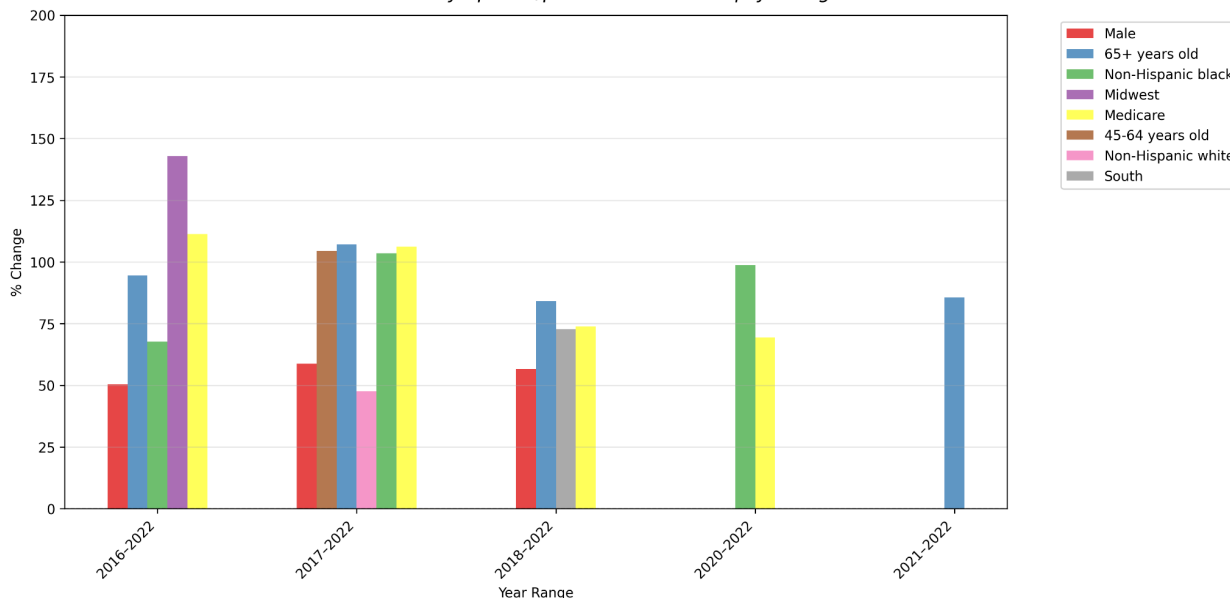- The 45–65 age group experienced a 110.81% increase in rates in 2017

Statistically Significant Changes in ED Visit Rates by Demographics:

Reason for visit: Other symptoms/problems related to psychological

Statistically Significant Changes in ED Visit Counts by Demographics:

