



National Action Plan for Expanding and Adapting the Healthcare System for the Duration of the COVID Pandemic



JOHNS HOPKINS
BLOOMBERG SCHOOL
of PUBLIC HEALTH

Center for
Health Security

AUTHORS

Eric Toner, MD

Senior Scholar, Senior Scientist

Richard Waldhorn, MD

Contributing Scholar, Professor

Tener Veenema, RN, PhD, MS, MPH

Visiting Scholar, Professor

Amesh Adalja, MD

Senior Scholar

Diane Meyer, RN, MPH

Senior Managing Analyst, Research Associate

Elena Martin, MPH

Analyst, Research Associate

Lauren Sauer, MS

Contributing Scholar, Assistant Professor

Matthew Watson

Senior Analyst, Senior Research Associate

Lee Daugherty Biddison, MD, MPH

Contributing Scholar, Chief Wellness Officer, Johns Hopkins Medicine, Vice Chair for Clinical Affairs and Associate Professor, Johns Hopkins Department of Medicine

Anita Cicero, JD

Deputy Director

Tom Inglesby, MD

Director, Professor

Published May 5, 2020

Copyright © 2020 Johns Hopkins University

EXECUTIVE SUMMARY

The COVID-19 (COVID) pandemic has led to unprecedented action and innovation in the US healthcare system; at the same time, it has presented extraordinary challenges and risks. Through dramatic augmentation of surge capacity, deferral of other services, and implementation of crisis standards of care, hospitals in many locations have been able to absorb the blow of the first peak of COVID cases and continue to provide lifesaving care to both COVID patients and others with life-threatening emergencies. But many communities are just beginning to experience the full force of the pandemic, and in every location, the healthcare response to COVID has come at a very dear price. Healthcare facilities have sustained huge financial losses, and healthcare workers' health and well-being have been put at high risk. New standard operating procedures and work processes have been improvised, and many old lessons have had to be relearned.

There is an urgent near-term need to address key challenges faced now by healthcare facilities and healthcare workers in the pandemic, and this current crisis also has made painfully apparent the many vulnerabilities of our healthcare system and the longer-term structural reforms that are necessary to sustain it. This report offers answers and recommendations related to the following problems, for which there are tractable solutions:

- How can we improve infection prevention in hospitals and maintain a robust supply chain for personal protective equipment (PPE)?
- What approach should we take to restarting deferred healthcare services?
- What financial support is needed for hospitals and healthcare providers?
- How should the healthcare workforce be sustained and augmented?
- How can we provide mental health support for healthcare workers in this crisis?
- How can we provide medical care and sick leave for all people in the United States?
- How can we make telemedicine a new normal?
- How can we reduce the number of undiagnosed infectious diseases in our hospitals?
- How can we better protect emergency medical services (EMS) personnel from infectious diseases?
- How can we better coordinate the healthcare response to COVID and the next pandemic?

This is not an exhaustive compilation of all the challenges the health sector faces, but these are among the most important. We have organized these topics and recommendations roughly in order of the urgency with which they must be addressed. There is much to be done now.

How can we improve infection prevention in hospitals and maintain a robust supply chain for PPE?

The opportunities for nosocomial COVID transmission in the healthcare system are numerous, particularly during aerosol-creating procedures such as intubation or manual ventilation. To prevent transmission in hospitals, infection prevention and control measures must be improved and maintained. The US Centers for Disease Prevention and Control (CDC) has provided and regularly updates guidelines on their website for infection prevention and control in healthcare settings. These recommendations, which cover topics such as ways to reduce exposure opportunities, patient isolation, staff training, infection prevention and control precautions, and environmental infection control, should be reviewed and implemented by all healthcare facilities.¹

Importantly, to properly operationalize these guidelines, facilities need consistent access to sufficient levels of proper PPE and other materials necessary to prevent transmission, such as hospital-grade disinfectants and hand sanitizer. Unfortunately, shortages of these resources, particularly PPE, have been widespread during the pandemic due to high demand, fragile supply chains, and limited stockpiles.^{2,3} This has greatly hindered infection prevention and control efforts. Whereas the national need for PPE during this first wave of the pandemic has been estimated,⁴ there is no publicly available information on the supply. Although PPE from the federal Strategic National Stockpile (SNS) has been distributed, for the most part healthcare facilities and states have had to source their own limited supplies of PPE, often in competition with each other.

There are several critical elements of the supply and use of PPE that must be considered at the state and federal levels in order to ensure ongoing healthcare operations.⁵ At each of the federal, state, and healthcare facility levels, PPE supplies and needs should be systematically and continually assessed. Supply chain issues are typically part of the incident command structure at each level. However, there is no preexisting mechanism for providing needed situational awareness regarding the availability of supplies. No agency of government is responsible for tracking supply or manufacturing capacity for PPE, and manufacturers are not required to report this information. To determine near-term PPE needs, forecasting scenarios should be used at all levels (including alternative PPE supplier options) to get ahead of possible absolute shortages.

If PPE supplies are not adequate to permit their use under conventional standards, back-up options should be identified in line with [crisis standards of care guidelines](#) to use PPE in ways that diverge from normal practices.

It is critical to implement a strategy to monitor PPE use and distribution and to centralize visibility of orders placed at every level. This improves purchasing power and allows for strategic realignment of supplies to match needs and fill gaps in coverage. It also allows for the identification of potential failure points and bottlenecks. These areas can then be targeted for rapid intervention and mitigation strategies.⁶

Decontamination and reuse strategies should be developed by healthcare facilities and tested in advance whenever possible. Validated and/or FDA-approved measures should be prioritized, and respirators should be collected and stored for future decontamination, even if the current supply does not warrant decontamination and reuse strategies.⁷

Finally, healthcare systems should look to adopt reusable respirators, such as elastomeric facemasks⁸ and powered air-purifying respirators (PAPRs), wherever possible, both now and going forward. Training and fit testing healthcare workers on respirators can be time-consuming and may waste PPE and critical personnel hours. Additionally, disposable respirators and respirators with disposable elements are reliant on a frail supply chain. The procurement and use of reusable respirators at scale may alleviate this reliance.

Once the crisis phase of the pandemic is over, entities at every level should conduct a high-level mapping of the depth of their PPE supply chain. Often, visibility of the entire supply chain system is quite limited, and a careful review of the entire system is the first step toward strengthening our supply chain capabilities.⁹ This review, conducted nationally and made public, should include mapping all elements of the supply chain, including the regulatory environment, raw materials, manufacturing, distribution (including transportation), and healthcare system use. Individual healthcare facilities should evaluate their supplier and distribution chains and evaluate the need for additional redundancies.

