University of Louisville Journal of Respiratory Infections

PERSPECTIVE PIECE

Emergency Medicine in the Time of COVID

Martin Huecker[1]*, *Jacob Shreffler*[1], *Adam Ross*[1], *Hugh Shoff*[1], *Mary Nan S. Mallory*[1], *J. Jeremy Thomas*[1]

[1]Department of Emergency Medicine, School of Medicine, University of Louisville, Louisville, KY, USA

*martin.huecker@louisville.edu

Recommended Citation: Huecker M, Shreffler J, Ross A, Schoff H, Mallory MNS, Thomas JJ. Emergency medicine in the time of COVID. Univ Louisville J Respir Infect **2020**; 4(1):Article 13. doi: 10.18297/jri/vol4/iss1/13.

Abstract

The novelty and uncertainty associated with COVID-19 has created challenges for politicians, citizens, and healthcare providers, leaving no one unaffected. As members of the front line of defense, providers in Emergency Departments (EDs) face the momentous challenge of effectively identifying and treating patients with COVID-19, working with experts in Infectious Disease, Internal Medicine, Critical Care, Public Health, and other disciplines. We must coordinate these efforts while also protecting staff, implementing strategies to reduce transmission, and managing ED patients with conditions unrelated to COVID-19. Striving to maintain a grasp of the rapidly accumulating publications in medical journals and the media, we provide this brief article as a pragmatic summary of the challenges facing the ED.

The new coronavirus SARS-CoV-2 causes COVID-19, a worldwide pandemic as of March 11, 2020, according to the World Health Organization. The infection has demanded unprecedented changes within the healthcare systems of all countries.[1] Leaders obtain frequent data updates on adequate treatment methods, advice for hospital protocols, new statistical models, and physical distancing/government mandated guidelines. The novelty and uncertainty associated with SARS-CoV-2 has created challenges for politicians, citizens, and healthcare providers, leaving no one unaffected. As members of the front line of defense, providers in Emergency Departments (EDs) face the momentous challenge of effectively identifying and treating patients with COVID-19, working with experts in Infectious Disease, Internal Medicine, Critical Care, Public Health, and others. We must coordinate these efforts while also protecting staff, implementing strategies to reduce transmission, and managing ED patients with conditions unrelated to COVID-19. Striving to maintain a grasp of the rapidly accumulating publications in medical journals and the media, we provide this brief article as a pragmatic summary of the challenges facing the ED.

The response to the COVID-19 wave of infection in a community begins with planning. Emergency providers must work with hospital leadership, community officials/health departments, laboratory personnel, emergency ancillary staff, respiratory therapists, pharmacists, and the consulting physicians who will help manage patients. Most cities fortunately benefitted from some warning of the infection before experiencing local surges that would overwhelm capacity. However, hospitals and EDs have experienced significant burdens in the management and mitigation of COVID-19. The preparation phase involves procurement of personal protective equipment (PPE), modification of work schedules, coordination of disaster preparedness and testing capacity, COVID-19 units for inpatients, pharmacologic and ventilatory treatment consensus, triage modifications such as outdoor tents, and operational challenges related to caring for both COVID-19 and non-COVID-19 patients (trauma, stroke, *etc.*). Education and updates have also proven difficult, requiring daily communication to frontline staff, while maintaining standards consistent with the changing information and data from places further along in outbreaks.

In addition, most hospitals were forced to cancel elective procedures in order to prepare for the possible surge of patients with COVID-19. This has resulted in significant financial burdens for hospitals and universities, with large amounts of lost revenue and resultant employee furloughs and job losses. While hospitals in major cities like New York City have been overrun with patients, many across the country are facing a significant decline in volumes and will likely require financial assistance to stay afloat.

