

CLINICAL INVESTIGATION

# Emergency department visits for emergent conditions among older adults during the COVID-19 pandemic

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## Funding information

Centers for Medicare and Medicaid  
Services, Grant/Award Number: HHSM-  
500-2013-13018I-T0001 Modification  
000002; National Academy of Medicine;  
National Center for Advancing  
Translational Sciences, Grant/Award  
Number: KL2TR001862; National Institute  
on Aging, Grant/Award Number:  
T32AG1934; NIH Clinical Center, Grant/  
Award Numbers: R33AG058926,  
R61AG069822; Gary and Mary West  
Health Institute; John A. Hartford  
Foundation

## Abstract

**Background/objective:** Emergency department (ED) visits have declined while excess mortality, not attributable to COVID-19, has grown. It is not known whether older adults are accessing emergency care differently from their younger counterparts. Our objective was to determine patterns of ED visit counts for emergent conditions during the COVID-19 pandemic for older adults.

**Design:** Retrospective, observational study.

**Setting:** Observational analysis of ED sites enrolled in a national clinical quality registry.

**Participants:** One hundred and sixty-four ED sites in 33 states from January 1, 2019 to November 15, 2020.

**Main outcome and measures:** We measured daily ED visit counts for acute myocardial infarction (AMI), stroke, sepsis, fall, and hip fracture, as well as deaths in the ED, by age categories. We estimated Poisson regression models comparing early and post-early pandemic periods (defined by the Centers for Disease Control and Prevention) to the pre-pandemic period. We report incident rate ratios to summarize changes in visit incidence.

**Results:** For AMI, stroke, and sepsis, the older (75–84) and oldest old (85+ years) had the greatest decline in visit counts initially and the smallest recovery in the post-early pandemic periods. For falls, visits declined early and partially

Alexander T. Janke and Snigdha Jain are co-first authors and contributed equally to this study.

Part of the results of this paper has been submitted as an abstract to American Geriatrics Society Conference 2021 and Society for Academic Emergency Medicine Conference 2021.

recovered uniformly across age categories. In contrast, hip fractures exhibited less change in visit rates across time periods. Deaths in the ED increased during the early pandemic period, but then fell and were persistently lower than baseline, especially for the older (75–84) and oldest old (85+ years).

**Conclusions:** The decline in ED visits for emergent conditions among older adults has been more pronounced and persistent than for younger patients, with fewer deaths in the ED. This is concerning given the greater prevalence and risk of poor outcomes for emergent conditions in this age group that are amenable to time-sensitive ED diagnosis and treatment, and may in part explain excess mortality during the COVID-19 era among older adults.

#### KEYWORDS

ED visits, emergency care, older adults, care-seeking

## INTRODUCTION

The Centers for Disease Control and Prevention (CDC) estimates an excess of 299,028 deaths from January 26 to October 3, 2020. While two-thirds of these deaths have been directly attributable to coronavirus disease-19 (COVID-19), a third have not.<sup>1</sup> Nearly 40% of COVID-19-related deaths have occurred in long-term care facilities with older adults disproportionately dying.<sup>2</sup> Concurrently, emergency department (ED) visits have declined,<sup>4–7</sup> with fewer presentations for emergent conditions such as acute myocardial infarction (AMI)<sup>5</sup> and stroke,<sup>6</sup> suggesting avoidance or delays in care-seeking as a potential mechanism for increased mortality.<sup>8</sup>

Almost a third of adults in the U.S. report actively delaying medical care secondary to concerns about COVID-19.<sup>9</sup> The greater prevalence of emergent conditions, such as AMI, stroke, and sepsis, among older adults<sup>10–13</sup> could make delays in care-seeking a significant public health risk. Despite greater rates of mortality during the pandemic, whether presentations for emergent conditions for older adults differ from their younger counterparts in the wake of COVID-19 is not known. Differential trends in ED visits for these conditions would suggest the need to more closely examine care-seeking behavior among older adults.<sup>14,15</sup>

We aimed to describe trends in ED visitation for select emergency conditions, as well as ED visits resulting in death in the ED, during the COVID-19 pandemic among older adults compared with middle-aged adults in a diverse sample of community EDs across the United States. Since care seeking can vary because of differences in clinical presentation of conditions based on age and perceived urgency, we selected a spectrum of conditions in older adults that warrant timely recognition and management: AMI, stroke, sepsis, fall, and hip fracture.

