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RESEARCH LETTER

Changes in Emergency Department Arrival Times for Acute Myocardial Infarction During the COVID-19 Pandemic Suggest Delays in Care Seeking

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COVID-19 caused a shift in acute care utilization, reflected by a sharp decline in overall emergency department (ED) visits beginning March 2020, including for time-sensitive conditions such as acute myocardial infarction (AMI).[1] AMI presentation has been noted to follow a characteristic circadian pattern, peaking between 8 and 11 AM.[2] We tested the hypothesis that changes in care-seeking behavior would be observed during the COVID-19 pandemic as a later peak ED arrival time for AMI.

We performed an exploratory observational analysis of community EDs from the American College of Emergency Physicians' Clinical Emergency Data Registry in 2019 and 2020. We characterized sites in the sample by visit volume, US Census Region location, and urban-rural classification. ED visits for AMI were defined using the Clinical Classification Software Revised category CIR009. We applied a simple segmented linear regression for AMI visit counts and time to identify 5 different time periods during the pandemic in which to describe arrivals. To do so, we modeled number of AMI visits against date in 2020 in a segmented linear regression. We fit break points in the model that best describe discontinuities in the linear trend of the outcome variable. This identified the period from March 6 to March 25, early in the pandemic, where AMI visits declined relative to their 2019 baseline. The outcome was AMI arrival time, defined by the standardized electronic health record date/time stamp reflecting the first evidence of ED patient triage or registration. We plotted quarter-hour arrivals, as proportion of daily arrivals, with overlaid nonparametric smoothed curves generated with a locally weighted scatterplot smoothing (bandwidth, 0.26) method, as well as the hourly percentage difference in proportion of arrivals. Approval for this exploratory observation analysis was obtained from the Institutional Review Board at the Yale University, and no informed consent was required. The analysis was performed using R, version 4.0.2 (R Foundation), and program scripts are available on request.

The sample included 170 EDs in 31 states, with a median ED visit volume of 32 516 (interquartile range, 19 029–50 446). Sites were well represented across census regions, with 54 (31.2%) in the West, 48 (28.2%) in the South, 28 (16.5%) in the Midwest, and 20 (11.8%) in the Northeast, with the remainder in Alaska and Hawaii. Forty-five sites (26.4%) were in rural areas. There were 68 484 ED visits for AMI in the sample across 2019 and 2020. The nadir in daily AMI visit counts took place on March 25, 2020, with 61 visits for AMI compared with 92 average daily visits in 2019.

Peak visit arrivals for AMI were from 12:30 to 12:45 PM in the first period, from January 1, 2020, to March 5, 2020, similar to 2019. In the period from March 6, 2020, to March 25, 2020, peak visit time shifted to 3:45 to 4:00 PM (Figure), 3 hours later in the day. Although peak visit time shifted back to the 2019 baseline in the following 3 periods, a greater proportion of visits occurred later in the day, especially 11:00 AM to 7:00 PM, from March 26,