Many factors will determine the strain of a COVID-19 wave that reaches each community: temperature and humidity, baseline population characteristics, per capita healthcare resources, nonpharmaceutical measures to decrease spread, and more.[2-4] The lack of guidelines and therapies during these unparalleled times have been especially challenging.[5] Emergency departments have had to quickly adapt and utilize procedures to triage and identify possible COVID-19 patients effectively.[6] Once patients with COVID-19 begin presenting to EDs within a community, ED leaders must implement plans for prehospital care (Emergency Medical Services (EMS) and air transport), triage and isolation of contagious patients, continuous care, and disposition to home or inpatient wards. Prehospital dispatchers should inquire about infectious symptoms when responding to calls. EMS workers must have proper PPE (contact and respiratory isolation) and protocols to decontaminate air and ground ambulances. Prehospital services should avoid aerosolizing procedures and should observe airborne precautions for patients who are critically ill or require intubation en route to the hospital.

Patients suspected of having COVID-19 who arrive by private vehicle or EMS should be placed directly in isolation treatment rooms. Staff (wearing PPE) should place a surgical mask on these patients and attempt to maintain 6 ft distance when possible. Patients who may need intubation or other aerosolizing procedure, and those who are critically ill, should be placed in negative pressure isolation rooms. ED staff should at minimum wear surgical masks, gowns, gloves, eye protection, frequently wash hands or use hand sanitizer; and learn proper doffing techniques. When performing (or present for) aerosolizing procedures, ED staff should use an N95 respirator or PAPR.

Frontline workers in the ED must become familiar with the epidemiology and clinical presentation of patients with COVID-19. These features differ based on geographic location, baseline health, age, *etc.* Data continue to accumulate from many countries describing the presenting features of COVID-19 patients, with great variability in cough, fever, and gastrointestinal symptoms. Pediatric patients appear to resist infection with SARS-CoV-2, and when infected will generally have mild or subclinical symptoms, though can progress to severe status or death.[7] Most adult patients will have mild symptoms, though depending on age groups, as many as 20% may require hospitalization, and as many as 5% ICU level care. The average age of patients ranges in the 50s, and males are more likely to have COVID-19 and to die from it. The overall case fatality rate varies greatly by country/region, but likely ranges from 0.5% to 5%.[8-11] Healthcare workers seem particularly affected depending on the country and resources, and the elderly (particularly nursing home residents) clearly experience the greatest mortality rate.

The incubation period may last as long as 14 days, and patients may be contagious but asymptomatic for 5 days.[12] This asymptomatic carrier concern raises important issues for ED workers: All patients presenting to the ED during periods of high prevalence should be considered potential COVID-19 patients.[13] COVID-19 can present as focal neurologic deficits (and stroke), altered mental status, lethargy, headache, malaise, myalgias, gastroenteritis, venous or arterial thrombosis, and other masquerading presentations.[14-21] However, COVID-19 usually presents similarly to other viral upper respiratory illnesses: rhinorrhea, cough, sneezing, sore throat, congestion.[14] Patients will usually have at least a history of fever, if not fever while in the ED. Patients often have cough or dyspnea, though some with rapid respiratory rate do not actually complaint of dyspnea. Some patients will recall high risk contact with infected individuals, but even early on, not all patients with COVID-19 have known contact with infected individuals.

Emergency physicians perform assessment of the ABCs (airway, breathing, circulation) immediately on all patients. We call attention to commentary from ED Critical Care experts on the avoidance of 'knee jerk' intubation in hypoxic COVID-19 patients, as prone positioning and high flow nasal cannula can ameliorate even severe respiratory distress.[22] Patients suspected of having COVID-19 who might require intubation should be isolated in a negative pressure room. Crash intubation should be avoided if possible. The most experienced physician should perform the intubation with video (not direct) laryngoscopy, and should wear double gown, double gloves and either PAPR *or* face shield, eye protection, and surgical mask over their N95 respirator. Some hospitals have initiated an intubation team to perform all intubations.[23] Preoxygenation should be optimized without aerosolizing procedures, with rare use of CPAP and BiPAP. The ventilator circuit should have a viral filter, and the room should have a HEPA filter. Ventilator management should avoid pulmonary trauma and follow ARDS guidelines as closely as possible.[24]

With no firm definitions established and widely accepted, COVID-19 has been divided into illness trajectories: mild upper respiratory disease, moderate lower respiratory involvement (pneumonia), and severe disease including an ARDS-like picture and critical status.[14] The ED evaluation and workup should vary based on initial impression of illness severity. Patients with mild URI symptoms, especially if in good health, likely do not require laboratory testing. The use of screening for COVID-19 by nasal swab will differ based on local resources, but patients with mild symptoms presumed to have the disease should quarantine at home for 14 days or until asymptomatic for at least 72

hours. Chest imaging with ultrasound and/or radiograph can be considered in mild cases, though likely will not change management. Most patients in the mild category should be discharged from the ED. The decision to consult infectious disease will vary by local practices.