Now and going forward, there are opportunities for innovation and adaptation of PPE approaches.¹⁰ Federal entities, including the Defense Advanced Research Projects Agency (DARPA), the Food and Drug Administration (FDA), and the National Institute of Occupational Safety and Health (NIOSH), should work with industry leaders, academic partners, innovation labs, and PPE end-users to create truly novel, reusable PPE solutions. Innovative approaches, such as improving elastomeric respirators and streamlining PAPRs, can reduce the reliance on the global raw material and manufacturing supply chains and will be beneficial to the entire system. Furthermore, having more domestic production of PPE would lessen our reliance on long and potentially vulnerable supply chains. New legal requirements for a centralized reporting system for certain supply chains could also be considered.

Recommendations:

- Federal, state, and local governments must continue to address PPE access issues or risk continued disease spread.
- As facilities continue to improvise to conserve PPE, they must also implement just-in-time training of healthcare workers in proper PPE selection, donning, and doffing and on other infection prevention and control measures, so that they can safely treat patients and use existing resources wisely.

- Healthcare facilities should continue to implement elevated levels of infection prevention and control practice for the long term. This may have the beneficial consequence of reducing other nosocomial infections.
- Healthcare facilities should develop crisis standard of care plans for PPE.
- The federal government should create a centralized information-sharing system so that, in a declared emergency, states and healthcare facilities work collaboratively in sourcing PPE and other scarce medical supplies.
- Federal agencies should continue to conduct research and provide guidance related to decontamination and reuse of PPE.
- Congress and the executive branch should consider legislation to foster greater domestic production of PPE.
- Healthcare facilities should devote a greater share of their respirator purchases to reusable devices, such as elastomeric face masks and PAPRs, and federal agencies should foster research into making these devices easier to use.
- The federal government should maintain situational awareness of the supply chains and manufacturing capacity of all PPE, and suppliers and manufacturers doing business in the United States should be required to supply the needed data.
- A much greater level of tracking and coordination of the medical supply chain is needed. Some of this challenge may best be suited to the SNS; however, this would require a much larger organization with broader powers and much more funding. Other aspects of the supply chain may best be managed by the critical infrastructure program of the Assistant Secretary for Preparedness and Response (ASPR), the FDA, or the CDC. It needs to be determined which organization is best suited to each item, but the supply chains of all regulated medical products, including countermeasures, medical devices, and PPE, should be actively tracked and coordinated.

What approach should we take to restarting deferred healthcare services?

Across the country, “elective” healthcare services in hospitals, outpatient centers, and physicians’ offices have been canceled or deferred in order to create capacity for COVID patients, conserve PPE, and avoid exposing noninfected patients to the virus circulating in these facilities. This has allowed for the reallocation of staff, space, and equipment to meet the surge demands of the pandemic in a US hospital system that normally operates at full capacity.

Some of the services, such as cosmetic procedures or joint replacements, are truly elective, but others, such as cancer or heart surgeries, become less elective the longer they are delayed. There is a need to resume these services as soon as possible. But pulling back from the surge model, in which anesthesiologists and surgeons are needed as critical care physicians, anesthesia machines are being used as ventilators,

and recovery rooms are used as makeshift intensive care units (ICUs), is possible only when the epidemiologic data in the community and in the healthcare system indicate a clear reduction in confirmed active new cases.¹¹ Hospital data on COVID presentations to the emergency department (ED), admissions, ICU census, and ventilator and PPE use should be analyzed to demonstrate a clear decline toward pre-COVID levels of use. If hospitals are operating well within their limits and have available capacity as the epidemic wanes in their region, then it would make sense for them to consider resuming elective procedures. However, if hospitals are still struggling to cope with COVID patients, then they should wait. It is the healthcare facilities themselves that are likely to know best, by reviewing epidemiologic data and utilization rates in their hospitals, the best timing for resuming elective procedures.

In addition to cancellation and delay of elective surgeries and other routine services, there has been a decrease in hospital visits for a variety of conditions, presumably related to stay-at-home orders, quarantine, or fear of contagion. As COVID cases decline in certain regions and patients increasingly view the risk of contracting COVID in a hospital to be lower, more patients are likely to present to EDs. Thus, we expect that in the coming months, hospital load due to non-COVID patients will increase. This will be occurring at the same time as social distancing is eased, which itself may result in more hospitalizations of COVID patients. For this reason, at least in the coming months, excess hospital and medical capacity should be maintained to cope with a potential rebound in COVID patients and rising numbers of non-COVID patients, until such a time when COVID is clearly reduced to small and manageable numbers in a given community and pent-up demand for regular medical care has been addressed. Regular reassessment of demand for routine hospital services and close monitoring of the numbers of hospitalized COVID cases will be needed as social distancing restrictions are relaxed.

In addition to the challenge of when to resume deferred procedures and how to maintain increased capacity for some time, hospitals, clinics, and physicians' offices will have to address infection control issues. Because there is asymptomatic infection in the community, as surgeries and outpatient services resume, there will be a significant risk of nosocomial spread of infection in hospitals, clinics, and outpatient surgery centers due to patients with unsuspected COVID infections who are being treated for unrelated conditions. Strict measures to prevent disease transmission, telephone or off-site screening, and rapid testing will be required. Routine rapid COVID testing for all hospital admission and preoperative patients should become the new normal. There may be a resurgence of COVID cases to such a level that cancellations may need to be resumed.

To organize a gradual resumption of services as the COVID critical care demand subsides, a priority system for restarting deferred healthcare services must be developed in hospitals and the healthcare system. For example, in-hospital oncology services, cardiovascular and stroke care, infusion services, and transplants might be assigned the highest priority.¹²

There also will be time pressure to resume revenue-generating procedures, without which hospitals will have difficulty staying solvent. Given the tremendous financial losses incurred by hospitals during surge conditions since mid-March 2020, it makes sense to focus on ways to bring medical procedures back on line safely and promptly. This is not only needed for the health of the population cared for by the hospital that has had to defer substantial amounts of care, but it will also strengthen the financial position of hospitals to respond to COVID and all other normal medical problems in the year ahead. One near-term priority for hospitals should be resuming surgical procedures that have been delayed, with a negative impact on the medical condition of a patient. Consideration should be given as well to prioritizing procedures that are least disruptive to ongoing inpatient COVID activity. Previously scheduled elective surgeries, semi-urgent newly scheduled surgeries, and diagnostic and interventional procedures in cardiac catheterization labs, interventional radiology, and gastrointestinal and pulmonary interventional endoscopy suites might be the next to resume.

To prepare for this transition, hospitals should develop a roster of patients or procedure types on a “waiting list” and assemble a team to prioritize them based on objective medical need and the availability of the relevant needed staff.¹³

Outpatient services in medical offices and clinics have also shut down or significantly curtailed services. As community spread of COVID decreases, these facilities will be able to resume operation, and they too will have a significant backlog of deferred patients. Again, an objective triage process managed by the facilities themselves should be used to assign priority.

