

## BRIEF REPORT

## General Medicine

# National trends in emergency conditions through the Omicron COVID-19 wave in commercial and Medicare Advantage enrollees

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## Abstract

**Objective:** To evaluate trends in emergency care sensitive conditions (ECSCs) from pre-COVID (March 2018–February 2020) through Omicron (December 2021–February 2022).

**Methods:** This cross-sectional analysis evaluated trends in ECSCs using claims (OptumLabs Data Warehouse) from commercial and Medicare Advantage enrollees. Emergency department (ED) visits for ECSCs (acute appendicitis, aortic aneurysm/dissection, cardiac arrest/severe arrhythmia, cerebral infarction, myocardial infarction, pulmonary embolism, opioid overdose, pre-eclampsia) were reported per 100,000 person months from March 2018 to February 2022 by pandemic wave. We calculated the percent change for each pandemic wave compared to the pre-pandemic period.

**Results:** There were 10,268,554 ED visits (March 2018–February 2022). The greatest increases in ECSCs were seen for pulmonary embolism, cardiac arrest/severe arrhythmia, myocardial infarction, and pre-eclampsia. For commercial enrollees, pulmonary embolism visit rates increased 22.7% (95% confidence interval [CI], 18.6%–26.9%) during Waves 2–3, 37.2% (95% CI, 29.1%–45.8%) during Delta, and 27.9% (95% CI,

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20.3%–36.1%) during Omicron, relative to pre-pandemic rates. Cardiac arrest/severe arrhythmia visit rates increased 4.0% (95% CI, 0.2%–8.0%) during Waves 2–3; myocardial infarction rates increased 4.9% (95% CI, 2.1%–7.8%) during Waves 2–3. Similar patterns were seen in Medicare Advantage enrollees. Pre-eclampsia visit rates among reproductive-age female enrollees increased 31.1% (95% CI, 20.9%–42.2%), 23.7% (95% CI, 7.5%–42.3%), and 34.7% (95% CI, 16.8%–55.2%) during Waves 2–3, Delta, and Omicron, respectively. ED visits for other ECSCs declined or exhibited smaller increases.

**Conclusions:** ED visit rates for acute cardiovascular conditions, pulmonary embolism and pre-eclampsia increased despite declines or stable rates for all-cause ED visits and ED visits for other conditions. Given the changing landscape of ECSCs, studies should identify drivers for these changes and interventions to mitigate them.

#### KEYWORDS

COVID-19, emergency care sensitive conditions, opioid use disorder, opioid overdose

## 1 | INTRODUCTION

### 1.1 | Background

Health care utilization patterns in the United States shifted abruptly early in the COVID-19 pandemic, with access barriers to in-person outpatient care and declining emergency department (ED) visits.<sup>1,2</sup> Delayed or deferred management of chronic conditions, coupled with post-acute sequelae of SARS-CoV-2 infection (Long COVID), may increase population-level risk for acute cardiovascular disease and other serious pathologies. Evolving social stressors and health care access disruptions may complicate the management of chronic conditions, including substance use disorders.<sup>3</sup>

### 1.2 | Importance

The consequences of COVID-19 disruptions have been considerable. Excess mortality, beyond that directly attributable to acute COVID-19 infection, has been estimated at 24% or a total of 260,000 deaths through February 2022.<sup>4</sup> Emergency care sensitive conditions (ECSCs) are those for which timely access to high-quality emergency care is essential to mitigate morbidity and mortality. A key component of health system readiness to adapt to changes in ECSCs volume now and in future pandemics and other disasters is to optimally manage these conditions, and their risk factors, despite inevitable disruptions in health care delivery.<sup>5</sup> Knowledge of how population rates of such ECSCs seen in the ED have changed throughout the COVID-19 pandemic is limited.

### 1.3 | Goals of this investigation

To characterize national trends in the population rates for ED visits for ECSCs from the pre-COVID period through the Omicron wave of the COVID-19 pandemic.

## 2 | MATERIALS AND METHODS

### 2.1 | Study design and setting

We conducted a cross-sectional analysis of ED visits from the Optum-Labs Data Warehouse (OLDW),<sup>6,7</sup> a longitudinal, real-world data asset containing de-identified medical and pharmacy claims as well as enrollment data from commercial and Medicare Advantage enrollees. OLDW contains longitudinal health information on enrollees, representing a diverse mixture of ages, ethnicities, and geographical regions across the United States with the greatest representation consisting of Midwestern and Southern states. Characteristics of commercial and Medicare Advantage beneficiaries in the OLDW have been shown to mirror the commercial and Medicare Advantage populations in the United States across age, race/ethnicity, and sex (see Table SA1 in the supporting information technical appendix).