### Key Points

- Emergency department (ED) visits for acute myocardial infarction (AMI), stroke, and sepsis declined more precipitously for older adults at the onset of the COVID-19 pandemic than for their younger counterparts.
- For older adults aged 75 or older, ED visits for AMI, stroke, and sepsis have remained considerably lower than pre-pandemic levels.
- Despite increased mortality among older adults during the COVID-19 pandemic, there has been a persistent decline in ED visits nationwide for emergent conditions among older adults without an accompanying increase in deaths in the ED, concerning for delayed or deferred care.

### Why Does this Paper Matter?

Changes in care seeking among older adults, for emergent conditions potentially amenable to rapid evaluation and treatment, may adversely impact morbidity and mortality in this vulnerable population.

## METHODS

This was a retrospective observational analysis of ED visit data drawn from the Clinical Emergency Department Registry (CEDR),<sup>16</sup> Centers for Medicare and Medicaid Services Qualified Clinical Data Registry of ED visits maintained by the American College of Emergency

Physicians. The analysis sample included ED sites continuously enrolled in the registry with data available across the United States from January 1, 2019 to November 15, 2020 (Figure S1). Data available at the visit-level included International Classification of Disease-Tenth Edition-Clinical Modification (ICD-10-CM) diagnosis codes, disposition (including death in the ED), as well as patient demographics. We grouped visits by age into three categories for older adults: aged 65–74, 75–84, and 85 and older. We included age 40–64 years as a comparison group. This approach is consistent with the age categories for COVID-19 risk of hospitalization and death as defined by the CDC.<sup>17</sup> As data on patient sex were also available, we include a supplementary analysis with breakdown by sex. To provide summary statistics on the sample local pandemic conditions, we merged site-level data on visit counts with county-level data on daily active COVID-19 cases per 1000 population, hospital bed utilization, and case fatality rate from the University of Maryland COVID-19 Impact Analysis Platform.<sup>18,19</sup>

Our outcomes of interest included ED visit counts for emergent conditions and for death in the ED across age categories. For emergent conditions, we defined AMI, stroke, sepsis, falls, and hip fracture, identified according to Clinical Classifications Software Refined (CCSR) codes *CIR009*, *CIR020*, *INF002*, *EXT002*, and ICD-10-CM code *S720* respectively. CCSR codes are groupings of ICD-10 codes developed by the Agency for Healthcare Research and Quality to classify over 70,000 ICD-10 codes into clinically meaningful categories for research purposes.<sup>20</sup> These conditions were specifically chosen to compare and contrast potential changes in care-seeking propensity where outcomes may be time-sensitive. Hip fracture was selected as the condition that may be less susceptible to discretion in care seeking in contrast to AMI, stroke, sepsis, and falls given the associated sudden impairment of mobility. In contrast, the absence of typical presenting symptoms for other conditions like chest discomfort for AMI or fever for sepsis among older persons might result in reduced recognition and consequent care-seeking for these emergencies.

Our comparison periods were as follows: the pre-pandemic period (January 1, 2019–March 28, 2020), the early pandemic period, as defined by the CDC<sup>3</sup> from March 29 to April 25, and the post-early pandemic period (April 26–November 15, 2020). We present summary statistics for EDs and contrast visit volume in the year prior (2019) and in 2020, as well as county-level COVID-19 characteristics including daily COVID-19 cases per 1000 people, hospital bed utilization, and case fatality rate.