Patients with underlying disease or a more severe clinical presentation will benefit from workup, including SARS-CoV-2 testing, laboratory tests, and imaging. The RT-PCR assay for the virus remains standard of care, though newer methods continue development, and antibody testing will likely become more prevalent. PCR testing has a concerning amount of false negatives (sensitivity 66-80%), and therefore should be repeated on patients in whom suspicion remains high.[14] Positive testing for other respiratory infections does not rule out COVID-19 disease.[25] Recent data does suggest that normal chest X-ray lowers the probability of COVID-19 illness.[26] Used early in the pandemic as a screening test, chest CT may add little to chest X-Ray and exposes the patient to large dose of radiation with minimal benefit.[27] Point of care lung ultrasound can show B lines, consolidations, and a thickened pleural line.[14] The complete blood count may show lymphopenia, thrombocytopenia, and anemia, though some patients will have elevated hemoglobin. Other laboratory findings of significance include elevated creatine kinase and creatinine, elevated d-dimer and lactate dehydrogenase, ferritin, C-reactive protein, troponin, brain natriuretic peptide.

Researchers have attempted to identify features of illness on initial presentation that could predict clinical deterioration in the coming days (usually 3 days post admission). Factors that have shown this association are myalgias, hypoxemia, AST and ALT elevation, high hemoglobin, advanced age and comorbidities.[28-32] Research has shown several factors predicting need for inpatient care and subsequent mortality: old age, cancer, immunocompromised state, diabetes, smoking, hypertension, cardiovascular diseases, metabolic disease/obesity, chronic obstructive pulmonary disease (COPD).[14]

Medical literature on treatment for COVID-19 is in constant flux, with aggressive research in progress for antiviral drugs, antibody approaches, and the search for a vaccine. Supportive care remains the primary treatment for moderate and severe patients. Of note, the early intubation approach has come under intense scrutiny, and we believe intubation should be avoided as long as possible. Early prone positioning and high flow nasal cannula appear to be very effective even in moderately hypoxemic patients.[22] Providers should show care in IV fluid resuscitation, and most patients are not volume depleted on presentation, and aggressive fluid resuscitation likely worsens pulmonary physiology. As data accumulates, more coherent guidelines on pharmacologic management will come. Lopinavir-ritonavir appears to offer no benefit.[33] Hydroxychloroquine and chloroquine could serve as prophylaxis more than treatment, and should likely not be combined with azithromycin.[34] Remdesivir may not ultimately provide a significant mortality benefit, though trials continue.[35] Patients with secondary bacterial infection should receive antibiotics. For very ill patients, the IL-6 inhibitor tocilizumab has shown some benefit.[36] Treatment in the Emergency Department will be largely supportive, and the most crucial decision could be the careful delay of endotracheal intubation.

As above, patients with mild URI symptoms should be discharged home in quarantine, with firm instructions on reasons to return to the ED. Patients with pneumonia and more severe disease could require admission, based on vital signs, laboratory findings, and presence of pre-existing conditions. Testing should occur in compliance with resources and in coordination with the local health department. All patients should maintain social distancing and avoid interaction with vulnerable populations.

Even when following evidence-based practice, EDs will have inevitable challenges related to operation during a pandemic. Should all patients coming to the ED receive a mask, for patient and staff protection? We assert that all infectious patients should don a surgical mask on arrival. Should any patients remain in the waiting area, or should triage be performed at the bedside? Should we allow 'homemade' PPE use? Should front-line workers be penalized for not working due to fear for their own health? Should those who come to work with fever or other infectious symptoms be sent home, even in the midst of personnel shortage? When should we consult the Infectious Disease service? Which COVID suspicious patients should be tested? How should we approach the trainee workforce? In the US currently, residents maintain their schedules, yet medical students as of May 11, 2020 have not returned to clinical duties. Research and educational limitations affect academic emergency physicians.

