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<https://doi.org/10.1016/j.jemermed.2022.08.003>

## Brief Report

### Sex- and Age-Related Impact of the COVID-19 Pandemic on Emergency Department Visits for Chest Pain in Curitiba, Brazil

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**Abstract—Background:** Women have higher mortality from acute coronary syndrome (ACS) compared with men. Women may hesitate to search for emergency care when experiencing chest pain, which delays treatment. **Objective:** Our aim was to evaluate the changes in emergency visits for chest pain according to sex and age during the COVID-19 pandemic period compared with previous years. **Methods:** We collected data on chest pain visits (*International Classification of Diseases, Tenth Revision, Clinical Modification* codes I20 [unstable angina], I21 [myocardial infarction], and R07.1-4 [chest pain]) from all public emergency departments (EDs) in Curitiba, Brazil. We compared the weekly rates of visits per 100,000 habitants on the epidemiologic weeks 11–52 of 2020 (COVID-19 pandemic period) with the average rates of the same weeks of 2018 and 2019 using Poisson regression. **Results:** From 2018 to 2020, 37,448 individuals presented to the ED for chest pain, of whom 8493 presented during the COVID-19 pandemic period. Compared with previous years, we observed a 23% reduction in chest pain visits (10.1 vs. 13.0 visits per 100,000 habitants/week;  $p < 0.001$ ), but this reduction was greater in women than in men (30% vs. 15%;  $p < 0.001$ ). This reduction was associated with age among women (27%, 31%, and 36% for < 50 years, between 50 and 69 years and > 70 years, respectively,  $p$  for age-related trend = 0.041), but not among men. **Conclusions:** In this population-level study of Curitiba, Brazil, the reduction in ED visits during the COVID-19 pandemic was greater in women than in men, particularly among those > 70 years

of age, suggesting that the sex- and age-related disparities in health care delivery for ACS may have worsened during the COVID-19 pandemic. © 2022 Elsevier Inc. All rights reserved.

**Keywords—**chest pain; COVID-19; epidemiology; female

#### Introduction

The COVID-19 pandemic had a number of impacts on health care, including cardiovascular (CV) emergency care. An increase in CV deaths and a decline in acute coronary syndrome (ACS) and chest pain admission rates in the early months of the pandemic were reported, raising concern about the possibility of patients being reluctant to seek emergency care (1,2). Previous studies have suggested that women delay seeking emergency care when they experience chest pain, are less likely to report “classic” anginal symptoms, and more often neglect ACS-related symptoms compared with men, which may contribute to their higher short-term mortality from ST-elevation myocardial infarction (STEMI) (3,4). Other factors, such as older age and socioeconomic status, have also been associated with longer time from symptom onset to first medical contact (5). These behavioral

RECEIVED: 27 January 2022; FINAL SUBMISSION RECEIVED: 6 July 2022;  
 ACCEPTED: 4 August 2022

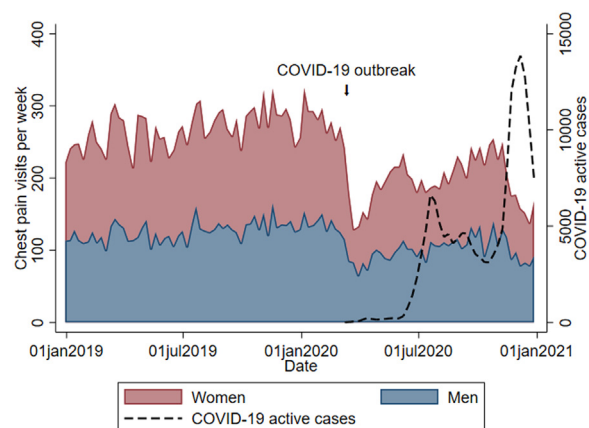
characteristics imply that reluctance to seek emergency care during the pandemic may differ among different demographic subgroups. However, sex- and age-related disparities in seeking emergency care when experiencing chest pain during the pandemic period have been poorly evaluated. We hypothesized that the reduction in emergency department (ED) visits during the COVID-19 pandemic differed according to age and sex.

