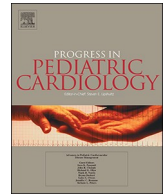




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Editorial

Disruption of healthcare: Will the COVID pandemic worsen non-COVID outcomes and disease outbreaks?

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1. Introduction

The spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has surpassed many early predictions and has created an evolving global public health and economic crisis [1]. As we confront the most devastating infectious disease epidemic of the past 100 years, we must realize that many more serious illnesses and avoidable deaths are likely, not just from Coronavirus Disease 2019 (COVID-19) but as a consequence of the social disruption it has caused, including the fear, and lack of trust, and structural dysfunction in our current reimbursement model of accessing and paying for medical care [2]. Numerous reports have documented a marked drop in vaccinations and primary prevention services, and an increased number of patients with heart disease, strokes, and other acute diseases who have been harmed because they were afraid to seek medical care during the pandemic [3].

The recent sharp drop in hospital admissions for acute myocardial infarctions (AMI) reported in several countries has baffled cardiovascular experts [4–6]. For example, Italy has seen a corresponding rise in AMI fatality rates in non-infected people who do present to hospitals, according to a new study [7]. In 54 hospital coronary care units, investigators counted 319 AMI cases during the week at the height of the coronavirus outbreak in northern Italy. In the same week a year earlier, they counted 618. Although the outbreak was worst in northern Italy, the decline in AMI admissions occurred throughout the country. The researchers also found a 47% reduction in hospitalizations for heart failure and a 53% reduction for atrial fibrillation. Patients with AMI who managed to get to the hospital during the pandemic also had worse outcomes. The death rate among patients with ST-elevation AMI (STEMI) more than tripled, from 4% in 2019 to 14% during the

outbreak. Considering the reported fall in admission rates combined with the increased fatality rates suggests that overall deaths from AMI increased by 75% [8]. Cardiac complication rates of STEMI intervention increased by 80%, from 10.6% to 19%. Of the patients with STEMI, 21% were positive for COVID-19 and 29% died, which was more than two-and-a-half times the 12% death rate in STEMI patients without COVID-19. A significant delay in time to revascularization during STEMI was also present. These findings are in line with studies reporting up to 50% declines in the number of STEMI interventions [9], AMI hospitalizations [10], and aortic dissections in the US [11], Hong Kong, and Spain during the pandemic [12].

Equally perplexing is conflicting data about crude mortality variations in different countries [13]. The reported all-cause mortality has increased in the US, Italy [14], and in Sweden, which recorded an almost 30% increase in crude mortality during the epidemic [15], but the crude death rate has gone down in Israel [16] and Norway [17] during the past 4 months, as compared with previous years. Although no two countries are exactly alike, making comparisons inexact, this variation in mortality raises challenging questions about how public health data are defined, collected and reported [18].

These drops in the number of patients with acute non-COVID-19 infections presenting to hospitals are even more puzzling as it is almost axiomatic that in times of social upheavals, the risk of AMIs and strokes increased markedly [19,20] given the well documented effects of stress and the brain-heart connection [21]. Depression, anxiety and frustration—emotions exacerbated by the pandemic—are all associated with at least a doubling of the risks for AMI. At least a quarter of cardiac patients have depression, and early treatment, before the onset of symptomatic cardiovascular disease, can decrease the risk of AMI and strokes

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by almost half [22]. Work and life stress, which also may be increased during times of great unrest, can markedly increase the risk of AMI. Moreover, events such as earthquakes, terrorist attacks, or war, in which an entire society is exposed to great stress, are risk factors for AMI. Finally, COVID-19 can directly affect the heart, which should be increasing the number of patients with heart problems [23].

The current decline in mortality in some affected countries may foretell higher-than-expected morbidity and mortality, once non-COVID-19-related care resumes, given delays in chronic care treatments, a large backlog of postponed surgeries [24] (estimated to be 28 million worldwide), and a surge of mental health issues for both healthcare providers and the public [25]. This response may be similar to what occurs after physician strikes are over and elective services are resumed, when overall mortality rates are higher than pre-strike rates [26].