We propose discussion on these concerns, but provide no definitive answers. As a Level 1 Trauma Center and comprehensive stroke center, the University of Louisville ED has unique challenges. Our major resuscitation room has four bays for patient care in a large open area, causing concerns with isolation and negative pressure. We recommend thorough screening of all trauma, stroke and other patients prior to placement in an ED room, to prevent contamination of staff and our critical resuscitation bay. Additionally, we concur with publications that have highlighted the atypical presentations of COVID-19 disease, having cared for stroke patients, blunt and penetrating trauma patients who were found to have COVID-19 on admission testing.

Specifically, many stroke and trauma patients with positive COVID-19 testing had no signs or symptoms of infection at the time of ED presentation and care.

While improvements in testing continue, availability and accuracy remain tenuous, and the US has not been aggressive with contact tracing. Screening will enhance clinical care within the ED but also help leaders make critical decisions on lifting of isolation guidelines as we aim to return to 'normal'. We praise efforts in determining strategies to help populations uniquely affected by COVID-19, including persons from low socioeconomic backgrounds, racial minority groups, geriatric patients, and individuals with substance use disorder. We also applaud efforts in researching ways to deliver healthcare in different patient-provider interaction settings during pandemics such as in the area of telemedicine. Furthermore, we agree with Duanmu *et al.* that developing robust databases on COVID-19 patients presenting to the ER will allow us to effectively make better data-informed decisions [37]. Publications on COVID-19 should be founded in scientific inquiry, not politics, and should not be locked behind paywalls. Establishing research investigations and collaborative agreements in a systematic way will allow us to reduce duplicative efforts and optimize scientific breakthroughs. We also must consider the potential large wave of infections that will come in the fall of 2020, if the summer does in fact reduce infection transmission and incidence. Finally, we must recognize that everyone involved in caring for COVID-19 patients is impacted to varying degrees. Let us remain connected, share our experiences, and learn from one another.

Acknowledgements: The authors would like to acknowledge Jessica Petrey, the UofL librarian, for her assistance in obtaining and organizing up to date references.

Received: May 12, 2020

Accepted: May 18, 2020

Published: June 2, 2020

Funding Source: The author(s) received no specific funding for this work.

Conflict of Interest: All authors declared no conflict of interest in relation to the main objective of this work.

References

1. Rismanbaf A. Potential treatments for COVID-19: A narrative literature review. Arch Acad Emerg Med **2020**; 8(1):e29. PMID: 32232214.

2. Ferguson NM, Laydon D, Nedjati-Gilani G, et al. Impact of non-pharmaceutical interventions (NPIs) to reduce COVID-19 mortality and healthcare demand: WHO Collaborating Centre for Infectious Disease Modelling, MRC Centre for Global Infectious Disease Analysis, Abdul Latif Jameel Institute for Disease and Emergency Analytics, Imperial College London, **2020** 16 March 2020. Report No.: 9.

3. Cheng VCC, Wong SC, Chen JHK, et al. Escalating infection control response to the rapidly evolving epidemiology of the coronavirus disease 2019 (COVID-19) due to SARS-CoV-2 in Hong Kong. Infect Control Hosp Epidemiol **2020**; 41(5):493-8. doi: 10.1017/ice.2020.58. PMID: 32131908.

4. Singer AJ, Morley EJ, Henry MC. Staying ahead of the wave. N Engl J Med **2020**; 382(18):e44. doi: 10.1056/NEJMc2009409. PMID: 32283005.

5. Mehta N, Mazer-Amirshahi M, Alkindi N, Pourmand A. Pharmacotherapy in COVID-19: A narrative review for emergency providers. Am J Emerg Med **2020**; 38(7):1488-93. doi: 10.1016/j.ajem.2020.04.035. PMID: 32336586.

6. Hunt M, Koziatek C. A case of COVID-19 pneumonia in a young male with full body rash as a presenting symptom. Clin Pract Cases Emerg Med **2020**; 4(2):219-21. doi: 10.5811/cpcem.2020.3.47349. PMID: 32282312.