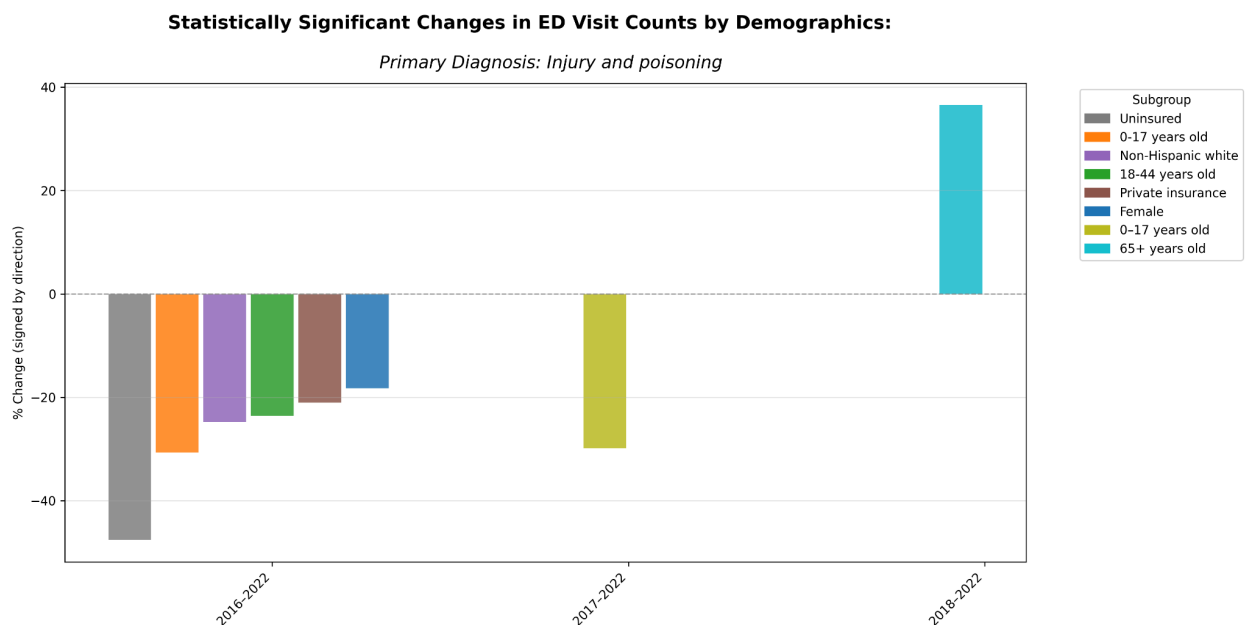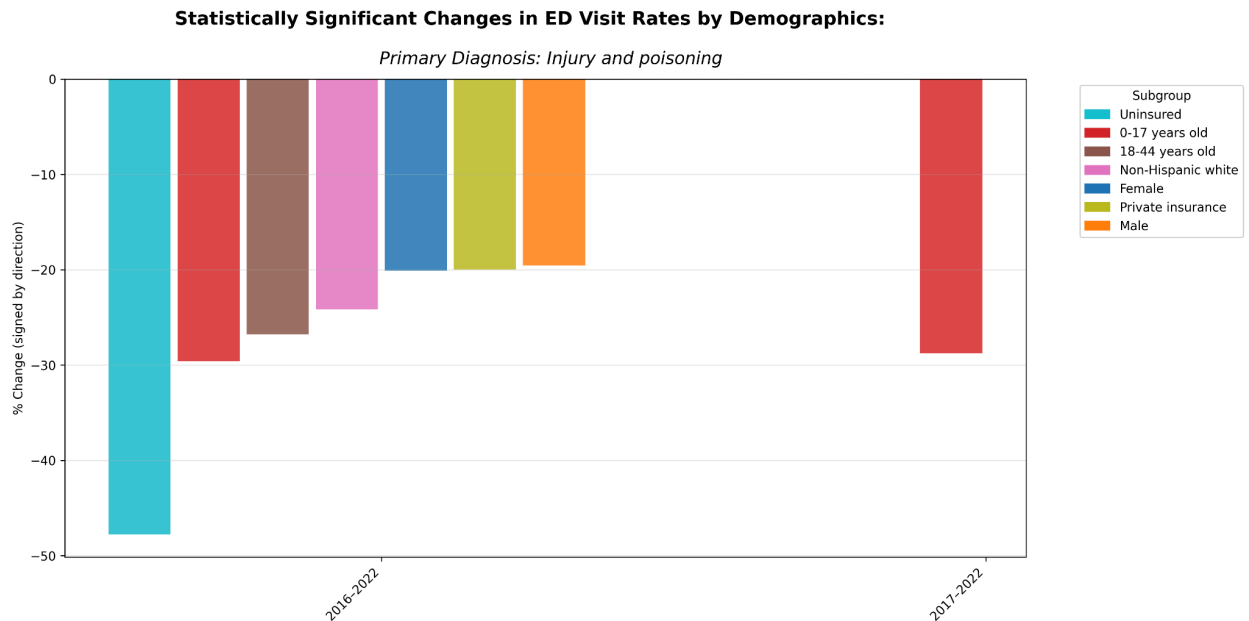*Reason for visit: Other symptoms/problems related to psychological*

Both primary diagnosis and reason-for-visit data consistently indicate an escalating mental and behavioral health crisis, with large and sustained increases in both counts and rates across diverse

demographic groups. These trends highlight the urgent need for targeted mental health interventions, especially for Hispanic populations, males, Medicaid beneficiaries, older adults, and residents of the Midwest region.