At the same time this is happening, inpatient or outpatient staff may be reduced due to illness or continued reassignment to other activities. To mitigate the demand for staff, outpatient practices should consider continuing telehealth for follow-up and many routine visits, expanding the use and responsibilities of allied health professionals, and adopting a team approach to care.¹⁴ And as with hospitals, in the outpatient setting, there must be continued emphasis on infection control measures, including appropriate use of PPE, masks for patients, telephone pre-screening, and segregation of respiratory illness patients in waiting areas and office entrances and exits.

Recommendations:

- Hospital data on COVID presentations to the ED, admissions, ICU census, and ventilator and PPE use should be analyzed to demonstrate a clear plateau or return to pre-COVID levels of utilization before deferred services are resumed.
- Augmented levels of hospital capacity must be maintained even as COVID cases decrease to be ready for a surge in non-COVID cases that were deferred and a possible rebound in COVID cases.
- Rapid COVID testing should become routine for all hospital admissions, and high levels of infection prevention should be maintained because of the risk presented by asymptomatic carriers.

- Resumption of deferred inpatient and outpatient services should be prioritized (triaged) based on an assessment of objective patient health needs and availability of needed hospital space, equipment, supplies, and staff.

What financial support is needed for healthcare facilities and healthcare providers?

The COVID pandemic has resulted in a precipitous decline in individuals seeking care for non-COVID-related health concerns. Many outpatient visits are being converted to a telemedicine format, and care requiring in-person evaluation is being postponed as much as possible. This approach covers a wide range of services, from office visits to imaging to elective surgeries. The loss of patient volume is resulting in financial challenges for both healthcare facilities and practitioners. In a survey of 724 medical practices throughout the United States conducted by the Medical Group Management Association, 97% of practices reported negative financial impacts as a result of the COVID pandemic.¹⁵ The survey also found that practices on average are seeing a 60% decrease in patient volumes and a 55% decrease in practice revenues.

While some areas have seen the need for many additional healthcare providers during the pandemic, most notably the New York City metro area,¹⁶ others that have not experienced the same numbers of cases are facing the reality of laying off or furloughing healthcare workers due to the fall-off in demand for non-COVID-related health services.¹⁷

Financial support will be needed for hospitals hardest hit by surges of COVID patients due to the extraordinary costs they have incurred for things such as increased staffing, purchases of PPE and ventilators, and configuring new ICUs and isolation rooms. At the same time, they have lost considerable income from revenue-generating services that they have had to cancel. Many practitioners and outpatient healthcare facilities have also lost much of their revenue due to canceled healthcare services.

But healthcare facilities and practitioners that have been relatively spared will also need financial support due to losses from cancellation of services and decreased patient volume because of stay-at-home orders. There are few corners of the healthcare system left untouched by the pandemic. Practices and healthcare facilities driven into insolvency during the pandemic will need financial support to pay healthcare workers' salaries, purchase needed supplies, and provide the care that has been deferred during the pandemic. This will be especially important as the peak of the pandemic passes and a surge of deferred non-COVID health services begins—but with the need for increased infection prevention and PPE requirements to prevent COVID transmission.

The ASPR office in the Department of Health and Human Services (HHS) has already provided \$100 million to support certain healthcare systems and coalitions in preparing for COVID surges.¹⁸ The Coronavirus Aid, Relief, and Economic Security (CARES) Act provides an additional \$175 billion to cover costs and losses to hospitals and some

providers.¹⁹ Until there is a vaccine, there will be ongoing public fear of contagion at healthcare settings, which may result in sustained decreases in patient volume beyond the immediate response and recovery to the pandemic. It is not clear that the funds authorized so far are enough to cover all the losses incurred to date, much less the ongoing losses that the health sector will continue to experience.

In addition to emergency funding, there needs to be ongoing funding to foster and incentivize greater sustained preparedness and infection prevention activities going forward. One way to do this is through marginal increases in payments to healthcare facilities for all services.

Recommendations:

- HHS and states should establish mechanisms to track financial losses in the health sector, and if losses prove to be significantly higher than what would be covered by the CARES Act, more assistance should be sought from Congress.
- HHS should consider establishing a crisis fund to provide short-term bridge funding for hospitals on the verge of financial collapse.
- To inform possible future funding legislation above and beyond the funding already authorized, HHS should determine how much additional funding may be needed to cover health-sector losses due to the pandemic.
- The Centers for Medicare and Medicaid Services (CMS) should consider funding facilities that achieve certain preparedness or infection prevention goals at a marginally higher rate than others.

How should the healthcare workforce be sustained and augmented?

Recruiting, retaining, and protecting healthcare workers during the COVID pandemic is fundamental to sustaining the US healthcare system.²⁰ Healthcare workers are among the groups with highest risk during the pandemic because of their prolonged proximity to infected patients, a situation compounded by shortages in protective equipment in the areas hardest hit by COVID. Inadequate protection of healthcare workers during the COVID pandemic undermines the ability to provide clinical care and fractures the system's social responsibility to the community. As of April 14, 2020, more than 9,000 healthcare workers in the United States had contracted the disease, and 27 had died.²¹ Many currently employed healthcare workers are over the age of 65 and have conditions that may elevate their risk for hospitalization or death if they contract COVID, suggesting that hospitals consider whether such workers, including physicians and nurses, should be redeployed away from the highest-risk sites.^{22,23}

Aggressive actions by state governors to procure additional supplies of PPE, rapid redesign of hospital workflow and staffing patterns (eg, “cohorting” of COVID patients, moving to unidirectional flow through units, and team nursing), engineering controls,

and special training of hospital staff are all logical and good attempts to mitigate transmission of disease. Yet, the implementation of these measures cannot compensate fully for a healthcare system that was underprepared for a pandemic of this scale. In the absence of adequate protective measures, an exhausted and demoralized healthcare workforce will continue to experience increased morbidity and mortality, with rising rates of absenteeism, and many may leave the workforce permanently. In addition to sourcing adequate PPE, healthcare facility administrators must practice transparent communications and display an unwavering commitment to worker safety.

Maintaining an adequate healthcare workforce during this crisis and in the future requires not only maintaining an adequate number of healthcare workers, but also optimizing conditions that enable each clinician to care for a high volume of patients. This includes retraining clinicians and allowing them to practice to the top of their licenses, in addition to strategies to enhance their well-being and avoid burn out. Given the uncertainty regarding the duration of the COVID pandemic, and with the promise of a vaccine a year or more away, it is essential that healthcare workers be able to perform to their full potential over an extended period of time.²⁴ Many communities and healthcare facilities struggled before the pandemic with chronic shortages of physicians, nurses, respiratory therapists, and other highly trained professionals. This will be exacerbated if healthcare workers leave the field as a result of the pandemic.