### 2.2 | Outcomes

We identified ED visits for select ECSCs among adults 18+ years of age (female enrollees 15–49 years old for pre-eclampsia). We calculated rates of visits for these conditions per 100,000 person-months of insurance enrollment over the period from March 2018–February 2022, including the pre-pandemic period (March 2018–February 2020), early pandemic period (March 2020–October 2020), COVID-19 waves 2–3 (November 2020–August 2021), Delta (September 2021–November 2021), and Omicron (December 2021–February 2022). The included conditions were acute appendicitis, aortic aneurysm/dissection, cardiac arrest/severe arrhythmia, cerebral infarction, myocardial infarction, pulmonary embolism, opioid overdose, and pre-eclampsia. The ICD-10 codes to identify these conditions were drawn from a previously developed taxonomy for ECSCs<sup>8</sup> with minor revisions (see Table SA2 in the supporting information technical appendix).

**The Bottom Line**

In this cross-sectional analysis of 21,318,612 all-cause emergency department visits from privately insured enrollees, during several waves of the COVID-19 pandemic following the early pandemic period, acute cardiovascular- and pre-eclampsia condition-visits increased, whereas other conditions, such as opioid-related overdose visits declined. Given the changing landscape of emergency care sensitive conditions, future research should identify drivers for these changes and interventions to mitigate them.

ture describing shifting acute care utilization during COVID-19. First, we define the early pandemic period from March 2020 to October 2020, corresponding to steep declines in ED visit rates as documented in multiple sources,<sup>9,10</sup> and before the rebound in visits<sup>11</sup> in October and November. We then report the subsequent 2nd and 3rd waves of infection, during and immediately following early mass vaccinations, from November 2020 to August 2021. Finally, we report the Delta (September to November 2021) and Omicron waves (December 2021 to February 2022), where COVID-19 case counts rose precipitously and out of proportion to prior waves as well.<sup>12</sup> Analyses were conducted with Stata 17.0.