6.2.3. The Decline of Injury-Related Visits

- A noticeable decline in counts of injury-related cases was observed in 2016 across several subgroups:
    - The 0–17 age group experienced a 30.66% decrease
    - Uninsured patients showed the most substantial decline at 47.63%
    - The downward trend for the 0–17 age group continued into 2017, with a further 29.87% decrease
- Corresponding rates for "Injury and Poisoning" also reflected this decline in 2016 across many of the same groups:
    - Uninsured patients rates dropped by 47.75%
    - The 0–17 age group rates decreased by 29.59%
    - Adults aged 18–44 saw a 26.76% decline in rates
    - Non-Hispanic White individuals experienced a 24.15% decrease
    - Female patients rates fell by 20.11%
    - Those with private insurance saw a 19.96% decline
- In 2017, the 0–17 age group continued to show a decrease in rates by 28.79%, mirroring the trends seen in counts.

Statistically Significant Changes in ED Visit Counts by Demographics:

Primary Diagnosis: Injury and poisoning

Statistically Significant Changes in ED Visit Rates by Demographics:

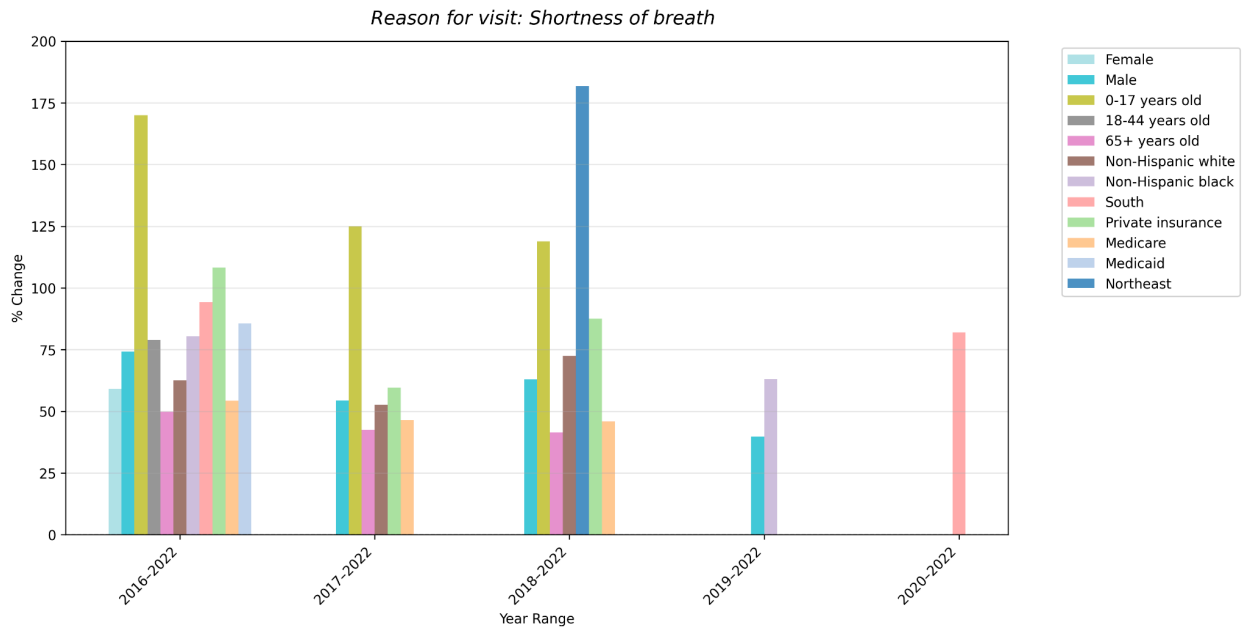*Primary Diagnosis: Injury and poisoning*

These parallel declines in both counts and rates across key demographic groups suggest a significant reduction in injury and poisoning cases during 2016 and 2017, particularly among younger individuals and uninsured populations.

6.3. Key Symptoms — Detailed Subgroup Findings

Shortness of Breath

- Age Group: Children 0–17 consistently showed the highest increase in counts with rises of 169.41% (2016), 120.97% (2017), and 117.71% (2018). Rates also increased notably, with 0–17 patients rising 43.72% (2016), 125% (2017), and 118.92% (2018). Seniors 65+ experienced steady increases in counts (76.23% in 2016) and rates (41.46% average from 2016-2018).
- Region: The Northeast had the largest surge in counts (187.16% in 2018) and rates (181.82% in 2018). The South region saw increases with counts rising 105.39% (2016). The West region demonstrated a steady increase during later years.
- Gender: Male patients had consistent increases in counts—81.31% (2016), 59.06% (2017), and 67.67% (2018)—with rates following a similar upward trend.
- Insurance: Counts for private insurance rose over 100% (104.29% in 2016), and Medicaid patients had similar growth (102.62% in 2016). Medicare patients also showed steady increases in both counts (79.9% in 2016) and rates.
- Ethnicity: Non-Hispanic Black patients had counts increase by 90.5% (2016) and rates by 80.45% (2016).