Healthcare workers are being mobilized and deployed to units within and outside of traditional healthcare settings to meet the surge in demand for screening, testing, medical countermeasures (once they become available), and clinical care. Keeping in mind that healthcare workers are coping with the same societal shifts and emotional stressors faced by the population at large, they are now expected to function in a rapidly evolving practice environment that differs greatly from that with which they are familiar.²⁵ Paradoxically, while areas such as New York City and New Jersey are desperate for additional staff, healthcare workers in other areas of the country are being furloughed, suggesting an inefficient distribution of healthcare workers as a national asset.

Healthcare workers' duties and willingness to work have always been context-specific and correspond to the nature and scale of threat that public health disasters pose to the common good. Willingness to continue to work, or not continue to work (absenteeism), in a large-scale public health emergency such as the COVID pandemic is dependent on a multitude of factors.²⁶⁻²⁸ Healthcare workers' perceptions of the risk, sense of their own clinical competence (eg, knowing how to care for patients during the pandemic), confidence in their employer's commitment to create a safe workplace environment (eg, preparedness planning for respiratory protection and worker vaccination programs), and logistical ability to show up for work (childcare, etc) contribute to their decision to keep working.²⁹⁻³¹ While the severity of the current pandemic calls for a population health ethic to "do the greatest good, for the greatest number, with the least amount of harm" and attends to our common good as a society, ultimately, healthcare workers need to know that they are safe and that they can keep their families safe.

As COVID significantly increases healthcare workers' risks of disease and death, particularly for those in high-risk categories, absenteeism due to the choice to not work is not entirely unreasonable.³² This decision making may represent adaptive behavior on the part of healthcare workers and thus offers a framework for organizations for designing support services and mitigation strategies to sustain the workforce.

Responsibility for creating and sustaining the healthcare workforce does not fall on the healthcare system alone: Government and public/private partnerships also contribute to the labor landscape. Healthcare workers will value support services and prioritized access to protective and preventive measures. These measures include priority for testing, preferential access to antiviral therapies and vaccination, and greater access to PPE when it becomes available.^{23,33,34} Ensuring care of and equal access to these assets for healthcare workers' family members would enhance workforce confidence and willingness to continue to work. Analogies of "going into battle" and "being at war with the virus" have led some to suggest that hazard pay, preferential tax treatment, and other financial remuneration may be warranted to protect the integrity of the workforce. As the healthcare system shifts to adapt to the impact of the pandemic, new sites are launching that need physician and nurse expertise, including telemedicine services, patient advice lines, and augmented telephone triage systems. Models for cross-state licensure of healthcare workers beyond existing discipline-specific compact states would facilitate staffing of these ventures.

Recommendations:

- Regulatory constraints addressing licensure, certification, and scope of practice of healthcare workers need to be relaxed so as to augment the existing healthcare workforce.
- Existing regulatory barriers to telephone- or video-based clinical encounters should be removed. These include changes in federal or state legislation or regulations, suspension of stringent enforcement of the Health Insurance Portability and Accountability (HIPA) Act, and ensuring payment parity with in-person encounters.
- Models for cross-state licensure of healthcare workers beyond existing discipline-specific compact states should be created to facilitate staffing various forms of telemedicine and e-health resources.
- Congress should immediately enact legislation and emergency regulatory authority to enable healthcare workers to deliver care to the top of their license and training—that is, practicing to the full extent of their education and training, instead of spending time doing activities that could be effectively done by others with less expertise—and to authorize and appropriate a consistent funding stream for healthcare worker emergency preparedness and response education and training. Relevant disciplines include advanced practice nurses, physician assistants, pharmacists, paramedics, and emergency medical technicians.

- States can activate state healthcare professional reserve units to provide immediate additional staffing for physical care delivery, telephone triage, and logistics support. Retired healthcare workers can provide invaluable service and expertise at the local level if deployed safely and appropriately.
- Federal and state governments should invest in programs to support the training and hiring of healthcare workers to foster the growth of the healthcare workforce.
- Healthcare facilities should consider hazard pay to healthcare workers involved in direct patient care of COVID patients during extraordinary surge conditions.

How can we provide mental health support for healthcare workers in this crisis?

The stress of caring for an ever-expanding number of COVID patients in health systems across the United States has placed a tremendous mental health burden on our healthcare workforce. While most of the population is socially distanced in the relative safety of their homes, healthcare workers, including clinical and support staff, are caring for patients with COVID, often without the resources required to do so safely. Lack of PPE, appropriate training, and staff have hindered their ability to save lives as they would normally. Tens of thousands of patients in the United States have died despite great efforts to save them, which has had a severe impact on morale. Additionally, the potential for healthcare workers to become infected is high: One recent CDC report found that, of those case reports that included data on healthcare worker employee status, 19% of those infected with COVID were reported to be healthcare workers, although it is not clear how many were infected on the job. At least 27 healthcare workers have died, but these statistics are all likely underestimates because of incomplete testing and reporting.²¹ Healthcare workers must also wrestle with the potential that they may infect members of their own family.

The morbidity and mortality of hospitalized COVID cases, coupled with the concern among healthcare workers that they themselves, their colleagues, or family members may contract the virus, have led to physical and mental exhaustion in the healthcare workforce.³⁵ It is imperative that leaders at the federal, state, and local levels identify ways to support and protect the mental health of this essential workforce so that they can continue to care for patients.

One potential exemplar to emulate is Project Liberty, which was initiated after the September 11 terrorist attacks in New York City to support the mental health needs of those affected by the crisis. This program was funded by FEMA's Crisis Counseling Assistance and Training Program, which "funds short-term public education, outreach, and crises counseling services" after a federal disaster declaration.³⁶

Additionally, individual facilities “need to address the stress on individual providers and on general operations by monitoring reactions and performance, altering assignments and schedules, modifying expectations, and creating mechanisms to offer psychosocial support as needed.”³⁷ For example, participants in one study that looked at the domestic response to the 2014-16 Ebola outbreak identified hospital-based mental health programs led by clergy members and counselors as critical to supporting their mental health and morale.³⁸ Some university systems have already implemented systems to support the mental health and wellbeing of healthcare workers, including links to emotional support hotlines, pastoral care, stress reduction activities, and many other resources.³⁹ It is important that all healthcare workers have access to these types of immediate and long-term resources to prevent lasting effects, such as post-traumatic stress disorder.

Recommendations:

- Hospitals and other healthcare facilities should make counseling available to staff and implement mental health and well-being support programs.
- Local and state governments should consider jurisdiction-wide mental health support programs for healthcare workers.
- HHS, through the Substance Abuse and Mental Health Services Administration (SAMHSA), should provide guidance and best practices to state and local governments and healthcare facilities.