## Methods

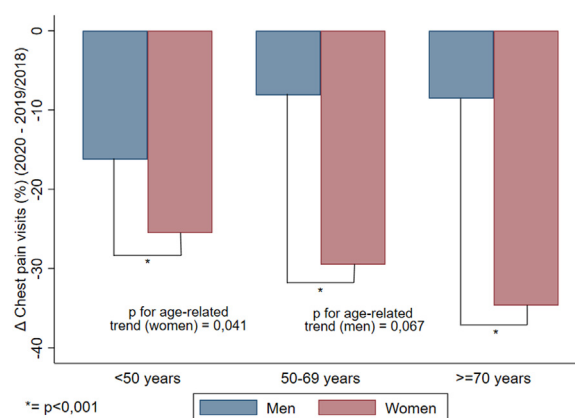
We collected data regarding adults (> 18 years) with chest pain visits from nine EDs, comprising all emergency units (*Unidades de Pronto Atendimento* in Portuguese) from the municipal public health system of the city of Curitiba, Brazil. These units are the first contact for patients who seek medical care due to chest pain. Curitiba city has 1.9 million inhabitants, with 45% of its population having access to this public health system only. Every ED visit in this system receives an *International Classification of Diseases, Tenth Revision, Clinical Modification* (ICD-10-CM), code, which is registered in an electronic database by the attendant physician (6). For this study, only the first visit was used for those patients who had repeated visits for chest pain. Chest pain visits were defined as those with ICD-10-CM codes I20 (unstable angina), I21 (myocardial infarction), and R07.1-4 (chest pain). We compared the weekly rates of visits per 100,000 population in epidemiologic weeks 11–52 of 2020 (COVID-19 pandemic period) with the mean rates for the same weeks in 2018 and 2019 using Poisson regression. Age-adjusted sex differences were calculated using information from the 2010 Brazilian census (7). Trends over time were calculated adding period–sex and period–age category interaction terms on Poisson regression. We further added a period–age category–sex interaction (age–sex interaction) to test whether the association between trends over time in ED visits and age category differed according to sex. The proportions of ED visits for chest pain that were diagnosed as acute myocardial infarction were compared between these periods using logistic regression. All analyses were conducted using Stata, version 15 (StataCorp). The Ethics Committee approved the study protocol.

## Results

We included 37,448 patients who presented to the ED for chest pain from 2018 to 2020, of whom 8493 presented during the COVID-19 pandemic period. Overall, there was a 23% reduction in the rates of individuals presenting with chest pain at the ED during the pandemic period (mean of 10.1 visits per 100,000 habitants/week), in comparison with the same epidemiologic weeks of 2018 and



**Figure 1.** Number of chest pain visits per week in the emergency department units in 2019 and 2020 in Curitiba, Brazil.



**Figure 2.** Change (%) in weekly emergency department visits for chest pain during the COVID-19 pandemic period (epidemiologic weeks 11–52 in 2020) compared with the same epidemiologic weeks in 2018 and 2019, according to sex and age category.

2019 (mean of 13.0 ED visits per 100.000 habitants/week;  $p < 0.001$ ). The reduction in ED visits for chest pain was most pronounced in the first 20 weeks of the pandemic (epidemiologic weeks 11–31) than in the last 20 weeks of the year (epidemiologic weeks 32–52) (Figure 1). This reduction was much greater in women than in men (30% vs. 15%;  $p < 0.001$ ) in all age categories.

Among women, the reduction in chest pain ED visits was greater in older age groups (27%, 31%, and 36% for < 50 years, between 50 and 69 years, and > 70 years, respectively;  $p$  for age-related trend = 0.041) (Figure 2). By contrast, the reduction in chest pain ED visits tended to be more pronounced at younger ages among men (19%, 10%, and 11% for < 50 years, between 50 and 69 years, and > 70 years, respectively;  $p$  for age-related trend = 0.067,  $p$  for age–sex interaction = 0.006). The proportion of ED visits for chest pain that were diagnosed as myocardial infarction did not change signif-

icantly during the COVID-19 pandemic period compared with previous years (1.5% vs. 1.8%, odds ratio 1.21; 95% CI 0.99–1.47;  $p = 0.054$ ), even when stratified by age and sex (Supplementary Table 1). Although there was a significant reduction in overall ED visits, it did not follow the same age and sex relationships as the chest pain ED visits (Supplementary Table 2).