Statistically Significant Changes in ED Visit Rates by Demographics:

Reason for visit: Shortness of breath

Statistically Significant Changes in ED Visit Counts by Demographics:

Reason for visit: Shortness of breath
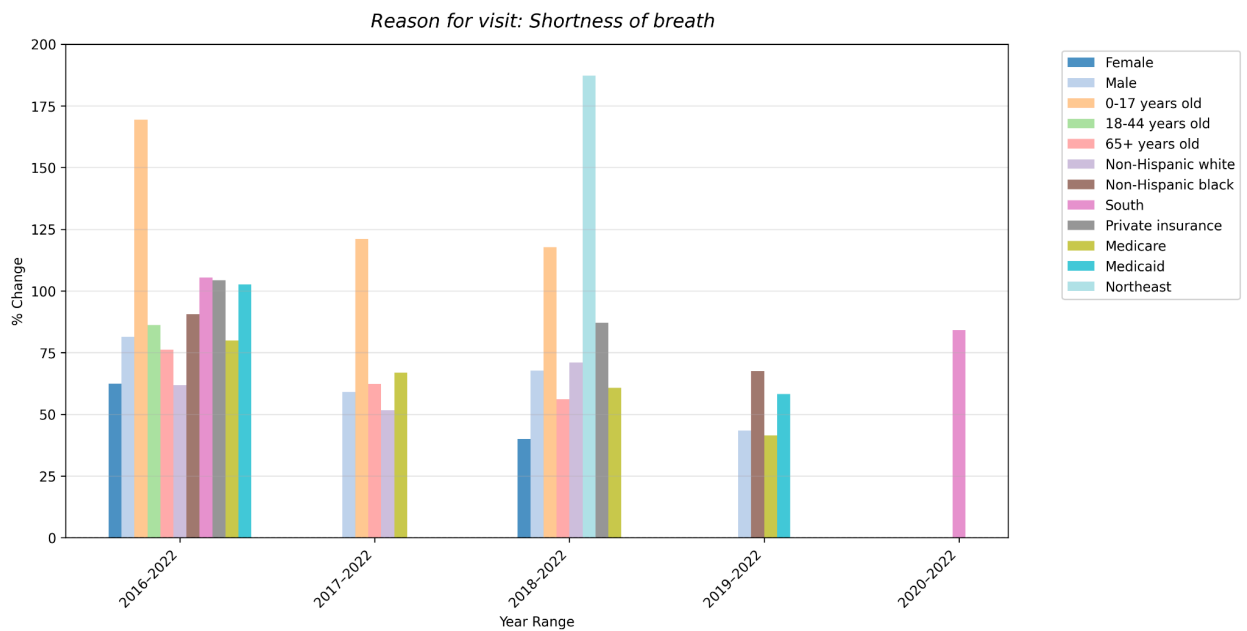

Cough

- Age Group: The 0–17 group saw a dramatic rise in counts (198.82% in 2020) and rates (200% in 2020). Conversely, 65+ showed a decline in rates by 43.94%.

- Region: The Northeast had high increases pre-pandemic (72.43% counts in 2016, 135.14% in 2017), while the West surged later with counts increasing 136.25% in 2021 and rates similarly high.
- Insurance: Counts and rates for private insurance holders increased substantially—counts by 55.32% in 2019 and 2020, rates by 55.32% (2020). Visits among Medicare patients declined in 2018 (rates 43.31% decrease).
- Gender: No major gender-specific spikes, but males showed modest increases in counts and rates.