How can we provide medical care and sick leave for all people in the United States?

Although systemic barriers and disparities in access to health care have been persistent issues in the United States, COVID has further exposed gaps in a system for ensuring the health of individuals in the nation. The current state of healthcare financing and delivery is insufficient to meet the needs of many individuals. Those without insurance may fear the financial consequences of seeking medical care, which could lead to greater morbidity and mortality as well as more transmission of disease.⁴⁰

Before the pandemic, approximately 26 million people in America did not have health insurance.⁴¹ As of April 30, 2020, another 30 million or more Americans are newly unemployed due to the response to the pandemic, and therefore many are, or soon will be, without employer-provided health coverage. This precludes people from having access to care for COVID and everything else.

Universal healthcare coverage is needed now more than ever to ensure coverage of COVID and non-COVID care for individuals who are without health insurance or who are newly unemployed due to the pandemic. For individuals recently unemployed, COBRA plans provide the ability to maintain coverage after termination of employment, but these plans can increase costs to individuals up to 5-fold from previous costs.⁴²

With the potential to need high levels of hospital care for extended periods of time due to severe COVID illness, lack of insurance coverage could cost individuals as much as \$75,000, and this figure does not include prolonged intensive care or mechanical ventilation.⁴³ The CARES Act provides \$30 billion to reimburse hospitals at Medicare rates for uncompensated care of patients who are uninsured and prohibits hospitals from balance billing these patients.⁴⁴ It is not clear, however, that this coverage extends to all aspects of care, including physicians' fees and outpatient or rehabilitation expenses.

Another need is paid sick leave. From the outset of the pandemic, the messaging to individuals and communities has been to stay home if you are sick. However, many employers do not offer paid time off, which creates a financial barrier to adhering to these public health recommendations.

The federal government should take action to ensure the ability of all individuals to attain health care, isolate if sick, and adhere to public health recommendations. This is needed not only to prevent the unnecessary loss of life but to protect communities and ensure measures can be taken to prevent the further spread of COVID.

Recommendations:

- The Administration and Congress should ensure that all healthcare costs related to COVID are covered under the CARES Act.
- Congress should pass legislation to require all employers to provide at least 10 days of paid sick leave to all employees for the duration of the pandemic.
- Given the high and growing number of uninsured people in the country due to this crisis, Congress should develop a plan to ensure access to affordable healthcare coverage for all Americans.

How can we make telemedicine a new normal?

The rise of telemedicine as an alternative and supplement to in-person visits had been steadily increasing over the past decade. Many routine healthcare needs, such as dermatology visits, primary care visits, and post-op visits, were found to be amenable to this technology without any detriment to patient care.⁴⁵ Even simple electronic chart review consultations of in-patients have been found to be beneficial in some contexts.⁴⁶

The advent of the pandemic and the ensuing limitation of outpatient clinic visits in many parts of the country created a need to immediately scale-up telemedicine and divert many patients to that format of interacting with their healthcare providers. As the pandemic continues and hospitals seek to preserve capacity and limit the exposure of both providers and patients to the virus at healthcare facilities, it is likely that use of telemedicine will continue to increase.

To that end, healthcare facilities should invest in technological solutions to accomplish such a transition. It is likely that this investment will have an enduring value that extends beyond the pandemic, as the growth of telemedicine will only increase and be accelerated significantly by its use during the pandemic.

It will be crucial, however, that healthcare facilities carefully scrutinize what may or may not be suitable for a telemedicine visit and not fail to evaluate patients in person when it is medically indicated. It is also vital that physician compensation plans, which often value telemedicine visits lower than in-person visits, treat such visits with parity so as not to disincentivize the use of telemedicine.

Recommendations:

- Healthcare facilities should make substantial long-term investments in telemedicine and telehealth.
- Healthcare payers should reimburse telemedicine visits on par with in-person visits.
- HHS in collaboration with professional societies should provide guidance and best practices for telemedicine and telehealth.

How can we reduce the number of undiagnosed infectious diseases in our hospitals?

The first cases of this pandemic, like those of SARS before it, were described as a viral pneumonia that defied diagnosis. Through a process of genetic sequencing, a novel coronavirus was identified.⁴⁷ Similarly, the 2009 H1N1 influenza pandemic virus was initially identified as an untypeable influenza virus in a research study.⁴⁸ It is certain that prior to the initial 41-person cluster of COVID patients in Wuhan, China, in late December 2019 and January 2010, the SARS-CoV-2 virus (the virus that causes COVID-19) was circulating and causing sporadic or unnoticed infections for weeks. However, these cases went unidentified, as they were hidden among other cases of pneumonia and influenza. This is not surprising, as many cases of pneumonia are not diagnosed to a specific microbiologic level;⁴⁹ rather, they are treated only empirically with broad-spectrum antibiotics with very basic microbiological investigation pursued. A similar situation occurs with sepsis, encephalitis, and viral meningitis.

The empirical treatment approach to infectious disease diagnosis leaves the world vulnerable to pandemic threats that go unnoticed as they make their first forays into humans, mixed among common clinical syndromes such as pneumonia, meningitis, encephalitis, and sepsis. In developed countries, there is no technological barrier to specific microbiologic diagnoses, as various technologies are commercially available but not widely used.⁵⁰ The advent of the pandemic has persuaded many hospitals to invest in such diagnostic tests.

To enhance pandemic preparedness, it is essential that such diagnostic testing become more widely employed in hospitals throughout the country with all infectious disease syndromes. To facilitate this improvement in diagnostic acumen, policymakers must remove diagnostic testing from payment bundles. Currently, hospitals are typically paid a lump sum for all care provided to a patient based on the diagnosis. With a fixed price for each diagnostic group, any dollar spent on diagnostic testing that does not shorten the length of stay reduces the reimbursement available to offset other costs. Therefore, there is a financial disincentive to diagnostic testing, because it diminishes hospital reimbursement for in-patients.

Recommendations:

- CMS and other payers should separate diagnostic testing from bundled payments.
- CDC and professional societies should provide guidance and best practices regarding microbiologic diagnostic testing.
- CMS and accrediting bodies should track and review excessive use of infectious disease diagnoses without a microbiologic diagnosis.

How can we better protect EMS personnel from infectious diseases?