To compare changes across age groups over time, we plotted daily ED visit counts for each of the select conditions, as well as deaths in the ED, by age categories with

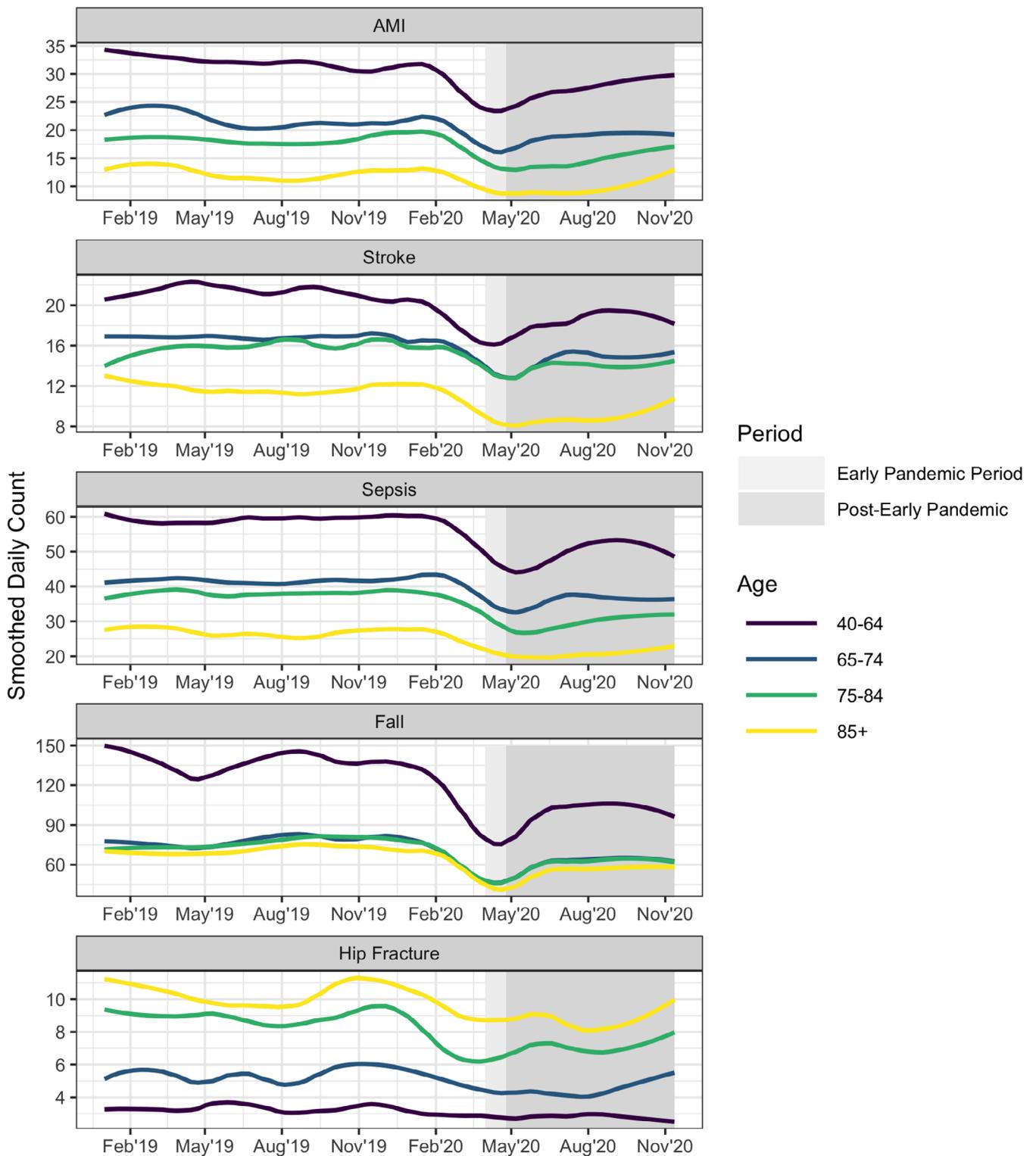
nonparametric smoothed curves generated with a locally weighted scatterplot smoothing (LOWESS; bandwidth 0.18). This method computes a least squares regression for each data point, using nearby points, while applying greater statistical weight to closer points.<sup>21</sup> To compare condition-specific differences in visit counts within age groups over the three time-periods, we used Poisson regression models with time-periods as an indicator variable and pre-pandemic period as the reference category. We report incident rate ratios (IRRs), the ratio of daily incidence rates for ED visits in the early and post-early pandemic period as compared with the reference time period. For example, an IRR of 1.20 would represent a 20% greater incidence of ED visits than in the pre-pandemic reference period. All analyses were conducted using R software (version 4.0.2; R Foundation) and Stata 15 (Stata, College Station, TX).