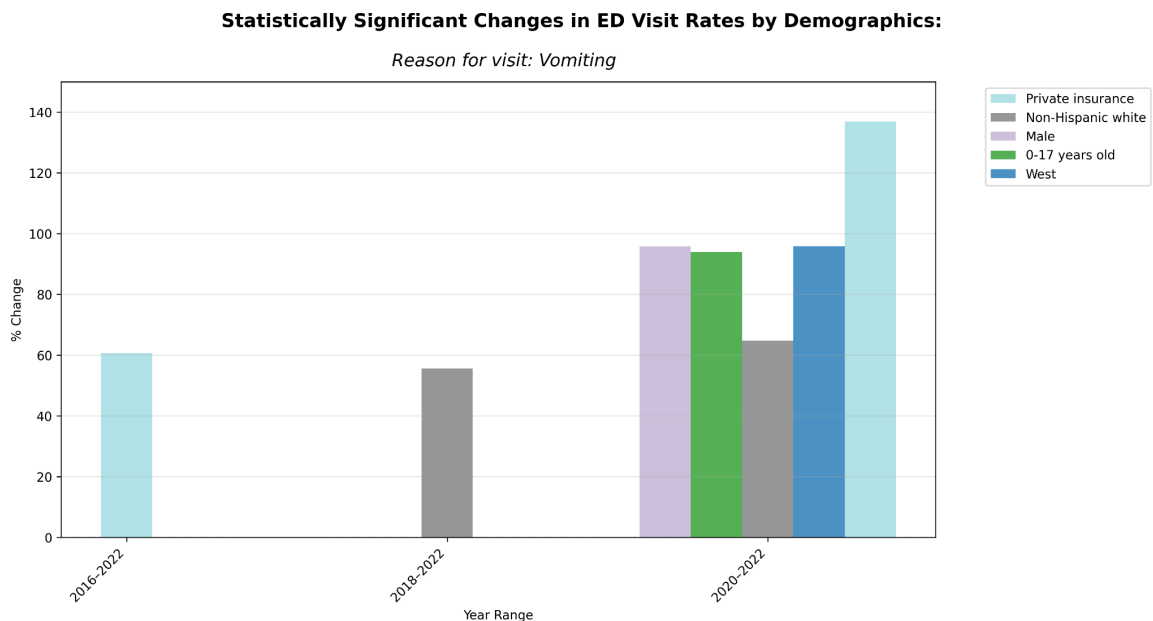**Statistically Significant Changes in ED Visit Counts by Demographics:**