## Discussion

The main finding of this population-level study was that a significant reduction in the rates of ED visits for chest pain occurred during the pandemic period, as compared with the previous 2 years, and this reduction was greater among women compared with men, particularly among women older than 70 years. The reduction in chest pain ED visits was not accompanied by a significantly higher proportion of myocardial infarction diagnoses, suggesting that the overall reduction in ED visits was not only due to a reduction in less severe visits. Compared with men, women have higher short-time mortality after an ACS, especially after STEMI, and this has been partially explained by delays in treatment among women (4). Our data suggest that sex- and age-related disparities may have worsened during the COVID-19 pandemic. Although older women were less likely to seek medical attention than younger women, this association was inverse among men, suggesting that this behavior was age- and sex-specific.

The reduction in ED visits for acute CV diseases during the COVID-19 pandemic has been described previously. Reports from the United States have found a 40% decrease in the cardiac catheterization laboratory activation for primary percutaneous coronary intervention, with similar reductions in admissions for ACS in other countries (2,8). Nevertheless, these studies did not report whether these findings differ according to age and sex. A more recent study evaluating ED visits for serious CV conditions in 18 states in the United States found that visits for non-STEMI and acute heart failure dropped considerably, with steeper reductions among women and people older than 65 years in the early periods of the COVID-19 pandemic (9). Our study adds that women, especially those older than 70 years, were also less likely to seek medical attention when experiencing chest pain during the pandemic period, which may indicate the existence of a behavioral pattern that make these groups more vulnerable to CV emergencies during the outbreak.

Before the COVID-19 pandemic, women with STEMI had already experienced greater delays until reperfusion compared with men, mostly driven by time from symptom onset to first medical contact (3). The reasons for these differences are likely multifactorial and include lack of awareness, misinterpretation of symptoms, barriers to ac-

cessing care, fear, and embarrassment (4,10). During the pandemic, these factors may have led to the decision not to seek emergency care when experiencing chest pain. It has been shown that women, especially as they become older, are more likely to comply with public recommendations of staying at home during this period, which may have contributed to these disparities (11).

Our data have important implications for the current and future outbreaks. Women were less likely to seek care for chest pain during the COVID-19 pandemic. This may result in delayed medical care support and, consequently, increase the risk of complications from myocardial infarction and other deadly causes of chest pain.

## Limitations

Our study has limitations; we included only EDs from the municipal public health system, and our results may not be generalized to private hospitals that provide care to patients with different income and education levels. Also, our inclusion criteria included the ICD-10-CM codes for R07.1-4, which is subjective and not specific. Women presenting with atypical symptoms, such as nausea, fatigue, or dyspnea, may have been left out of the analysis.

## Conclusions

The COVID-19 pandemic resulted in a significant reduction in rates of ED visits due to chest pain, disproportionately affecting the rate of women seeking care, especially those older than 70 years. More studies should be performed to determine the reasons for these age- and sex-related differences and their impacts on health.

## Supplementary Materials

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.jemermed.2022.08.003](https://doi.org/10.1016/j.jemermed.2022.08.003).

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### ARTICLE SUMMARY

#### **1. Why is this topic important?**

The COVID-19 pandemic had a major impact on health care systems, including emergency cardiovascular care. Delays in accessing emergency care when experiencing chest pain may result in inadequate medical support and higher risk of complications from myocardial infarction.

#### **2. What does this study attempt to show?**

Our study showed differences in emergency department visits according to sex and age category to identify groups most at risk of delaying or not seeking medical care when experiencing chest pain.

#### **3. What are the key findings?**

Women were less likely to seek medical attention for chest pain during the pandemic period, particularly among those older than 70 years. This suggests the sex- and age-related disparities in accessing health care for chest pain may have increased during the COVID-19 pandemic.

#### **4. How is patient care impacted?**

The COVID-19 pandemic increased the disparity in patients seeking care for chest pain.