## RESULTS

Our sample included 164 EDs across 33 states. Median ED visit volume in 2019 was 27,220 (interquartile range [IQR]:11,322–46,506), as compared with 14,831 (IQR: 7280–22,382) from January 1 to November 15, 2020. Through the early and post-early pandemic periods (March 29–November 15, 2020), represented counties had a median daily active COVID-19 case count of 2.85 per 1000 people (IQR: 1.86–3.84). Median hospital bed utilization was 57.3% (IQR: 49.9%–57.9%), and median daily COVID-19 case fatality rate (ratio of reported deaths to reported population-level cases) was 1.42 (IQR: 1.07–2.10) during this period.

Figure 1 depicts smoothed daily visit counts for AMI, stroke, sepsis, falls, and hip fractures, across all three periods of analysis. Daily visit counts (Table S1) declined during the early pandemic period across all age groups. Visits for falls declined precipitously (from 354 daily to 182 daily) whereas those for AMI (84–57 daily), stroke (65–49 daily), and sepsis (165–130 daily) had smaller but considerable declines. Visits for hip fracture decreased (27–21 daily), but by a smaller amount than for the other conditions. Across AMI, stroke, and sepsis, the older (75–84 years) and oldest old (85+ years) had the greatest decline in visits during the early pandemic period and the smallest recovery in the post-early pandemic periods.

Figure 2 depicts IRRs for the early pandemic period and the post-early pandemic period across conditions. For AMI, stroke, and sepsis, visit counts partially rebounded during the post-early pandemic period for middle-aged adults and older adults 65–74 years of age. For the age groups 75–84 and 85 or older, visits for AMI, stroke, and sepsis remained the most depressed from