Reason for visit: Cough

Statistically Significant Changes in ED Visit Rates by Demographics:
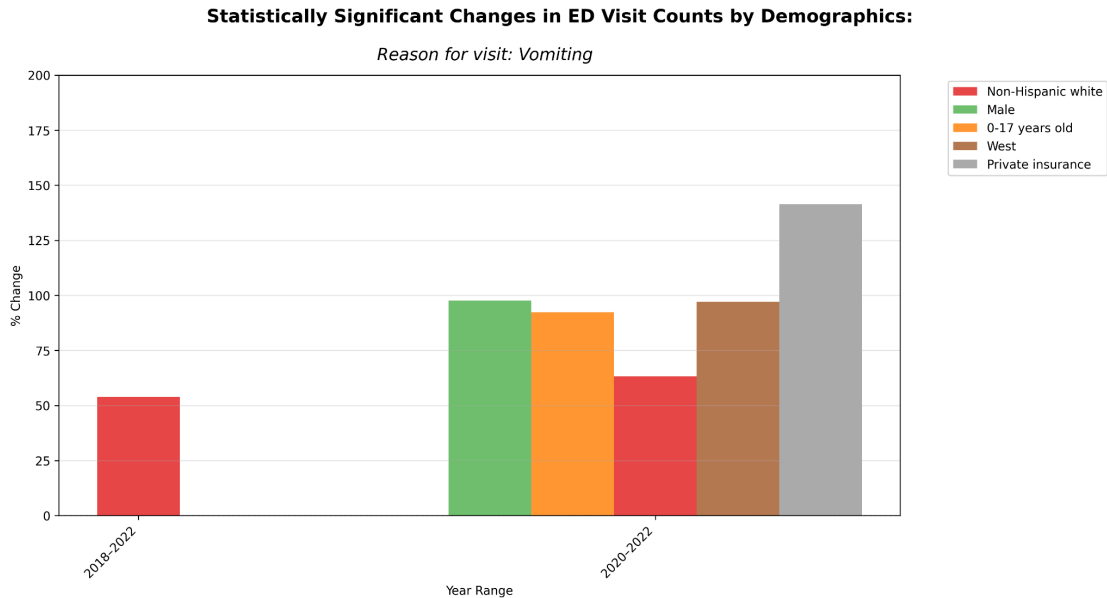
Reasons for visit: Cough
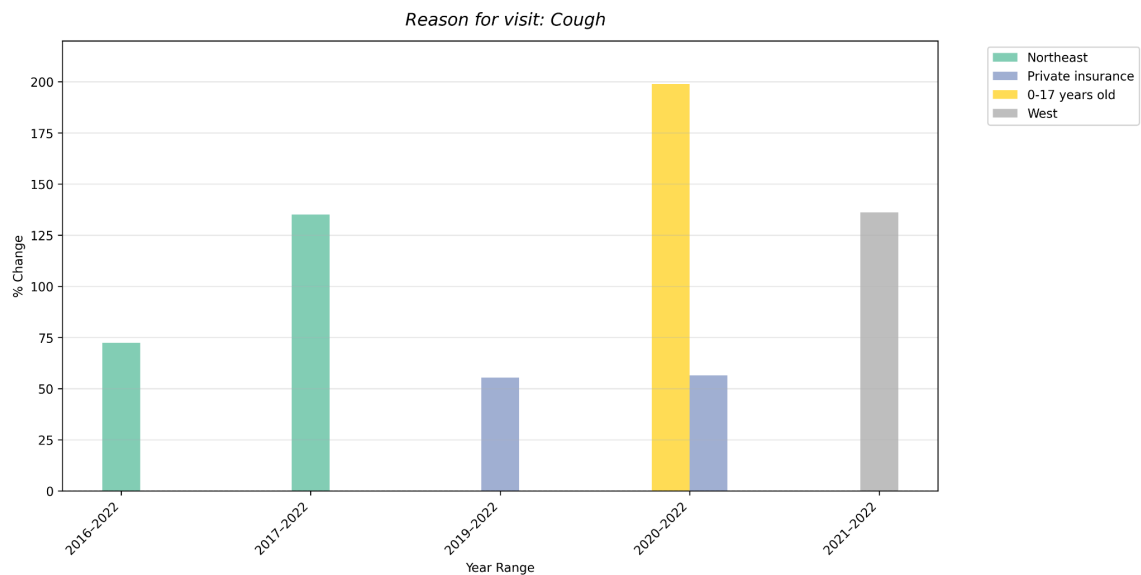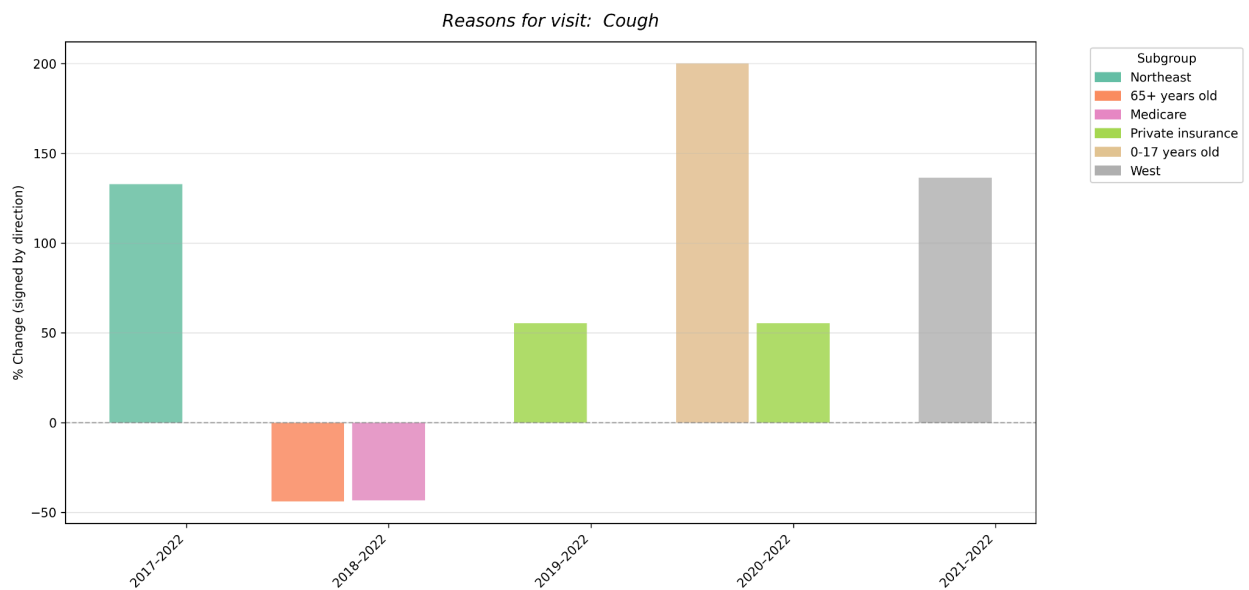
Vomiting

