Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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EDITORIAL COMMENT

Declining Admissions for Acute Cardiovascular Illness

The COVID-19 Paradox*

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The rapid emergence and spread of severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) into a worldwide pandemic has dramatically altered the way of life for billions around the globe. Appropriate concern has been directed at limiting the spread of the virus, the pressure placed on overwhelmed health care systems, and mortality from this devastating disease. Although health care providers have been busy caring for the millions of infected individuals, a growing number of reports, including our own clinical observations, indicate that other common acute cardiovascular disorders have all but disappeared from emergency departments and hospital wards.

SEE PAGE 280

In this issue of the *Journal*, Bhatt et al. (1) present interesting data from a retrospective study involving 15 U.S. centers. The authors used primary admitting International Classification of Diseases-10th revision codes to identify 7,187 cardiovascular admissions from January 2019 through March 2020. Controlling for temporal trends, they observed a 43% reduction in hospitalization rates for acute cardiovascular conditions including heart failure, acute coronary syndrome, and stroke since community spread of SARS-CoV-2 has been reported in the United States. When stratified by the reason for admission, the relative distribution of the various types of acute cardiovascular hospitalizations remained unchanged. Among admitted cardiac patients, those hospitalized in the coronavirus disease-2019 (COVID-19) era, defined in the study as March 2020, had a total length of stay 1.2 days shorter than patients admitted in March 2019. Furthermore, those admitted for cardiac reasons in the COVID-19 era had numerically greater rates of in-hospital death than patients in the preceding 15 months.

Taken at face value, a reduction in cardiovascular hospitalizations may be considered a cause to celebrate, with fewer individuals hospitalized for devastating cardiovascular events. As the authors indicate, possible explanations for such as shift may include a reduction in unhealthy behaviors such as high-salt meals at restaurants or reductions in air pollution from fewer cars on the road. Similarly, increased access to health care providers through the use of telemedicine may allow for treatment and mitigation of deteriorating cardiac conditions before patients require hospitalization.

Unfortunately, this rose-colored assessment runs contrary to our current understanding of COVID-19 infection and cardiovascular disease pathology, making it unlikely that major cardiovascular events are truly less common during this pandemic. Early work unraveling COVID-19 has revealed a large, systemic inflammatory response, with elevations in erythrocyte sedimentation rate, C-reactive protein, ferritin, D-dimer, and interleukin-6 levels (2). Such robust inflammation would be expected to drive increases in plaque destabilization and atherothrombotic events with resultant acute coronary

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syndrome and cerebrovascular events, as evidenced by reports of large vessel strokes in otherwise young, healthy individuals (3). Furthermore, acute stressors (of which a global pandemic is likely to qualify) are frequently associated with increased cardiovascular events; for example, the number of atherosclerosis-related cardiovascular deaths increased significantly after the Northridge Earthquake in Southern California in 1994 (4). As Bhatt et al. (1) describe, however, patients with these conditions are not flooding hospitals but are paradoxically missing from the wards.

This finding may prove to be the result of unintended consequences of otherwise well-intentioned public messaging campaigns meant to flatten the curve of COVID-19. With governmental agencies, medical societies, and public health organizations stressing the importance of staying at home, individuals with unclear or vague symptoms may wavier in their decision to seek medical care. Evidence of this can be seen with increases in symptom-to-door time for patients presenting with acute coronary syndrome, waiting at home until their symptoms become unbearable. One Australian hospital reported a 4-fold increase in the time of symptom onset to medical contact for patients with ST-segment-elevation myocardial infarction, reaching longer than 11 h, between the pre-COVID and COVID eras (5). Even worse, other studies indicate that patients may be staying at home altogether, with reductions in admissions for acute coronary syndrome and catheterization lab activations for ST-segment elevation myocardial infarction by as much as 40% compared with pre-COVID time periods (6–8). Data from the Office for National Statistics in the United Kingdom demonstrate numerically higher non-COVID-related death rates since the start of the pandemic compared with the 5-year average over the equivalent calendar timeframe (9). Certainly, limited access to testing may result in underrepresentation of the number of deaths from COVID-19 infection; however, when juxtaposed to the mounting evidence of fewer admissions for common deadly conditions such as heart attack and stroke, one must consider the possibility of collateral COVID mortality related to delayed or forgone care. Equally concerning, Bhatt et al. (1) found higher rates of in-hospital mortality among those admitted for cardiac reasons in the COVID era. Delayed presentations for critical, time-sensitive illnesses such as heart failure and acute coronary syndrome may contribute to the observed increased mortality; however, adverse effects from COVID-19 may also play a role. Patients with complex cardiovascular conditions require repeat examination and assessment to provide optimal care. The common use of contact isolation while awaiting COVID testing minimizes contact with patients, with associated worse clinical outcomes (10).

Although the fear of contracting COVID-19 at medical facilities likely keeps some patients at home, the economic ripple effect of the pandemic forces many others to grapple with the decision of whether to present to a hospital without health insurance. In the current system of employer-sponsored health plans, the Robert Wood Johnson Foundation estimates that as many as 25 million Americans could lose insurance coverage because of the pandemic (11). Prior studies have clearly demonstrated that lack of health insurance is associated with delayed presentation to the emergency department, including for major cardiovascular conditions such as acute myocardial infarction (12). Despite billions of dollars in economic stimulus and relief from the federal government, millions of Americans are experiencing simultaneous loss of “health and wealth,” the effects of which will likely continue far beyond the current COVID-19 crisis. Such effects are felt most acutely by minority populations, who have seen the largest increases in unemployment, as well as higher rates of COVID-19 infection and death (13,14). Analysis of admissions in more heterogeneous populations may prove helpful in understanding how racial and ethnic minority populations are being affected, potentially disproportionately so.

For those who are hospitalized for cardiovascular conditions, shorter lengths of stay should also be interpreted with caution. In the best-case scenario, a smaller elective procedure volume and desire to minimize uninfected patients’ exposure to COVID-19 may drive previously unrealized clinical efficiencies, with resultant shorter lengths of stay. Conversely, the high demand for clinical resources and bed space to care for patients with COVID-19 may result in premature discharges before clinical optimization has been achieved. Future assessments of readmission rates after an index cardiovascular hospitalization in the COVID-19 era will help elucidate which of these scenarios predominates.

We are all bound together in our fight against the novel SARS-CoV-2. Much like in times of war, governments, health care organizations, and individuals have dedicated unprecedented resources, time, and energy to combating a common foe. Similarly, the consequences of COVID-19 are not limited to those with the virus but include collateral damage to patients with other diseases. Defeating COVID-19 will require a dramatic reshaping of care delivery, novel

approaches to patient management, and large-scale reallocation of resources. Among this behemoth endeavor, we must also ensure that patients with non-COVID-19-related illnesses continue to receive timely, evidence-based, and high-quality care. Accomplishing these tasks simultaneously leaves us all with even greater appreciation for the frontline health care workers who are leading the charge in this time of need.

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