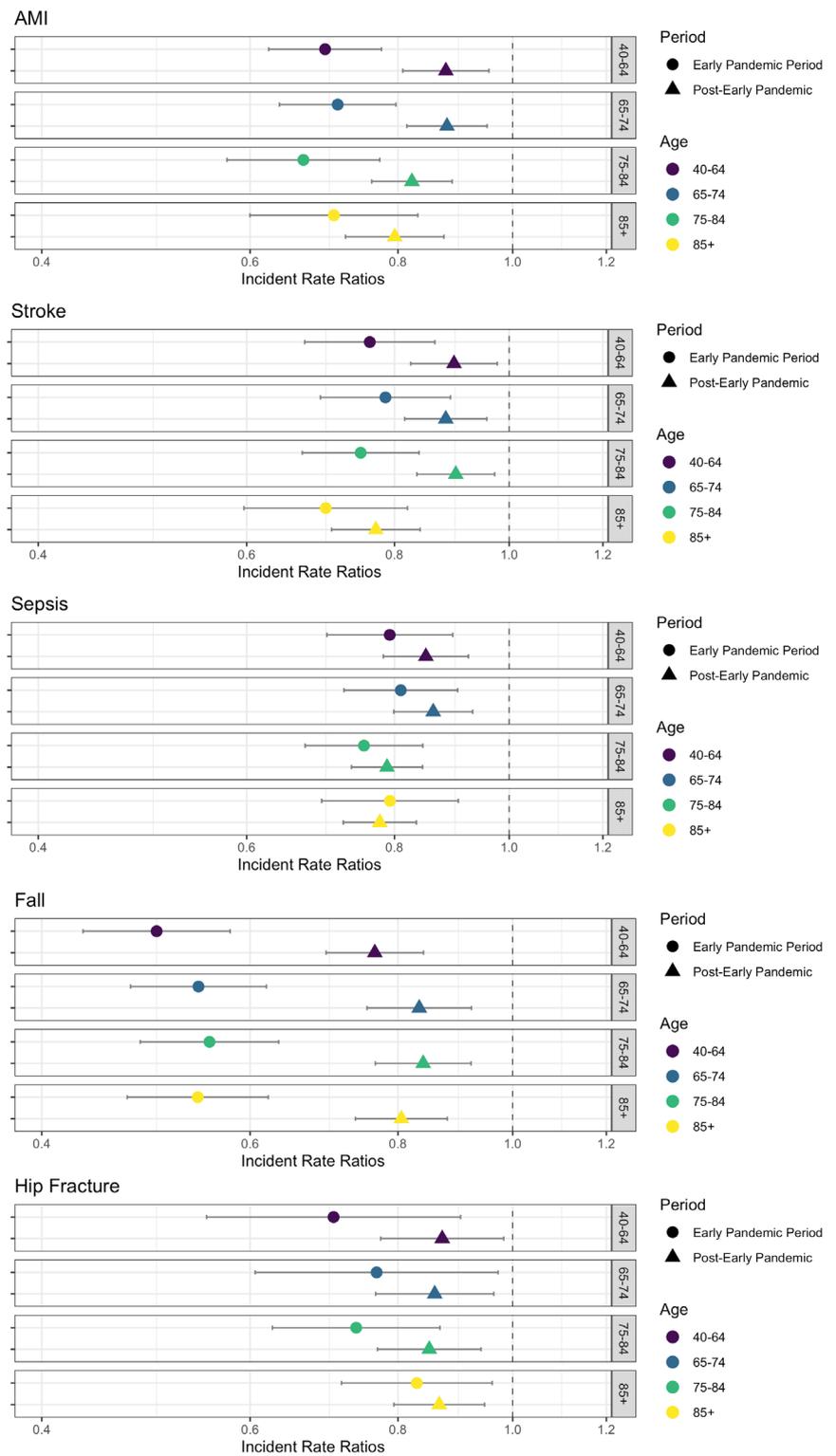


**FIGURE 1** Emergency department (ED) visit counts for select conditions by age category. Smoothed daily visit counts for acute myocardial infarction, stroke, sepsis, fall, and hip fracture are reported by age category. Shaded areas represent the timeframe for the early pandemic period, March 29–April 25, 2020, as defined by the CDC, and the post-early pandemic (April 26–November 15, 2020). Data are drawn from a national quality registry of community EDs, and the sample includes 164 EDs across 33 states

baseline. In the case of AMI, for example, there were 18% fewer visits for those aged 75–84 and 21% fewer visits for those older than 85 years of age compared with their pre-