2. The fate of vaccinations on community wellness

As the coronavirus continues its relentless spread, leaving death and economic devastation, other ancient diseases such as measles, polio, and pertussis may begin to proliferate again as vaccination rates drop precipitously [27]. When the immunized population becomes smaller, contagious and deadly childhood diseases—many already resurging because of the “anti-vaxxers” and rising distrust of governments—could reemerge, killing children and adults alike. The fear of contagion during the pandemic has disrupted infectious disease immunization and monitoring programs, which could allow the spread of these ancient diseases into new populations instead of consigning them to history. In addition, access to essential medicines, including vaccines, has been reduced by disrupted supply chains, transportation problems, flight cancellations, trade restrictions among countries, and border closings [28].

The Centers for Disease Control and Prevention's (CDC) Vaccine Safety Datalink has reported an almost 50% drop in the number of measles vaccinations during the first quarter of 2020 compared to the first quarter of 2019 [29,30]. This drop has also occurred across the world as countries order lockdowns of varying severity. At this writing, most countries had suspended mass polio vaccination campaigns, and 25 countries have postponed mass measles vaccination campaigns [31].

Before the pandemic, global measles cases were already surging, reaching an estimated 10 million in 2018, with 140,000 measles-related deaths—a 58% increase over the previous 2 years [32]. Measles was all but eliminated in the US in 2000, but misinformation and confusion about vaccine safety increased the number of measles cases to 1200 in 2019—the highest number in the US in almost three decades [33]. Now, reduced community immunity has made COVID-19 a clear and present danger for reversing these hard-won gains in measles eradication. This danger will increase when schools reopen and districts that allow non-medical exemptions from vaccinations requirements will leave exposed children unprotected [34].

2.1. Recommendations on steps to be taken

The COVID-19 pandemic has challenged the entire healthcare system to develop new approaches to managing the disease and its myriad consequences. As the fear of contagion is stoked by media reports and health systems are asked to defer non urgent visits, people with illnesses and unvaccinated children are avoiding hospitals and clinics for their own safety or to defer to those patients needing urgent care [35]. Until the COVID-19 pandemic is under control, organizations must balance the need to keep adults and children healthy and to care for those infected with the illness with the need to convince the critically ill to seek immediate care, all amid worsening care disparities and social threats to health.

We must preserve the public's trust in public health and the healthcare system. This will require designing flexible and innovative

delivery mechanisms to address preventable illnesses, and for COVID-19 in particular, reducing deaths from the coronavirus while addressing comorbid conditions, mitigating the disruption to the economy and living standards, and preventing children from falling behind on their growth and development. Therefore, we recommend that countries implement and continuously strengthen the measures described below.