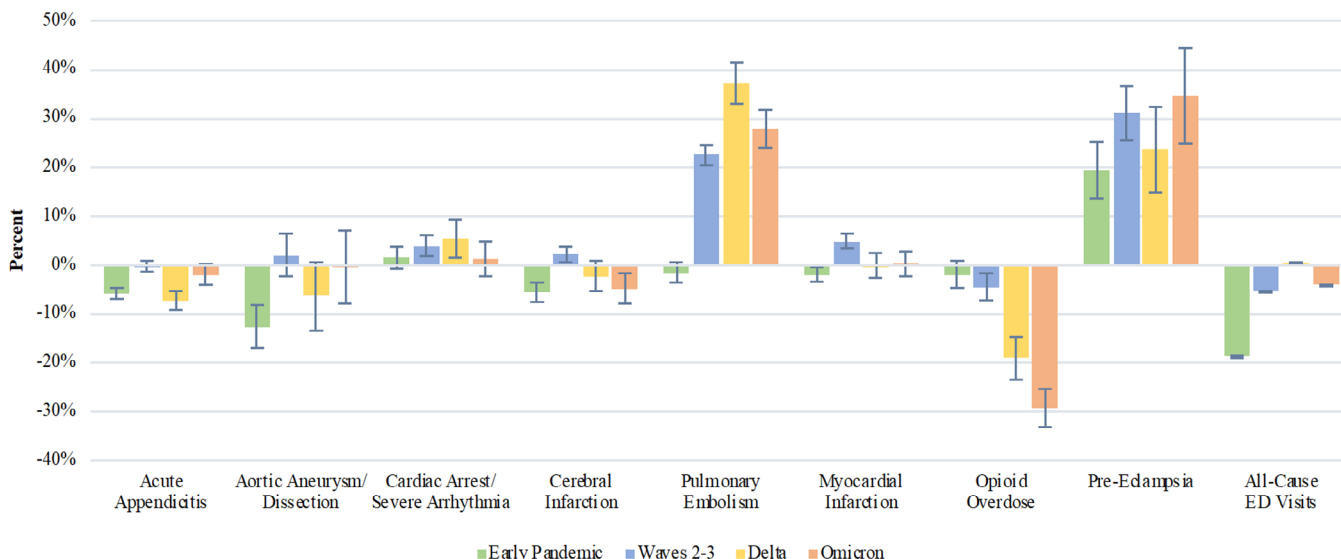
**3 | RESULTS**

**2.3 | Analysis**

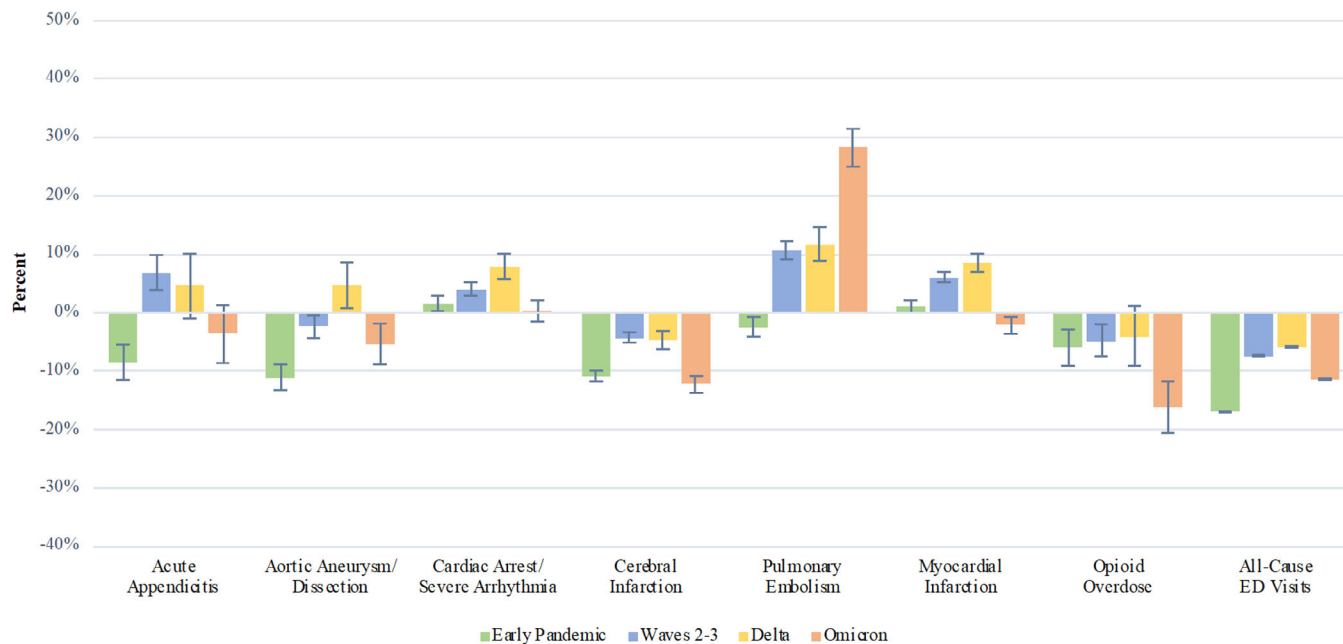
Monthly rates of ED visits for ECSCs per 100,000 persons months for each study period were reported for commercial and Medicare Advantage enrollees separately (because the 2 populations may have different health care utilization patterns). We reported all-cause and COVID-19-specific ED visits per 100 and 1000 person months for commercial enrollees and 1000 and 10,000 person months for Medicare Advantage enrollees. To account for seasonal differences in ED visit rates, Poisson regression models were used to calculate percent changes in ED visit rates for each pandemic period compared to rates during the corresponding months during the pre-pandemic period (March 2018–October 2018, November 2018–August 2019, September 2019–November 2019, and December 2019–February 2020, respectively). We chose time periods for descriptive reporting based on relevant underlying epidemiological factors in existing litera-

The study sample included 10,911,984 enrollees (7,328,875 commercial; 3,583,109 Medicare Advantage) between March 2018 and February 2022, comprising 819,189,561 person months (607,171,899 commercial; 212,017,662 Medicare Advantage) and 21,318,612 ED visits (10,268,554 commercial; 11,050,058 Medicare Advantage).