- Age Group: Counts rose sharply for 0–17 year-olds (92.43% in 2020), with rates showing similar increases (93.88%).
- Gender: Male patients showed strong increases in counts (97.65% in 2020) and rates (95.83%).
- Ethnicity: Non-Hispanic White patients' counts increased by 63.21% in 2020 and showed growth in 2018 as well.
- Region: The West region led increases with counts up 97.08% (2020) and rates similarly high (95.92%).
- Insurance: Visits among private insurance holders jumped sharply with counts up 141.32% (2020) and rates increasing 136.84% (2020). There was also a moderate increase in 2016 counts (60.71% rates).

Statistically Significant Changes in ED Visit Rates by Demographics:

Reason for visit: Vomiting

Statistically Significant Changes in ED Visit Counts by Demographics:

Reason for visit: Vomiting

The pandemic clearly had a **significant effect** on the increase in emergency department (ED) visits for several acute symptoms.

- **Respiratory symptoms** like **shortness of breath** and **cough** saw dramatic increases, particularly in 2020, aligning with the initial waves of COVID-19. These are hallmark symptoms of the virus and likely drove many people—especially children and unvaccinated populations—to seek emergency care.
- **Vomiting**, often associated with viral infections or post-viral syndromes, also rose notably, especially in children and privately insured patients. This may reflect gastrointestinal manifestations of COVID-19 or heightened parental concern during the pandemic.
- **Non-specific pain** increased among older adults, possibly due to limited access to routine care during lockdowns, delayed treatment for chronic conditions, or COVID-related complications.

The spike in these symptoms during 2020–2021 strongly suggests that the pandemic **both directly and indirectly** increased the volume of ED visits for these complaints—due to the virus itself, delayed outpatient care, and heightened health-seeking behavior.

6.4. A Deeper Look: The Narrative of Subgroups

While overall visit trends showed limited statistical significance, a deeper look at the data reveals distinct and impactful narratives among key subgroups. This analysis highlights several populations that were disproportionately affected by shifts in ED utilization and the health crises of this period.

- **Age-Based Trends**: Children (0–17) and older adults (65+) consistently experienced some of the most dramatic increases across a wide range of conditions. Children saw unprecedented surges in respiratory, gastrointestinal, and mental health-related visits, with a **200% increase in cough-related rates in 2020** alone. Meanwhile, older adults showed a sustained rise in visits for pain and psychological issues, which may be linked to pandemic-related care disruptions or an increase in chronic disease management needs.
- **Gender and Ethnicity**: Male patients consistently showed a significant increase in ED visits for both acute symptoms and mental/behavioral health disorders. This finding suggests a potentially overlooked area of vulnerability, with mental health visit rates rising by **35.53% in 2017** for this group. Similarly, while not as widespread, specific ethnic groups, including Non-Hispanic Black and Hispanic individuals, experienced sharp increases in mental health visits and other specific diagnoses.
- **Payer and Regional Differences**: The data also reveals a clear divide by insurance type and geography. Patients with Medicare and private insurance had some of the most substantial increases in visits for conditions like pain, vomiting, and respiratory issues. Regionally, the **Northeast** and **West** experienced the most dramatic spikes, especially for respiratory symptoms, with the Northeast seeing a **181.82% increase in shortness of breath rates in 2018**.

In essence, the data tells a story of uneven impact: certain populations bore the brunt of the health crises from 2016-2022. Understanding these subgroup-specific trends is critical for developing targeted public health strategies and ensuring equitable healthcare access in the future.