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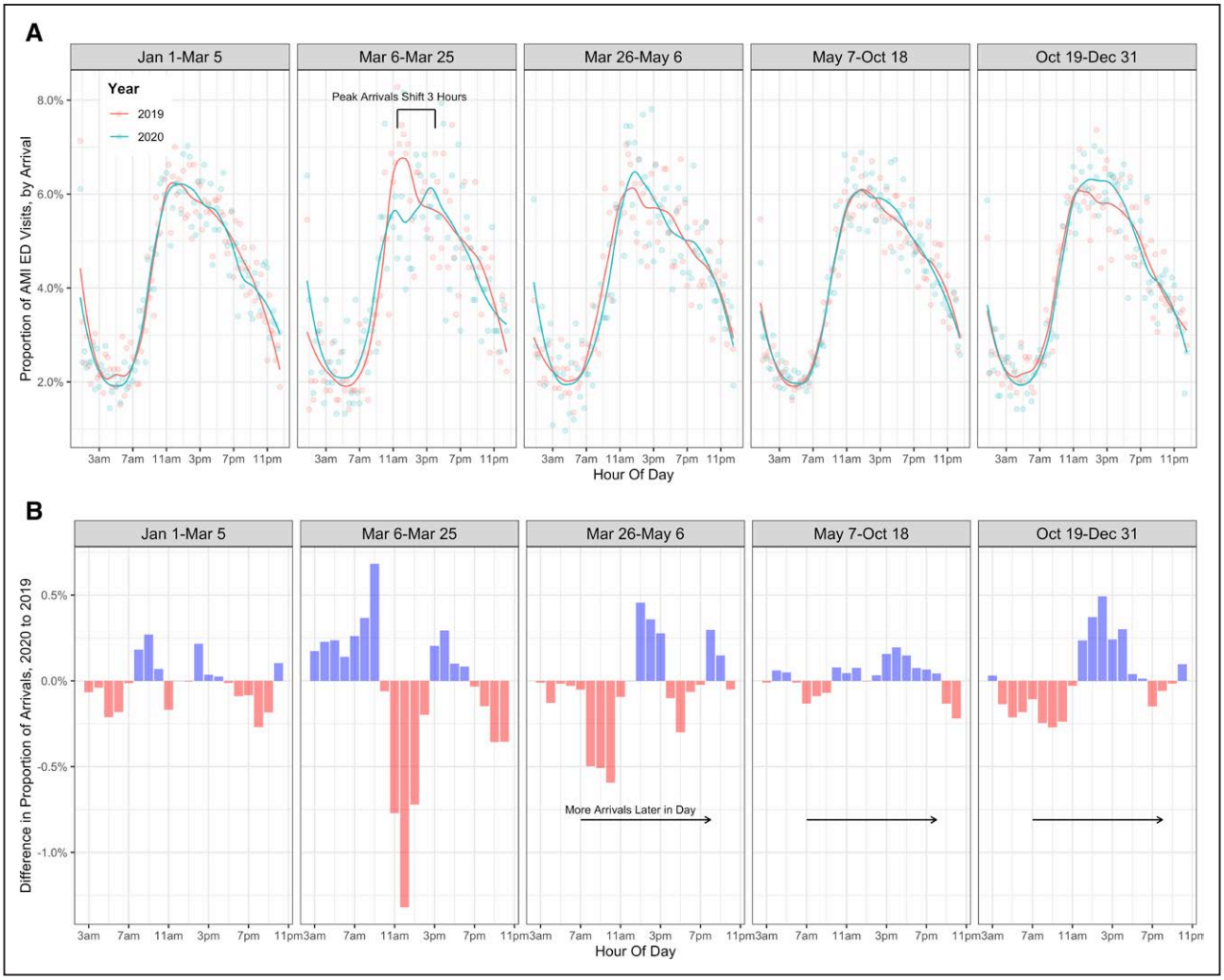

Figure. Arrival times for acute myocardial infarction (AMI), 2020 vs 2019.
A, Distribution of visits by hourly arrival. **B**, Percent different in proportion hourly arrival. Proportion of daily visits by their hour of arrival for AMI. Sample includes 170 sites across 31 states in the Clinical Emergency Data Registry. ED indicates emergency department.

2020, through December 31, 2020, as compared with 2019 (Figure).

Compared with 2019, peak ED arrival time for AMI shifted 3 hours later in the day early in the pandemic. This occurred as pandemic media attention was growing and the first stay-at-home orders took place, as well as when the first large declines in ED visits nationwide were observed.[1] Arrivals shifted later in the day in subsequent periods. One potential explanation for these findings is delays in seeking emergency care. In the context of AMI, these differences have consequences on time to definitive treatment.[3] Delays may also result in more severe presentations—a potential contributor to excess mortality during COVID-19.[4] In addition to encouraging patients to seek care early, emergency services availability should match patterns of arrivals (eg, percutaneous coronary intervention). While there may be delayed care-seeking, alternative explanations for our findings include underlying differences in epidemiology from changes in sleep-wake patterns or incident stressors related to AMI. Our study is limited by comparison to a single year baseline, which introduces the possibility that the baseline itself is an outlier.[5] We also do not have information on the underlying prevalence of coronary artery disease or its geographic variation, which may be an important driver of arrival times for AMI. Without time of symptom onset, what we interpret as modest within-day delay may be an underestimate if patients are waiting excess of a day to seek care. Individual site or regional-level characterization of changed care-seeking behaviors is limited by the tremendous heterogeneity across time and space in COVID-19 outbreak, the occurrence of difference phenomena such as stay-at-home orders, local fear regarding COVID-19, and other policies not uniform across sites. Lastly, this work does not include a clinical outcome. Future AMI evaluations should consider evolving arrival patterns to further understand risk factors for delays in care-seeking. In summary, this analysis provides the first demonstration that the COVID-19 pandemic has resulted

in observable daily changes in emergency care-seeking for AMIs nationally.

ARTICLE INFORMATION

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Disclosures

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