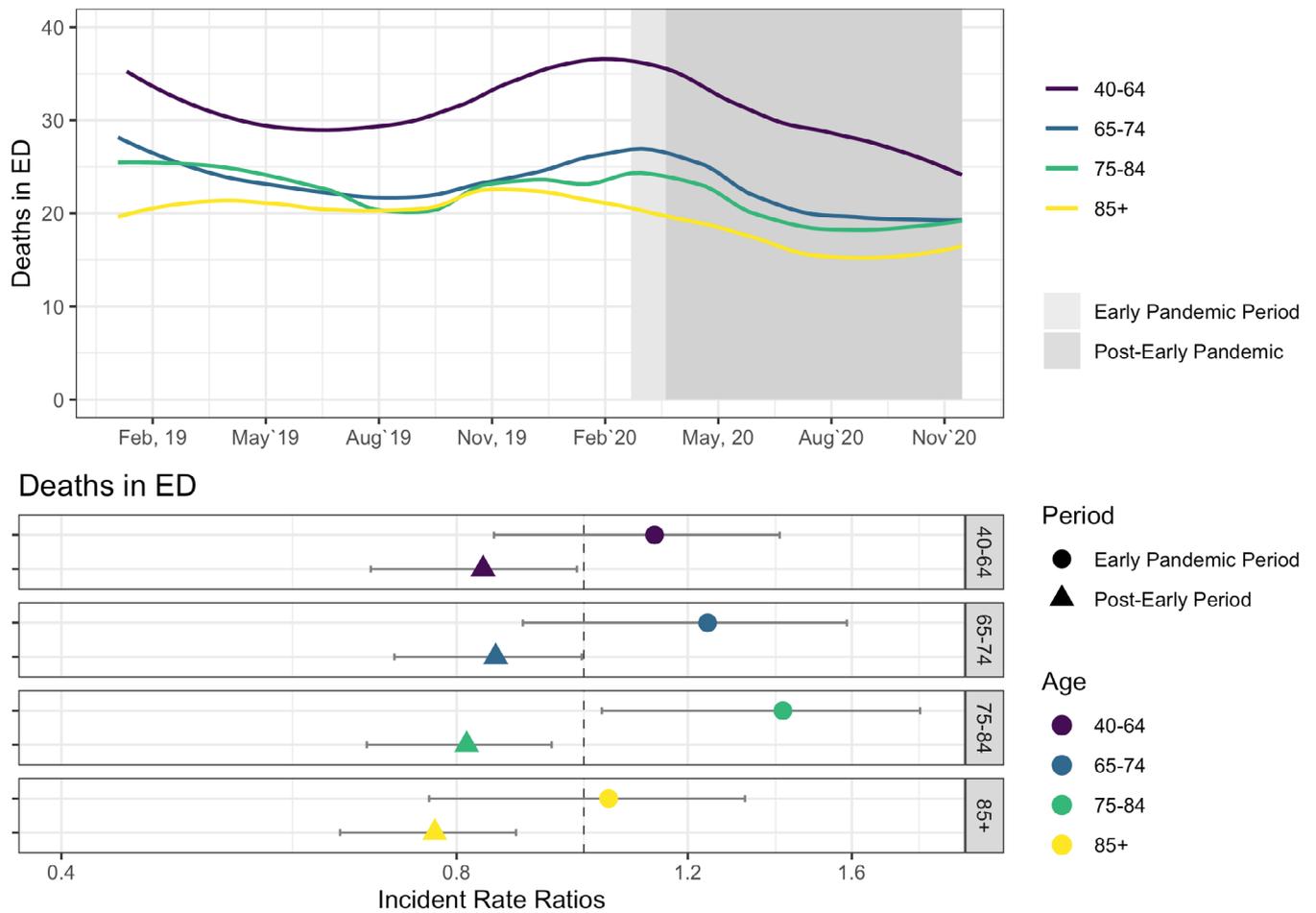
pandemic visit counts (IRR 0.82, 95% CI 0.76, 0.89; IRR 0.79, 95% CI 0.72, 0.87 respectively). For stroke, older adults between 75 and 84 years of age had 10% fewer

**FIGURE 2** Incident rate ratios for emergency department (ED) visits for acute myocardial infarction (AMI), stroke, and sepsis by age category. Each box is an unadjusted Poisson regression model for visit count for select time-sensitive conditions AMI, stroke, sepsis, fall, and hip fracture among specific age groups with reported incident rate ratio. Error bars represent 95% confidence intervals. The models include categories for pre-pandemic (January 1, 2019–March 28, 2020), early pandemic period (March 29–April 25, 2020), and post-early pandemic (April 26–November 15, 2020). Data are drawn from a national quality registry of community EDs, and the sample includes 164 EDs across 33 states [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]



visits and those older than 85 had 23% fewer visits compared with baseline (IRR 0.90, 95% CI 0.84, 0.97; IRR 0.77, 95% CI 0.71, 0.84 respectively). Similarly, for sepsis, older adults between 75 and 84 years and 85 or older, there were 21% and 22% fewer visits (IRR 0.79, 95% CI 0.74, 0.84; IRR 0.78, 95% CI 0.72, 0.83) respectively.

ED visits for falls decreased the most of all the conditions studied, with the largest decline for patients of all ages during the early pandemic period and an increase during the post-early period (Figure 1). In contrast to the other conditions, hip fractures exhibited a fairly muted decline in visit counts, especially as compared with falls,



**FIGURE 3** Emergency department (ED) deaths in ED, counts, and incident rate ratios by age. Smoothed daily counts for deaths in ED are reported by age category. Shaded areas represent the timeframe for the early pandemic period, March 29–April 25, 2020, as defined by the CDC, and the post-early pandemic (April 26–November 15, 2020). Data are drawn from a national quality registry of community EDs, and the sample includes 164 EDs across 33 states. Each box is an unadjusted Poisson regression model for death in ED counts, among specific age groups with reported incident rate ratio. Error bars represent 95% confidence intervals [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

across age categories. Notably, the oldest group of patients, 85 and older, did see a statistically significant decline in incidence of visits for hip fracture which persisted in the post-early period (early pandemic period: IRR 0.83, 95% CI 0.72, 0.96; post-early period: IRR 0.87 95% CI 0.79, 0.94).