- 1) **Restore Public Confidence in the Public Health System.** The lead voices on health communication should be scientists and experts in public health [36]. We see this in the countries that are best managing the pandemic. Better public understanding of the evolving risks and explicit trade-offs, improved confidence and social trust in government, and affirming the safety of hospitals and clinics are crucial to preserving confidence in the public health and healthcare systems. The public has little experience with the pandemic of this scale. Uncertainty about the course and severity of the pandemic and the potential of a vaccine remains high; thus, effective risk communication is essential to ensure widespread adoption of evidence-based public health recommendations. Expanded public access to testing and improved understanding of antibody response and protection will help the public adopt protective behaviors and vaccine administration later. In 2009, factors that contributed to the wide acceptance of the H1N1 influenza A virus vaccination were access to current and accurate information and confidence in the vaccine, which was enhanced when President Obama's daughters were immunized [37]. Furthermore, targeted messages promoting behaviors that decrease personal and public health risks and that are compatible with the values and beliefs of different segments of society will be important in preventing the spread of the virus. We need better models of risk and policies, that make clear sense to the public, and that can help risk-stratify employees and healthcare providers [38].
- 2) **Reimagine Building Trust and Effective Communication.** As in all public health emergencies, timely, truthful communication is essential to building and maintaining public trusts [39]. Trustworthy and actionable data within and across nations are essential to mounting effective public health prevention and amelioration efforts. Americans' trust in the federal government to do the right thing has dropped to just 17%, and the mishandling of the pandemic continues to reduce this trust even more [40]. Trust affects perceptions of communication, and, conversely, communication can foster or damage trust. The content of an official emergency message will immediately be judged by the public for its timeliness and honesty, as well as the trustworthiness of the messenger [41]. Trust in the information source influences the public's judgment of the quality of the information, as well as their adoption of recommended actions [42–44]. For instance, in the United Kingdom, trust in government authorities, the perception that communication was clear, and the lessening of uncertainty early in the H1N1 pandemic were associated with the adoption of behaviors to prevent infection [45]. Such communication is particularly important to minority communities [46]. In one study, elderly white people (67%) were more likely to self-report having been vaccinated than were African Americans (43%) or Hispanics (53%). Distrust of vaccinations was a major factor in the low vaccination rates of African Americans; unequal access to vaccinations explained only 2% of the disparity [47].
- 3) **Leverage Timely and Transparent Reporting of Complete, and Accurate Data.** We need robust public health surveillance systems, tracking and contact tracing, and reporting on comorbid conditions. Baseline data are critical to understanding the impact of key risk factors on disease prognosis to improved predictions. Disease incidence and progression for many conditions can vary by ethnicity and COVID-19 may be no different. Even in the US, needed information about infections, hospital admissions, and deaths is not readily available in some regions as a result of economic concerns

and political pressures [48]. Some key concerns include:

- a. **Implement Surveillance and Analytics.** We need accurate data and truthful, transparent reporting systems [49], using software to measure and track high-risk environments such as in nursing homes [50], apartment buildings, prisons and college dorms. Surveillance should greatly curtail local outbreaks if widely implemented and can facilitate contact tracing [51].
 - b. **Robust Public Health Practices.** Practices include risk stratification by comorbidities, reporting on race/ethnicity to address inequities, and refining care delivery models.
- 4) **Reduce Delayed Essential Clinical Care.** Nearly half of Americans say they or someone in their family has skipped or delayed essential medical care out of safety concerns during the pandemic, including 11% who say a condition has worsened because of the missed care [52]. If people ignore the public-health ramifications of their behaviors and are even encouraged to do so by political leaders who see public health as an annoyance and dental, the pandemic will remain out of control. Lack of control of the pandemic leads to delays in all care areas. Ending sheltering-in-place declarations and reopening the economy raises several challenges:
- a. **Reopening Challenges.** The volume of surgical and non-surgical invasive procedural cases, such as cardiac catheterization and biopsies, will pose significant challenges for recovering systems [53]. Delays will persist and many patients will have more complicated and more advanced disease. Triage will be essential, requiring smart scheduling, spacing, adequate personal protective equipment (PPE) and addressing the fears of patients and providers. A large and diverse patient population will also have conditions that are not immediately life-threatening but may still require surgery and invasive procedures that should not be postponed (e.g., biopsies for presumed malignancy). Postponing treatment risks exacerbating acute diseases (e.g., biliary colic, cardiac stenosis), chronic deterioration (e.g., bariatric surgery), or persistent disability and pain (e.g., severe osteoarthritis requiring joint replacement).
 - b. **Patient backlog.** Hospitals and clinics should prepare to address patient backlog over the long haul as reduced in-person density may be needed to ensure patient and staff safety [54]. We learned this from the 2003 Severe Acute Respiratory Syndrome (SARS) epidemic in Toronto, where hospitals and health systems required substantial funding to deal with this backlog of cases [55]. Data and patient registries should guide efforts to address the patient backlog, with stratification of patients by risk, aggressive reminder/recall, case management, and use of telehealth alongside in-person clinical care. Facility procedure requirements for a recent negative SARS-CoV-2 diagnostic test result may overwhelm communities' testing capacity and create further challenges to clearing the essential procedures backlog. The experience of Hong Kong after the SARS pandemic illustrates the issues of managing the backlog of treatments [56]. After 30% of medical services were suspended, the backlog increased to 16,000 cases, and even when operating capacity returned to normal, hospital recovery took years.
 - c. **Health Disparities.** Managing disease outbreaks is a key component of public health, but another is reducing health disparities [57]. African American and Latinos make up a disproportionate share of confirmed COVID-19 cases and deaths in the US [58]. These care and outcomes disparities are avoidable and socially unjust systematic differences in health between minority and majority groups. Disrupted elective or emergency care negatively affects marginalized groups disproportionately. Policymakers, managers, and clinicians should protect the most vulnerable from negative unintended consequences and avoid worsening health inequalities. Health care and other economic rights should be considered part of our social contract. We must