6.5 No Significant change: A Closer Look at Potential Disparities

The absence of statistically significant increases in emergency department visits among certain subgroups, such as female patients, Non-Hispanic Black individuals, Hispanic individuals, and other racial minorities, may not necessarily indicate stable healthcare utilization. Instead, this finding could point to **potential disparities in access**, **recognition, or treatment** within the emergency care system. Factors such as structural inequities, implicit bias, or cultural and economic barriers may have influenced care-seeking behavior or diagnosis patterns during the study period. Accordingly, these trends warrant deeper investigation to fully understand and address issues of equity in emergency healthcare delivery.

7.Conclusion and Recommendations

Conclusion:

The analysis of Emergency Department (ED) visits from 2016 to 2022 reveals a complex and shifting landscape of healthcare utilization, with 2018 standing out as the only year with a statistically significant difference in overall visit counts compared to the 2022 baseline. Beyond this single robust finding, the data highlights several consistent and impactful trends. The most prominent are the escalating crisis in **mental and behavioral health**, which showed large and sustained increases across many demographics, and a clear rise in acute symptom-related visits (e.g., respiratory, GI symptoms) during the pandemic years. These surges were not uniform; they disproportionately affected key subgroups, including **children (0–17 years old), Senior citizens (65+ years old), male patients, and individuals with private insurance**, suggesting these populations were uniquely vulnerable to the health challenges of this period. Additionally, the data points to a notable decline in injury-related visits and an anomaly in different categories which is a positive indication. These findings underscore the critical need for targeted public health interventions tailored to these high-risk populations, particularly in addressing the ongoing mental health crisis and preparing for future public health events and spreading awareness regarding this matter.

Recommendations:

Based on the analysis of emergency department utilization data from 2016 to 2022, several key recommendations emerge. First, the consistent and statistically significant rise in visits for individuals **65 years and older** and the escalating of **mental and behavioral health crisis** highlight the urgent need for targeted public health interventions. These trends warrant more detailed investigation to understand their underlying causes and to develop effective healthcare strategies and community support programs. Furthermore, future research should focus on studying the factors behind the surge regarding Payers categories with statistically significant rise to determine if similar regulations or support systems could be applied to other payer categories to manage and potentially improve healthcare access. Moreover, the disparities revealed in this analysis underscore the importance of leveraging data to inform policy and ensure equitable and effective healthcare delivery for all subgroups.

8. Disclaimer

This analysis is based on estimates of emergency department visits derived from the National Hospital Ambulatory Medical Care Survey (NHAMCS) data for the United States from 2016-2022. The conclusions drawn are subject to the following considerations:

- 2022 is used as a baseline, this does not mean that there is no significant change enter-years.
- Color encodings are chart-specific. Please refer to legends.
- Rates were originally reported per 1,000 population but were normalized to proportions (divided by 1,000) for comparative analysis.
- **Estimates from Sample Data:** All figures presented are estimates derived from a sample of hospitals and are not direct counts of the entire U.S. population. As such, they are subject to sampling variability.
- **Interpretation of Confidence Intervals:** Our interpretations of differences and trends rely on the analysis of 95% Confidence Intervals (CIs). Where a **95% Confidence Interval** indicates that if the survey were repeated many times, approximately 95% of the calculated intervals would contain the true population value.
- **Statistical Significance:**
  - When the 95% Confidence Intervals of two estimates **do not overlap**, the observed difference is considered **statistically significant**. This suggests that the difference is unlikely to be due to random chance and likely represents a real difference in the underlying population.
  - When the 95% Confidence Intervals **overlap**, the observed difference is **not considered statistically significant**. This means that, despite any numerical difference in the estimates, we cannot confidently conclude that a true difference exists in the underlying population; the observed variation may be due to random sampling.
- **Statistical vs. Practical Significance:** A statistically significant difference does not automatically imply a practically or clinically meaningful difference. The magnitude and context of the observed change should also be considered.
- **Data Reliability:** Only estimates marked as 'Yes' under the 'Reliable' column in the original dataset were included in this analysis. Estimates not meeting these reliability criteria were excluded due to high uncertainty.
- **Correlation vs. Causation:** This analysis describes patterns and associations within the data. It does not imply causation unless further rigorous investigation and contextual knowledge support such conclusions.