Emergency medical services systems and providers are on the front lines of the health response to large-scale disasters, including COVID. EMS professionals in the United States have provided medical care and transportation during pandemic influenzas, importations of Ebola, and other high-consequence pathogens, but none have had the widespread systemic effects of COVID. Because of the unpredictable and, at times, chaotic nature of EMS practice, EMS providers face different occupational health risks compared with hospital-based clinicians. Infection control and prevention practices in EMS rely primarily on the provision and proper use of PPE and on universal precautions, such as hand hygiene. However, like other healthcare workers, EMS providers have been facing serious shortages of PPE. EMS agencies chronically struggle with inadequate funding, which limits their ability to stockpile appropriate PPE.⁵¹ As such, COVID is taking a dramatic toll on the EMS workforce in the hardest hit areas. Amid record-high call volumes, it was reported that 1 in every 4 New York fire department EMS providers had called in sick and that roughly 10% of the workforce had tested positive for COVID.⁵² A similar but perhaps less dramatic strain on EMS is expected in other states with increasing COVID transmission. It is not clear what role infected EMS personnel may play in the spread of COVID.

The highly fragmented nature of EMS practice in the United States makes achieving systemic reforms challenging. However, recent years have seen some qualified successes. HHS's Hospital Preparedness Program (HPP) provides a grant mechanism to enable hospitals, public health departments, EMS agencies, and other stakeholders in a given locality to conduct joint planning for large-scale emergencies, an investment that

we believe has paid dividends. However, additional resources and creative thinking will be needed to more fully integrate EMS systems and providers into the larger healthcare response to high-consequence epidemic and pandemic diseases. To that end, we recommend the following:

Recommendations

- Federal, state, and local governments should prioritize and fund EMS systems and providers to receive PPE, particularly N95 respirators, on par with hospitals.
- States should integrate EMS data into COVID surveillance systems to better understand disease transmission, especially in large cities.
- In the longer term, CMS should reconsider the reimbursement process for EMS, and state and local governments should reassess the baseline funding needs of EMS.

How can we better coordinate the healthcare response to COVID and the next pandemic?

During any disaster, it is important for healthcare facilities to work together to effectively treat as many patients as possible. This is especially true in a catastrophic event like the COVID pandemic. Hospitals need to work with each other, EMS, and public health agencies to distribute patient load optimally. They also need to coordinate around staffing, resources, and uniform implementation of crisis standards of care, among many other issues. Without this coordination, for example, a hospital could be completely overwhelmed, resulting in unnecessary deaths, while a neighboring hospital has plenty of excess capacity.

During the response to COVID, we have seen examples of healthcare facilities sharing resources (eg, ventilators) and personnel. Largely, but not exclusively, this has occurred within health systems. We have also seen very encouraging evidence of collaboration among competing health systems around crisis standards of care and allocation of scarce resources. And we have seen unprecedented action by mayors and governors to coordinate the health response using their emergency powers. State hospital associations and boards of health have also been providing important coordination. These actions are very encouraging, and continued cooperation will be essential in the near term going forward as deferred services are resumed and possible subsequent waves of COVID occur.

Healthcare coalitions^{53,54} have been created to foster this kind of cooperation. Healthcare coalitions are fundamental to the current US national strategy for healthcare preparedness. As a required part of the HPP program, the 360 healthcare coalitions are intended to foster collaborative planning for and response to disasters and emergencies among local healthcare facilities, public health agencies, EMS, and other stakeholders.¹⁸ For example, coalitions should be helping to coordinate the sharing of scarce resources,

such as PPE, ventilators, and healthcare workers. In addition, healthcare coalitions are well situated to gather needed data on healthcare facility capacity and share that with the state. At this point, we do not know how effective coalitions have been during the pandemic or what specific roles they have played in various communities. Hopefully, the pandemic will be a driver of even more robust engagement in the coalitions by a variety of healthcare entities.

The federal government has limited situational awareness of the front-line healthcare system. For over a decade, HHS has sought an effective mechanism to know how hospitals and other healthcare facilities are doing during a crisis and what help they may need. However, there is no existing system for hospitals to efficiently provide real-time capacity data and operational status to ASPR. This hampers the ability to coordinate federal support and decision making at the highest levels of government. HHS must prioritize finding solutions to this important gap in federal emergency management. One solution may be to harness the vast amounts of data that exist in electronic medical records systems.

Recommendations:

- The healthcare situational awareness capabilities of ASPR should be substantially improved now and in the future so that the secretary and the White House can have a clear and up-to-the-minute understanding of what is happening on the ground in hospitals and other healthcare facilities.
- The ways in which mayors and governors coordinated the healthcare response in their jurisdictions and the emergency measures they implemented should be studied and compiled to distill a compendium of best practices to inform the remainder of this pandemic and future crises.
- The role and effectiveness of healthcare coalitions during the COVID pandemic should be studied to provide best practices going forward and to inform future program strategy.
- Electronic medical records must be made interoperable, more accessible, and searchable by public health personnel to aid in state and federal situational awareness and emergency management. Pilot projects to explore the feasibility of this should be considered.
- The federal HPP should be greatly strengthened. Its budget should be increased significantly in conjunction with a strategy for enhancing healthcare preparedness across the board. This funding is especially needed to pay for coalition and other cross-sectoral and regional activities.
- Likewise, the CMS's emergency preparedness rule should be further strengthened and tied to reimbursement levels. The relative proportion of healthcare preparedness that should be funded through HPP versus CMS reimbursement needs to be determined.

- The United States needs more hospital surge capacity. Market forces have driven the number of staffed beds to a level that provides very little surge capacity, and many small hospitals in rural communities have closed. This makes the country vulnerable to unpredictable surges in volume, whether from an epidemic or another kind of disaster. Local, state, and federal governments all have an interest in there being more surge capacity, and they should all provide funding toward this end.

CONCLUSION

The COVID pandemic has clearly demonstrated the need for more robust healthcare preparedness and some fundamental changes in US health policy. In this report, we have outlined both short- and long-term recommendations to address this need. Each of these high-level recommendations needs to be fully fleshed out, which will require much more work, but we believe that together they provide a reasonable action plan for meeting the immediate pressing issues presented by the pandemic and adapting the healthcare system to make it more resilient to future epidemics and emergencies. We have not addressed all of the issues facing the healthcare system, but we have made judgments about what we feel are the highest priorities. As time goes on and as we learn more, these priorities may well change.

These recommendations will cost billions of dollars, but they may also provide day-to-day benefits in the quality of patient care and will certainly cost less than the trillions now being spent because our public health and healthcare system was not prepared or equipped for this pandemic.