Visit counts resulting in death in the ED were higher in the early pandemic period. Across all age groups included in the analysis, average daily death in ED counts increased from 16.6 in the reference period to 19.7 in the early pandemic period, then falling to 12.9 in the post-early pandemic period. Figure 3 depicts smoothed daily deaths occurring in the ED, as well as the IRRs for the early pandemic period and post-early pandemic periods. The decline in ED visits with disposition death in ED, during the post-early pandemic period, was most pronounced in the 75–84 age category (IRR 0.81, 95% CI 0.68, 0.95) and the 85+ age category (IRR 0.77, 95% CI 0.65, 0.89).

Supplemental analyses conducted to evaluate for differences in ED visits and deaths by sex (male, female) did not reveal statistically significant differences in trend by sex (Figures S2 and S3).

## DISCUSSION

In this nationwide study of community EDs, we found that visit counts for conditions that are emergent but subject to discretion in medical care seeking such as AMI, stroke, and sepsis declined precipitously during the early pandemic period and remained lower than pre-pandemic levels through the summer and fall, especially for the older (75–84) and oldest old (85+ years in age). Although deaths in ED increased in the early pandemic period, they fell significantly during the post-early pandemic period especially in the oldest age categories. With hundreds of thousands

of excess deaths since the onset of the pandemic,<sup>1</sup> and a disproportionate number in patients from long-term facilities, it seems many did not die in the ED. Our findings are concerning for emergency care avoidance as a potential mechanism for excess mortality among older adults.

The overall decline in ED visits across all ages observed in our study is consistent with findings from prior studies describing reduced acute care utilization for non-COVID conditions.<sup>4-7</sup> However, the finding of greater and more persistent ED visit decline among the older and oldest adults (those greater than 75 and 85 years of age respectively) compared with younger adults across a diverse set of conditions has not been demonstrated previously. This finding of mounting declines in visit counts for emergent conditions, in successively increasing age strata, is concerning not only because of the increasing prevalence of these conditions with advanced age but also because of the accompanying greater risk for adverse outcomes in older adults.<sup>22-25</sup> We did not see a concurrent increase in deaths in ED for sites examined despite the nationwide increase in deaths from all-causes among older adults.<sup>2</sup> Furthermore, in the absence of appropriate intervention, AMI, stroke and sepsis could lead to not only increased risk of short-term mortality but also long-term morbidity in the form of ischemic heart disease and heart failure, neurological and functional impairment, and organ dysfunction, functional and cognitive impairment respectively.<sup>26,27</sup> In contrast to adults aged 75 and older, although visits for AMI, stroke, and sepsis declined for middle-aged adults (40-64 years) and for those 65-74 years of age during the early part of the pandemic, there was a subsequent increase in visits with counts approximating pre-pandemic levels by November.

There could be a few possible explanations for the changes we observed in ED visits. First, the observation of muted decline in hip fracture, in contrast to other conditions studied, suggests that the perceived urgency of medical care seeking may vary by condition. Some conditions, like a painful hip fracture with newly impaired mobility, may prompt urgent care while others, like AMI or stroke, may present with atypical and less well-recognized symptoms in older adults, resulting in delayed care despite their significant health consequences.<sup>28,29</sup> Second, the social distancing essential to protecting older adults from coronavirus infection may further isolate and disconnect them from families and caregivers who may be their primary point of contact for recognition of changes in health status, or for general health concerns, including transportation to access medical care visits and the ED. Third, the increased risk of COVID-19-related fatality exposure could be checking older persons and their families, with many considering and weighing the risks of seeking emergency care despite symptom recognition, if not absolutely impeding function.<sup>30</sup> Fourth,

there could have been a true reduction in the incidence of these conditions among older adults relative to the general population as a consequence of increased observance of social distancing, masking, and “stay at home” policies throughout the pandemic. For example, reduced physical activity could have led to a decrease in falls; fewer elective procedures including dental work to a decrease in sepsis; and reduction in viral respiratory illnesses to decrease in systemic inflammatory triggers that are known risk factors for AMI and stroke.