7. Ludvigsson JF. Systematic review of COVID-19 in children shows milder cases and a better prognosis than adults. Acta Paediatr **2020**; 109(6):1088-95. doi: 10.1111/apa.15270. PMID: 32202343.

8. Lai CC, Wang CY, Wang YH, Hsueh SC, Ko WC, Hsueh PR. Global epidemiology of coronavirus disease 2019 (COVID-19): Disease incidence, daily cumulative index, mortality, and their association with country healthcare resources and economic status. Int J Antimicrob Agents **2020**; 55(4):105946. doi: 10.1016/j.ijantimicag.2020.105946. PMID: 32199877.

9. Wu YC, Chen CS, Chan YJ. The outbreak of COVID-19: An overview. J Chin Med Assoc **2020**; 83(3):217-20. doi: 10.1097/jcma.0000000000000270. PMID: 32134861.

10. Yi Y, Lagniton PNP, Ye S, Li E, Xu RH. COVID-19: What has been learned and to be learned about the novel coronavirus disease. Int J Biol Sci **2020**; 16(10):1753-66. doi: 10.7150/ijbs.45134. PMID: 32226295.

11. Petrosillo N, Viceconte G, Ergonul O, Ippolito G, Petersen E. COVID-19, SARS and MERS: Are they closely related? Clin Microbiol Infect **2020**; 26(6):729-34. doi: 10.1016/j.cmi.2020.03.026. PMID: 32234451.

12. Arons MM, Hatfield KM, Reddy SC, et al. Presymptomatic SARS-CoV-2 infections and transmission in a skilled nursing facility. N Engl J Med **2020**; 382(22):2081-90. doi: 10.1056/NEJMoa2008457. PMID: 32329971.

13. Wee LE, Fua TP, Chua YY, et al. Containing COVID-19 in the emergency department: The role of improved case detection and segregation of suspect cases. Acad Emerg Med **2020**; 27(5):379-87. doi: 10.1111/acem.13984. PMID: 32281231.

14. Chavez S, Long B, Koyfman A, Liang SY. Coronavirus disease (COVID-19): A primer for emergency physicians. Am J Emerg Med **2021**; 44:220-9. doi: 10.1016/j.ajem.2020.03.036. PMID: 32265065.

15. Li LQ, Huang T, Wang YQ, et al. COVID-19 patients' clinical characteristics, discharge rate, and fatality rate of meta-analysis. J Med Virol **2020**; 92(6):577-83. doi: 10.1002/jmv.25757. PMID: 32162702.

16. Lechien JR, Chiesa-Estomba CM, Place S, et al. Clinical and epidemiological characteristics of 1420 european patients with mild-to-moderate coronavirus disease 2019. J Intern Med **2020**; 288(3):335-44. doi: 10.1111/joim.13089. PMID: 32352202.

17. Pascarella G, Strumia A, Piliego C, et al. COVID-19 diagnosis and management: A comprehensive review. J Intern Med **2020**; 288(2):192-206. doi: 10.1111/joim.13091. PMID: 32348588.

18. Das G, Mukherjee N, Ghosh S. Neurological insights of COVID-19 pandemic. ACS Chem Neurosci **2020**; 11(9):1206-9. doi: 10.1021/acschemneuro.0c00201. PMID: 32320211.

19. Mao L, Jin H, Wang M, et al. Neurologic manifestations of hospitalized patients with coronavirus disease 2019 in Wuhan, China. JAMA Neurol **2020**; 77(6):683-90. doi: 10.1001/jamaneurol.2020.1127. PMID: 32275288.

20. Bikdeli B, Madhavan MV, Jimenez D, et al. COVID-19 and thrombotic or thromboembolic disease: Implications for prevention, antithrombotic therapy, and follow-up: JACC state-of-the-art review. J Am Coll Cardiol **2020**; 75(23):2950-73. doi: 10.1016/j.jacc.2020.04.031. PMID: 32311448.

21. Carod-Artal FJ. Neurological complications of coronavirus and COVID-19. Rev Neurol **2020**; 70(9):311-22. doi: 10.33588/rn.7009.2020179. PMID: 32329044.