REFERENCES

1. Centers for Disease Control and Prevention. Infection control guidance for healthcare professionals about coronavirus (COVID-19). Last reviewed April 24, 2020. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control.html>. Accessed April 27, 2020.
2. American Nurses Association. Survey: nurses fear going to work due to lack of protection from virus more than 32k nurses share experience from the front lines [press release]. April 24, 2020. <https://www.nursingworld.org/news/news-releases/2020/survey-nurses-fear-going-to-work-due-to-lack-of-protection-from-virus-more-than-32k-nurses-share-experience-from-the-front-lines/>. Accessed May 1, 2020.
3. Grimm CA. *Hospital Experiences Responding to the COVID-19 Pandemic: Results of a National Pulse Survey March 23-27, 2020*. Washington, DC: HHS Office of the Inspector General; 2020. <https://oig.hhs.gov/oei/reports/oei-06-20-00300.pdf>. Accessed May 1, 2020.
4. Toner E. Interim estimate of US PPE needs for COVID-19. Johns Hopkins Center for Health Security. April 18, 2020. <https://www.centerforhealthsecurity.org/resources/COVID-19/PPE/PPE-estimate.pdf>. Accessed May 4, 2020.
5. Livingston E, Desai A, Berkwits M. Sourcing personal protective equipment during the COVID-19 pandemic. *JAMA* 2020 Mar 28. doi:10.1001/jama.2020.5317
6. World Health Organization. Rational use of personal protective equipment for coronavirus disease (COVID-19) and considerations during severe shortages. April 6, 2020. [https://www.who.int/publications-detail/rational-use-of-personal-protective-equipment-for-coronavirus-disease-\(covid-19\)-and-considerations-during-severe-shortages](https://www.who.int/publications-detail/rational-use-of-personal-protective-equipment-for-coronavirus-disease-(covid-19)-and-considerations-during-severe-shortages). Accessed April 27, 2020.
7. Centers for Disease Control and Prevention. Strategies for optimizing the supply of facemasks. Last reviewed March 17, 2020. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/face-masks.html>. Accessed May 4, 2020.
8. Bessesen MT, Adams JC, Radonovich L, Anderson J. Disinfection of reusable elastomeric respirators by health care workers: a feasibility study and development of standard operating procedures. *Am J Infect Control* 2015;43(6):629-634.
9. Gooding EJ. A mixed methods approach to modeling personal protective equipment supply chains for infectious disease outbreak response (master's thesis, Massachusetts Institute of Technology, June 2016). <https://dspace.mit.edu/bitstream/handle/1721.1/104810/958277973-MIT.pdf?sequence=1>. Accessed May 4, 2020.
10. Bauchner H, Fontanarosa PB, Livingston EH. Conserving supply of personal protective equipment—a call for ideas. *JAMA* 2020 Mar 20. doi:10.1001/jama.2020.4770
11. Gottlieb S, Rivers C, McClellan M, Silvis L, Watson C. *National Coronavirus Response: A Road Map to Reopening*. American Enterprise Institute. March 28, 2020. <https://www.aei.org/research-products/report/national-coronavirus-response-a-road-map-to-reopening/>. Accessed May 4, 2020.
12. Stahel PF. How to risk-stratify elective surgery during the COVID-19 pandemic? *Patient Saf Surg* 2020;14:8. doi:10.1186/s13037-020-00235-9
13. American College of Surgeons. Joint statement: roadmap for resuming elective surgery after COVID-19 pandemic. April 17, 2020. <https://www.facs.org/covid-19/clinical-guidance/roadmap-elective-surgery>. Accessed May 4, 2020.
14. Hollander JE, Carr BG. Virtually perfect? Telemedicine for Covid-19. *N Engl J Med* 2020;382(18):1679-1681.
15. Medical Group Management Association. COVID-19 financial impact on medical practices. April 8, 2020. <https://mgma.com/getattachment/9b8be0c2-0744-41bf-864f-04007d6adbd2/2004-G09621D-COVID-Financial-Impact-One-Pager-8-5x11-MW-2.pdf.aspx?lang=en-US&ext=.pdf>. Accessed May 4, 2020.
16. City of New York. Volunteer. <https://www1.nyc.gov/site/helpnownyc/index.page>. Accessed April 27, 2020.

17. Gabler E, Montague Z, Ashford G. During a pandemic, an unanticipated problem: out-of-work health workers. *New York Times* April 3, 2020; updated April 15, 2020. <https://www.nytimes.com/2020/04/03/us/politics/coronavirus-health-care-workers-layoffs.html>. Accessed May 4, 2020.
18. Department of Health and Human Services. HHS provides \$100 million to help U.S. healthcare systems prepare for COVID-19 patients [press release]. March 24, 2020. <https://www.hhs.gov/about/news/2020/03/24/hhs-provides-100-million-to-help-us-health-care-systems-prepare-for-covid-patients.html>. Accessed April 27, 2020.
19. Schwartz K, Tolbert J, Pollitz K, Neuman T. Update on COVID-19 funding for hospitals and other providers. Kaiser Family Foundation. April 24, 2020. <https://www.kff.org/coronavirus-policy-watch/update-on-covid-19-funding-for-hospitals-and-other-providers/>. Accessed May 4, 2020.
20. Adalja AA, Toner E, Inglesby TV. Priorities for the US health community responding to COVID. *JAMA* 2020;323(14):1343-1344.
21. Characteristics of health care personnel with COVID-19—United States, February 12–April 9, 2020. *MMWR Morb Mortal Wkly Rep* 2020;69:477-481.
22. Owens C. Special report: health care workers vs. coronavirus. *Axios* April 6, 2020. <https://www.axios.com/health-care-workers-coronavirus-cf42a822-f17a-4c40-9d75-7d43ff3c0b84.html>. Accessed May 4, 2020.
23. Adams JG, Walls RM. Supporting the health care workforce during the COVID global epidemic. *JAMA* 2020;323(15):1439-1440. doi:10.1001/jama.2020.3972
24. Editorial. COVID-19: protecting health-care workers. *Lancet* 2020;395(10228):922.
25. Shanafelt T, Ripp J, Trockel M. Understanding and addressing sources of anxiety among health care professionals during the COVID-19 pandemic. *JAMA* 2020 Apr 7. doi:10.1001/jama.2020.5893.
26. Balicer RD, Barnett DJ, Thompson CB, et al. Characterizing hospital workers' willingness to report to duty in an influenza pandemic through threat- and efficacy-based assessment. *BMC Public Health* 2010;10:436. doi: 10.1186/1471-2458-10-436
27. Aoyagi Y, Beck CR, Dingwall R, Nguyen-Van-Tam JS. Healthcare workers' willingness to work during an influenza pandemic: a systematic review and meta-analysis. *Influenza Other Respir Viruses* 2015;9(3):120-130. doi: 10.1111/irv.12310
28. Vawter DE, Garrett JE, Prehn AW, Gervais KG. Health care workers' willingness to work in a pandemic. *Am J Bioeth* 2008;8(8):21-23. doi: 10.1080/15265160802318204
29. Gershon RR, Magda LA, Qureshi KA, et al. Factors associated with the ability and willingness of essential workers to report to duty during a pandemic. *J Occup Environ Med* 2010;52(10):995-1003. doi: 10.1097/JOM.0b013e3181f43872
30. Gershon RR, Magda LA, Canton AN, et al. Pandemic-related ability and willingness in home healthcare workers. *Am J Disaster Med* 2010;5(1):15-26. doi.org/10.5055/ajdm.2010.0002
31. Martin SD. Nurses' ability and willingness to work during pandemic flu. *J Nurs Manag* 2011;19(1):98-108. doi: 10.1111/j.1365-2834.2010.01190.x
32. Coleman CH. Beyond the call of duty: compelling health care professionals to work during an influenza pandemic. *Iowa Law Review* 2008;94:1.
33. Garrett AL, Park YS, Redlener I. Mitigating absenteeism in hospital workers during a pandemic. *Disaster Med Public Health Prep* 2009;3(Suppl 2):S141-S147. doi: 10.1097/DMP.0b013e3181c12959
34. Vawter DE, Gervais KG, Garrett JE; Pandemic Influenza Ethics Work Group. Allocating pandemic influenza vaccines in Minnesota: recommendations of the Pandemic Influenza Ethics Work Group. *Vaccine* 2007;25(35):6522-6536. doi:10.1016/j.vaccine.2007.05.057.
35. Gold J. The COVID-19 crisis too few are talking about: healthcare workers' mental health. *STAT* April 3, 2020. <https://www.statnews.com/2020/04/03/the-covid-19-crisis-too-few-are-talking-about-health-care-workers-mental-health/>. Accessed May 4, 2020.
36. Felton CJ. Project Liberty: a public health response to New Yorkers' mental health needs arising from the World Trade Center terrorist attacks. *J Urban Health* 2002;79(3):429-433.