Our results should be interpreted within the confines of our study design and dataset. First, the CEDR data does not capture outcomes after ED visits, except in the case of death in the ED setting, precluding a subsequent analysis examining the relationship between ED visits for time-sensitive emergencies and long-term outcomes in the broader population. Second, we could not address the confounding effect of COVID-19 in the diagnostic coding of ED presentations in the absence of granular data on laboratory tests, especially given the limited and highly variable testing infrastructure early in the pandemic. It is possible that some individuals presented, and indeed were diagnosed with COVID-19, while also being managed for a heart attack, stroke, sepsis, or falls. Claims data from the ED is an imperfect measure of the mix of pathology at presentation; however, we attempted to minimize this by including diagnosis codes which are specific within the ED for emergent conditions. Finally, it would have been interesting to evaluate differences by race/ethnicity to evaluate disparities in ED utilization during the pandemic; however, data for race/ethnicity were not available. Information comparing female versus male were included. Supplementary analyses (Figures S2 and S3) by sex did not reveal statistically significant differences in the trends across age groups.

In conclusion, there has been a more pronounced and persistent decline in visits to the EDs nationwide for emergent conditions among older adults compared with their younger counterparts, with fewer deaths in ED after the early pandemic period. These findings raise the concern that increased mortality for older adults during the COVID-19 era, especially that occurring outside of ED and inpatient settings, may be related to changes in medical care seeking and warrant investigation and interventions targeting older adult populations at greatest risk.

## ACKNOWLEDGMENTS

## FINANCIAL DISCLOSURE

Arjun Venkatesh reports support of Contract Number HHSM-500-2013-13018I-T0001 Modification 000002 by the Centers for Medicare & Medicaid Services, an agency

of the U.S. Department of Health and Human Services. Arjun Venkatesh also reports career development support of grant KL2TR001862 from the National Center for Advancing Translational Science and Yale Center for Clinical Investigation and the American Board of Emergency Medicine-National Academy of Medicine Anniversary Fellowship. Snigdha Jain is supported by a training grant from National Institute of Aging (T32AG1934). Ula Hwang is supported by the NIH (R33AG058926, R61AG069822), the John A. Hartford Foundation, and the Gary and Mary West Health Institute.

### CONFLICT OF INTEREST

The authors have no conflicts of interest to report.

### AUTHOR CONTRIBUTIONS

All those who have contributed significantly to the work have been listed as authors. ATJ, SJ, AKV conceived the study. ATJ performed the analysis. ATJ and SJ prepared the manuscript and all authors contributed significantly to its revision.

### SPONSOR'S ROLE

There was no specific sponsorship for this work.

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## SUPPORTING INFORMATION

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

**Table S1.** Visit counts by period, condition, and age category in the analysis sample.

**Figure S1.** ED sites from the Clinical Emergency Department Registry in the analysis sample.

**Figure S2.** Emergency Department Visit Counts for Select Conditions By Age Category and by Sex. Smoothed daily visit counts for AMI, stroke, sepsis, fall, and hip fracture are reported by age category. Shaded areas represent the timeframe for the early pandemic period, March 29 through April 25, 2020, as defined by the CDC, and the post-early pandemic (April 26 through November 15, 2020). Data are drawn from a national quality registry of community emergency departments, and the sample includes 164 EDs across 33 states.

**Figure S3.** Emergency Department Deaths in ED, Counts, By Age Category and Sex. Smoothed daily counts for deaths in ED are reported by age category and by sex. Shaded areas represent the timeframe for the early pandemic period, March 29 through April 25, 2020, as defined by the CDC, and the post-early pandemic (April 26 through November 15, 2020). Data are drawn from a national quality registry of community emergency departments, and the sample includes 164 EDs across 33 states.

**How to cite this article:** Janke AT, Jain S, Hwang U, et al. Emergency department visits for emergent conditions among older adults during the COVID-19 pandemic. *J Am Geriatr Soc*. 2021;69(7):1713–1721. <https://doi.org/10.1111/jgs.17227>