22. Caputo ND, Strayer RJ, Levitan R. Early self-proning in awake, non-intubated patients in the emergency department: A single ED's experience during the COVID-19 pandemic. Acad Emerg Med **2020**; 27(5):375-8. doi: 10.1111/acem.13994. PMID: 32320506.

23. Luo M, Cao S, Wei L, et al. Precautions for intubating patients with COVID-19. Anesthesiology **2020**; 132(6):1616-8. doi: 10.1097/aln.0000000000003288. PMID: 32195703.

24. Poston JT, Patel BK, Davis AM. Management of critically ill adults with COVID-19. JAMA **2020**; 323(18):1839-41. doi: 10.1001/jama.2020.4914. PMID: 32215647.

25. Kim D, Quinn J, Pinsky B, Shah NH, Brown I. Rates of co-infection between SARS-CoV-2 and other respiratory pathogens. JAMA **2020**; 323(20):2085-6. doi: 10.1001/jama.2020.6266. PMID: 32293646.

26. Cummings MJ, Baldwin MR, Abrams D, et al. Epidemiology, clinical course, and outcomes of critically ill adults with COVID-19 in New York city: A prospective cohort study. medRxiv **2020**:2020.04.15.20067157. doi: 10.1101/2020.04.15.20067157.

27. Hope MD, Raptis CA, Henry TS. Chest computed tomography for detection of coronavirus disease 2019 (COVID-19): Don't rush the science. Ann Intern Med **2020**; 173(2):147-8. doi: 10.7326/m20-1382. PMID: 32267912.

28. Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: A retrospective cohort study. Lancet **2020**; 395(10229):1054-62. doi: 10.1016/s0140-6736(20)30566-3. PMID: 32171076.

29. Zhou M, Zhang X, Qu J. Coronavirus disease 2019 (COVID-19): A clinical update. Front Med **2020**; 14(2):126-35. doi: 10.1007/s11684-020-0767-8. PMID: 32240462.

30. Terpos E, Ntanasis-Stathopoulos I, Elalamy I, et al. Hematological findings and complications of COVID-19. Am J Hematol **2020**; 95(7):834-47. doi: 10.1002/ajh.25829. PMID: 32282949.

31. Ji D, Zhang D, Xu J, et al. Prediction for progression risk in patients with COVID-19 pneumonia: The call score. Clin Infect Dis **2020**; 71(6):1393-9. doi: 10.1093/cid/ciaa414. PMID: 32271369.

32. Cai Q, Huang D, Yu H, et al. COVID-19: Abnormal liver function tests. J Hepatol **2020**; 73(3):566-74. doi: 10.1016/j.jhep.2020.04.006. PMID: 32298767.

33. Cao B, Wang Y, Wen D, et al. A trial of lopinavir-ritonavir in adults hospitalized with severe COVID-19. N Engl J Med **2020**; 382(19):1787-99. doi: 10.1056/NEJMoa2001282. PMID: 32187464.

34. Magagnoli J, Narendran S, Pereira F, et al. Outcomes of hydroxychloroquine usage in United States veterans hospitalized with COVID-19. medRxiv **2020**:2020.04.16.20065920. doi: 10.1101/2020.04.16.20065920.

35. Wang Y, Zhang D, Du G, et al. Remdesivir in adults with severe COVID-19: A randomised, double-blind, placebo-controlled, multicentre trial. Lancet **2020**; 395(10236):1569-78. doi: 10.1016/s0140-6736(20)31022-9. PMID: 32423584.

36. Xu X, Han M, Li T, et al. Effective treatment of severe COVID-19 patients with tocilizumab. Proc Natl Acad Sci U S A **2020**; 117(20):10970-5. doi: 10.1073/pnas.2005615117. PMID: 32350134.

37. Duanmu Y, Brown IP, Gibb WR, et al. Characteristics of emergency department patients with COVID-19 at a single site in northern California: Clinical observations and public health implications. Acad Emerg Med **2020**; 27(6):505-9. doi: 10.1111/acem.14003. PMID: 32344458.