37. Pfefferbaum B, North CS. Mental health and the COVID-19 pandemic. *N Engl J Med* 2020 Apr 13. doi: 10.1056/NEJMp2008017.
38. Meyer D, Kirk Sell T, Schoch-Spana M, et al. Lessons from the domestic Ebola response: improving healthcare system resilience to high consequence infectious diseases. *Am J Infect Control* 2018;46(5):533-537. doi: <https://doi.org/10.1016/j.ajic.2017.11.001>
39. Johns Hopkins Medicine. Office of Well-Being. COVID-19 support resources. <https://www.hopkinsmedicine.org/joy-at-jhm/office-of-well-being/index.html>. Accessed May 4, 2020.
40. Witters D. In U.S., 14% with likely COVID-19 to avoid care due to cost. Gallup April 28, 2020. <https://news.gallup.com/poll/309224/avoid-care-likely-covid-due-cost.aspx>. Accessed May 1, 2020.
41. Cohen RA, Terlizzi EP, Martinez ME. Health insurance coverage: early release of estimates from the National Health Interview Survey, 2018. National Center for Health Statistics. May 2019. <https://www.cdc.gov/nchs/data/nhis/earlyrelease/insur201905.pdf>. Accessed April 27, 2020.
42. Kaiser Family Foundation. Average annual single premium per enrolled employee for employer-based health insurance. 2018. <https://www.kff.org/other/state-indicator/single-coverage/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D>. Accessed May 4, 2020.
43. FAIR Health Brief. *COVID-19: The Projected Economic Impact of the COVID-19 Pandemic on the US Healthcare System*. March 25, 2020. <https://s3.amazonaws.com/media2.fairhealth.org/brief/asset/COVID-19%20-%20The%20Projected%20Economic%20Impact%20of%20the%20COVID-19%20Pandemic%20on%20the%20US%20Healthcare%20System.pdf>. Accessed April 27, 2020.
44. Young CL, Dorn S, Adler L, Fish-Parcham C, Straw T. Responding to COVID-19: using the CARES Act's hospital fund to help the uninsured, achieve other goals. Health Affairs blog April 11, 2020. <https://www.healthaffairs.org/doi/10.1377/hblog20200409.207680/full/>. Accessed April 27, 2020. Accessed May 4, 2020.
45. Tuckson RV, Edmunds M, Hodgkins ML. Telehealth. *N Engl J Med* 2017;377(16):1585-1592. doi: 10.1056/NEJMSr1503323
46. Ahmed S, Kelly YP, Behera TR, et al. Utility, appropriateness, and content of electronic consultations across medical subspecialties: a cohort study. *Ann Intern Med* 2020 Apr 14. doi:
47. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 2020;395(10223):497-506. doi:10.1016/S0140-6736(20)30183-5.
48. Novel Swine-Origin Influenza A (H1N1) Virus Investigation Team; Dawood FS, Jain S, Finelli L, et al. Emergence of a novel-swine origin influenza A (H1N1) virus in humans. *N Engl J Med* 2009;360(25):2605-2615. doi: 10.1056/NEJMoa0903810
49. Jain S, Self WH, Wunderink RG, et al. Community-acquired pneumonia requiring hospitalization among U.S. adults. *N Engl J Med* 2015;373(5):415-427. doi: 10.1056/NEJMoa1500245
50. Adalja A, Watson M, Toner E, Cicero A, Inglesby T. *The Characteristics of Pandemic Pathogens*. Baltimore: Johns Hopkins Center for Health Security; 2018. https://www.centerforhealthsecurity.org/our-work/pubs_archive/pubs-pdfs/2018/180510-pandemic-pathogens-report.pdf. Accessed May 4, 2020.
51. Association for Professionals in Infection Control and Epidemiology. *Guide to Infection Prevention in Emergency Medical Services*. Washington, DC: APIC; 2013. https://apic.org/wp-content/uploads/2019/02/EMS_Guide_web.pdf. Accessed April 28, 2020.
52. A quarter of all FDNY EMS members out sick as 911 calls at all-time high. *NBC New York* April 4, 2020. <https://www.nbcnewyork.com/news/local/a-quarter-of-all-fdny-ems-members-out-sick-as-911-calls-at-all-time-high/2359538/>. Accessed May 4, 2020.
53. US Department of Health and Human Services. HPP in your state. Public Health Emergency website. April 25, 2020. <https://www.phe.gov/Preparedness/planning/hpp/Pages/find-hc-coalition.aspx>. Accessed April 28, 2020.
54. Assistant Secretary for Preparedness and Response. Hospital Preparedness Program. <https://www.phe.gov/Preparedness/planning/hpp/Documents/hpp-intro-508.pdf>. Accessed April 28, 2020.

**Johns Hopkins
Center for Health Security**

621 E. Pratt Street, Suite 210
Baltimore, MD 21202

Tel: 443-573-3304

Fax: 443-573-3305

centerhealthsecurity@jhu.edu
centerforhealthsecurity.org



JOHNS HOPKINS
BLOOMBERG SCHOOL
of PUBLIC HEALTH

**Center for
Health Security**