Percent changes for all-cause and condition-specific ED visits for each pandemic period compared to the corresponding months in the pre-pandemic period for commercial and Medicare Advantage enrollees are shown in Figures 1 and 2; absolute rates for each period are provided in Table 1 and for each month for Figures 3 and 4; details with Poisson model estimates, as well as all-cause ED visits and person months of enrollment are displayed in the supporting information technical appendix (Table SA3-4). ED visits for all conditions, except pre-eclampsia, declined or did not increase during the early pandemic period for both commercial and Medicare Advantage enrollees.



**FIGURE 1** Percent change in acute care sensitive condition and all-cause emergency department visits in commercial enrollees during the COVID-19 pandemic compared to pre-pandemic \*\*Bars are percent change during the pandemic period (Early Pandemic, Waves 2–3, Delta, Omicron) compared to the months during the corresponding pre-pandemic period. Capped lines are 95% confidence intervals. Lines that do not cross 0 indicate statistical significance.



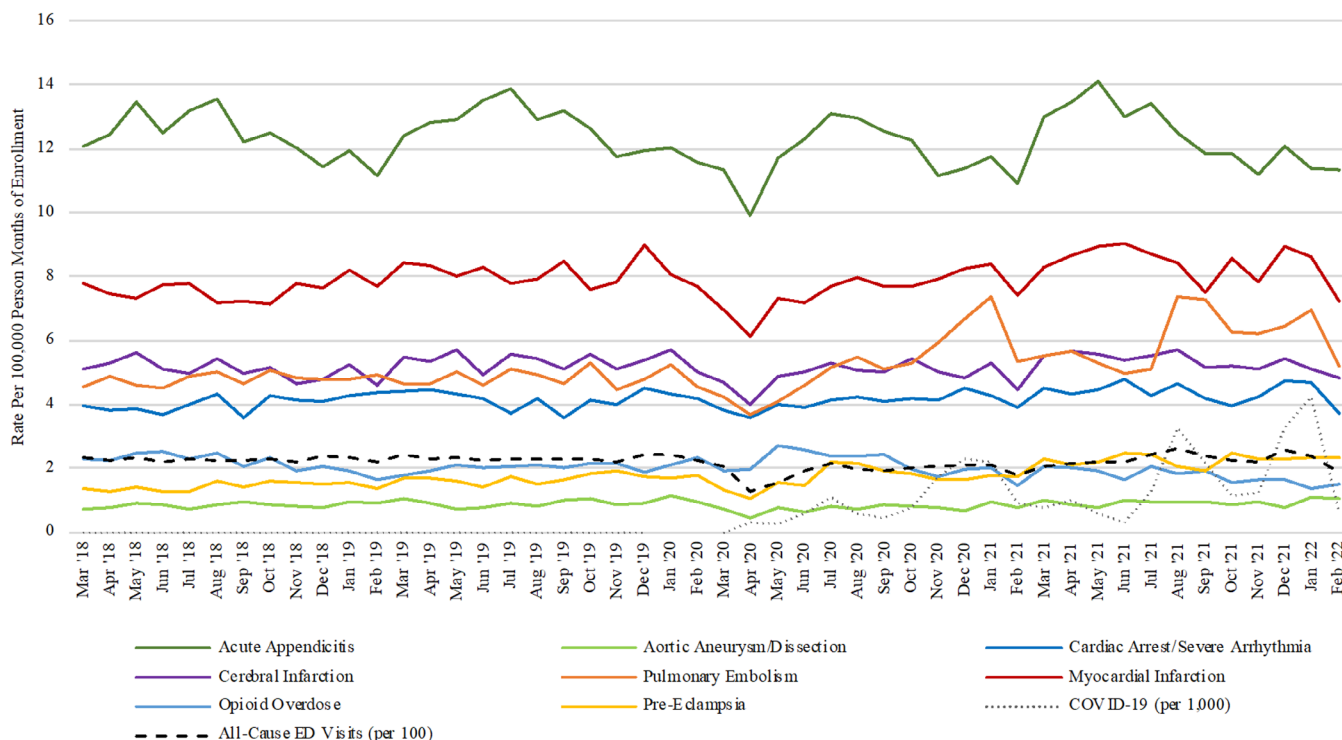
**FIGURE 2** Percent change in acute care sensitive condition and all-cause emergency department visits in Medicare Advantage enrollees During the COVID-19 pandemic compared to pre-pandemic \*\*Bars are percent change during the pandemic period (Early Pandemic, Waves 2–3, Delta, Omicron) compared to the months during the corresponding pre-pandemic period. Capped lines are 95% confidence intervals. Lines that do not cross 0 indicate statistical significance.

**TABLE 1** Rate of acute care sensitive condition and COVID-19 emergency department visits per 100,000 person months for pre-pandemic and pandemic periods.

Rate of visits per 100,000 person months									
	Acute appendicitis	Aortic aneurysm /dissection	Cardiac arrest/severe arrhythmia	Cerebral infarction	Pulmonary embolism	Myocardial infarction	Opioid overdoses	Pre- eclampsia <sup>a</sup>	COVID-19
<b>Commercial</b>									
Period									
Pre-pandemic 1	12.7	0.8	3.9	5.2	4.8	7.5	2.3	1.4	N/A
Pre-pandemic 2	12.5	0.9	4.2	5.2	4.8	8.0	2.0	1.6	N/A
Pre-pandemic 3	12.5	1.0	3.9	5.3	4.8	8.0	2.1	1.8	N/A
Pre-pandemic 4	11.8	1.0	4.3	5.4	4.9	8.3	2.1	1.7	N/A
Early pandemic	12.0	0.7	4.0	4.9	4.7	7.3	2.3	1.7	39.3
Waves 2–3	12.5	0.9	4.4	5.3	5.9	8.4	1.9	2.0	112.2
Delta	11.6	0.9	4.1	5.1	6.6	8.0	1.7	2.2	114.1
Omicron	11.6	1.0	4.4	5.1	6.2	8.3	1.5	2.3	238.9
<b>Medicare Advantage</b>									
Period									
Pre-pandemic 1	5.5	9.8	33.0	56.5	19.5	55.3	5.7	N/A	N/A
Pre-pandemic 2	5.2	10.6	35.2	57.4	20.9	59.4	5.5	N/A	N/A
Pre-pandemic 3	4.9	10.2	33.0	55.6	21.1	59.6	5.4	N/A	N/A
Pre-pandemic 4	5.3	10.5	37.8	57.4	19.7	65.9	5.4	N/A	N/A
Early pandemic	5.1	8.8	33.6	50.3	19.0	55.9	5.4	N/A	112.1
Waves 2–3	5.6	10.4	36.6	54.9	23.1	63.1	5.2	N/A	277.6
Delta	5.1	10.7	35.7	53.0	23.6	64.7	5.2	N/A	266.4
Omicron	5.1	9.9	37.9	50.4	25.2	64.5	4.6	N/A	504.5

<sup>a</sup>Per 100,000 person months of reproductive age.

Abbreviations: N/A, not applicable.



**FIGURE 3** Monthly rates of acute care sensitive condition emergency department visits per 100,000 person months of enrollment in commercial enrollees before and during the COVID-19 pandemic \*\*All-cause ED visits are reported per 100 person months; COVID-19 ED visits are reported per 1,000 person months; COVID-19 ED visit rates are not shown for January–February 2020 due to having case counts <11.

For commercial enrollees, compared to pre-pandemic, pulmonary embolism visit rates increased 22.7% (95% confidence interval [CI], 18.6%–26.9%) during Waves 2–3, 37.2% (95% CI, 29.1%–45.8%) during Delta, and 27.9% (95% CI, 20.3%–36.1%) during Omicron. Cardiac arrest/severe arrhythmia visit rates increased 4.0% (95% CI, 0.2%–8.0%) during Waves 2–3; myocardial infarction rates increased 4.9% (95% CI, 2.1%–7.8%) during Waves 2–3. Pre-eclampsia visit rates among reproductive-age female enrollees increased 31.1% (95% CI, 20.9%–42.2%) during Waves 2–3, 23.7% (95% CI, 7.5%–42.3%) during Delta, and 34.7% (95% CI, 16.8%–55.2%) during Omicron. In contrast to these increases, visit rates for opioid overdoses declined, with the largest decline during Omicron, –29.3% (95% CI, –36.6% to –21.1%). ED visit rates for other ECSCs declined (ie, acute appendicitis) or fluctuated (ie, aortic aneurysm/dissection, cerebral infarction) after the early pandemic.

ED visits for Medicare Advantage enrollees followed a similar pattern to commercial enrollee visits for most conditions. The largest growth compared to pre-pandemic was observed in pulmonary embolism- and myocardial infarction-associated ED visit rates, with respective increases of 10.6% (95% CI, 7.5%–13.8%) and 6.1% (95% CI, 4.3%–7.9%) during Waves 2–3 and 11.8% (95% CI, 6.3%–17.5%) and 8.6% (95% CI, 5.4%–11.9%) during Delta. From pre-pandemic to Omicron, ED visit rates for pulmonary embolism also increased by 28.3% (95% CI, 22.1%–34.8%). Compared to pre-pandemic, ED visit rates for opioid overdoses and cerebral infarction declined, whereas ED visit rates for acute appendicitis, aortic aneurysm/dissection, and cardiac

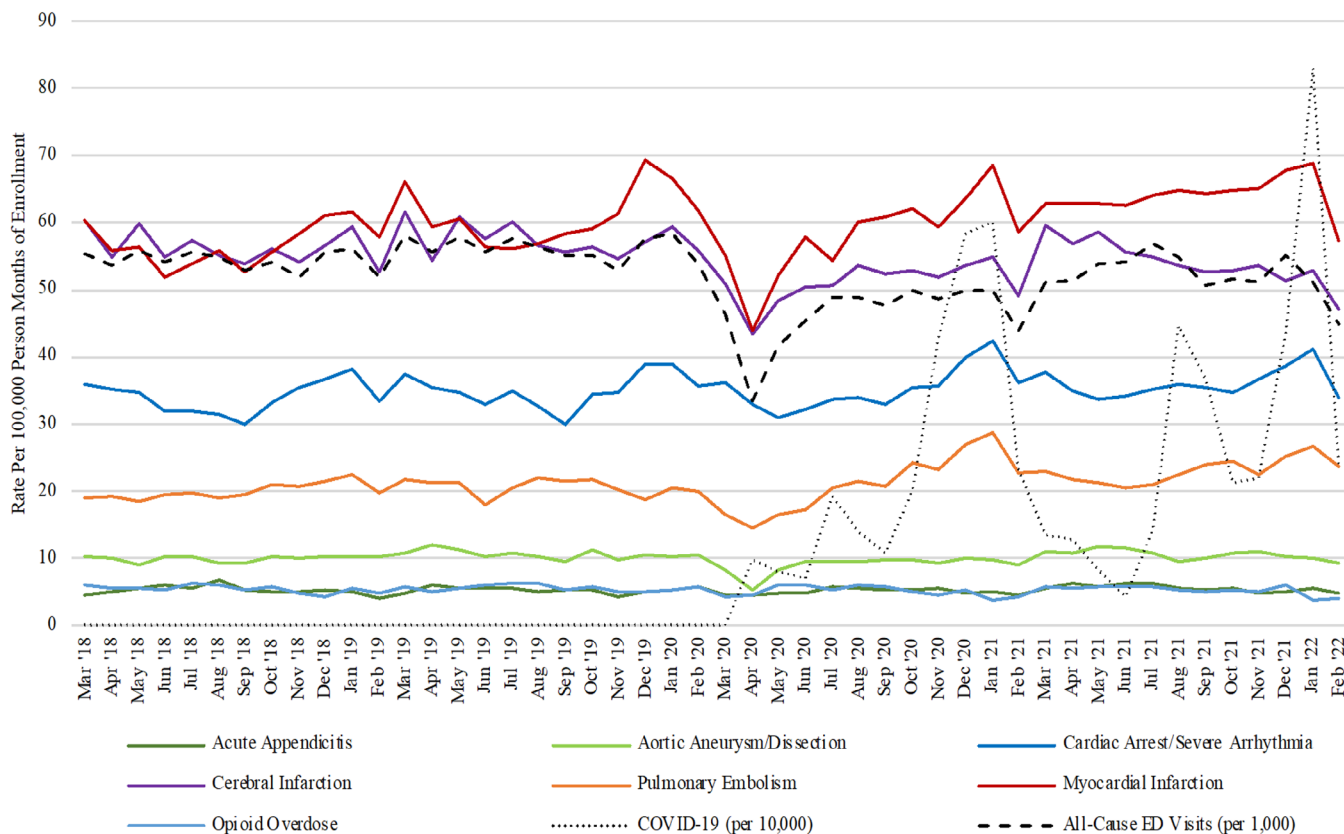
arrest/severe arrhythmia fluctuated, returning to pre-pandemic levels by Omicron.

#### 4 | LIMITATIONS

This analysis has limitations inherent to the use of administrative claims data. First, we were unable to directly assess clinical severity of ED presentations. Second, it is possible that some changes in ED visit rates may be related to shifting thresholds for diagnostic testing which could, in turn, under- or overestimate true population risk. Third, there may have been changes in the enrollee populations related to the pandemic (eg, due to job losses or changes). Finally, the results from this study may have limited generalizability outside of people with commercial or Medicare Advantage health insurance, such as people without health insurance or those with Medicaid.

#### 5 | DISCUSSION

Our primary finding was that ED visit rates for acute cardiovascular- and pre-eclampsia-associated ED visits had a sustained increase during multiple COVID-19 waves following the early pandemic period despite minimal change or declines in ED visits for other conditions. Pulmonary embolism and pre-eclampsia-associated ED visits continued to increase through Omicron. Cardiovascular conditions including



**FIGURE 4** Monthly rates of acute care sensitive condition emergency department visits per 100,000 person months of enrollment in Medicare Advantage enrollees before and during the COVID-19 pandemic. \*\*All-cause ED visits are reported per 1,000 person months; COVID-19 ED visits are reported per 10,000 person months.

pulmonary embolism are known to be associated with COVID-19 infection;<sup>13</sup> a recent study of hospital births found increases in maternal morbidity, including pre-eclampsia, during the pandemic.<sup>14</sup> Possible drivers of these changes could include the direct contribution of COVID-19 infection, either its acute phase or chronic sequelae, reduced care-seeking or access to screening and preventive care leading to worsening clinical condition (eg, undetected proteinuria early in pregnancy), and reduced ED and hospital capacity leading to delays in care for acute conditions.

Another important finding was that opioid overdose ED visits decreased for all but one of the pandemic periods for commercial and Medicare Advantage enrollees. These declines are consistent with national data from the Centers for Disease Control and Prevention (CDC) which showed an 18% decrease in nonfatal overdose ED visits from 2020 to 2021,<sup>15</sup> and may signal that more people are dying from an opioid-related overdose before making it to the ED,<sup>16</sup> and an urgent need for clinical and policy efforts that expand access to first-line medications and harm reduction interventions. Further research is needed to understand the discrepancy between increasing fatal opioid overdoses and decreasing opioid overdose ED visits.

Rates of ED visits for ECSCs exhibited declines or minimal changes for most conditions during the early pandemic, when delayed and deferred care was most common. Cerebral infarction-associated ED visit rates also declined during the later COVID-19 pandemic waves for Medicare Advantage enrollees. These decreases may be due, in part,

to delayed care seeking because of underlying perceptual, social, and behavioral factors.<sup>17</sup> For acute appendicitis, ED visit rates decreased during Delta for commercial enrollees, but increased for Medicare Advantage enrollees during Waves 2–3. It is plausible that there were more self-limited cases of appendicitis in commercial enrollees that never presented to the ED, whereas there were more complicated cases in Medicare Advantage (aged or disabled) enrollees, as the latter population is at greater risk of complications from acute appendicitis given their greater medical complexity. A cross-sectional analysis of 745 patients at a single site supports this hypothesis, demonstrating increased admissions for perforated appendicitis and decreased admissions for uncomplicated appendicitis during the earlier waves of the COVID-19 pandemic.<sup>18</sup>

Future research is needed to evaluate the drivers of the changes in these rates, including the relative contributions of COVID-19 infection and its sequelae versus social and health care disruptions and the persistence of these changes in different populations. If changes in rates of acute cardiovascular conditions reflect the chronic sequelae of COVID infection, clinical investigation into potential mitigators of this risk would be warranted. Insofar as COVID-19 morbidity has been disproportionately experienced by minoritized communities,<sup>19</sup> the clinical management of COVID sequelae may be particularly relevant to health equity.

If changes for acute cardiovascular conditions are found to be a transient effect of health care system disruptions related to care-seeking

changes or policy responses, there are further implications to consider. Future health policy work should isolate and characterize health care disruptions most likely to result in downstream harm. Some outpatient clinical services may be safely deferred whereas others not. Understanding the ways in which health care services can mitigate pandemic spread and meet pandemic demand for care is essential given the likelihood of future pandemics and other disasters.

## AUTHOR CONTRIBUTIONS

MAS, ERM, MMJ, and ATJ conceived the study. MAS performed the analyses. MAS and ATJ drafted the manuscript and all authors contributed substantively to its revision.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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