ensure that disadvantaged populations are not further discriminated against—consciously or unconsciously—during the reopening process. A recent American Academy of Pediatrics report calls out structural racism in child health that must be addressed with specific steps, and that these inequities cannot be addressed without calling out systemic racism and addressing at multiple levels [59]. We believe health care has an opportunity and a responsibility to name racism, make it visible with actionable data and stories, and commit to equity-advancing policies and practices. Although progress has been made toward racial equality and equity, the evidence to support the continued negative impact of racism on health and well-being through implicit and explicit biases, institutional structures, and interpersonal relationships is clear. The report cites examples of work to be done such as mandatory cultural competency training for staff; systematic data collection and tracking on disparities; tools to screen for racism and promote positive development approaches; support community strategies to mitigate racism through interdisciplinary partnerships that recognize the lived expertise and experiences of people of color. We in health care abandon our calling and violate our oaths if we allow inequities to persist.

- d. **Other Socioeconomic Considerations:** Consideration of other socioeconomic disparities along with racial and ethnic inequalities is essential for equitable care access. An integrated community-based strategy to care for children, including school partnerships, community foundations, food banks, and other community resources must be called upon to support the necessities of daily living. Transportation systems may be tailored to transport-at-risk patients without personal access to safe transportation to appointments. Community-based care and deriving novel platforms for access to care are key to supporting the health of populations that are marginalized (e.g., telemedicine and home visits).
- e. **Post Viral Long-Term Sequelae.** Too many discussions of COVID-19 focus on death rates and neglect the risk of long-term sequelae of survivors. Such sequelae may include comorbidities brought on by coagulopathy; debilitating fatigue; mental health issues; and post inflammatory syndrome that we are beginning to see in children, with the potential for debilitating long-term illness in some. The Institute of Medicine, estimated that between 500 thousand and 2 million US residents live with the illness or illnesses awkwardly named “myalgic encephalomyelitis/chronic fatigue syndrome” (ME/CFS), which may be triggered by viral/bacterial infections [60]. In addition to emerging reports of damage to lungs, kidneys and hearts, reports of ongoing crushing fatigue, muscle pain, cognitive problems, and other symptoms seem similar to those of ME/CFS are increasing [61]. Up to 25% of patients with ME/CFS are housebound or bedbound for years. After the 2002–2003 SARS epidemic that sickened 8000 people worldwide, one study found that 27% of 369 survivors still had psychiatric morbidities and chronic fatigue several years later [62]. Epidemiologists warn that that COVID-19 will eventually be infect 50% to 70% of the US population, so if these morbidity rates are as high as in patients with SARS-CoV-2, millions of patients will experience chronic post-viral illnesses. Already, we know that the virus can, in rare cases, infiltrate the central nervous system and lead to a Guillain-Barre Syndrome, which is characterized by rapid nerve damage that can lead to paralysis [63]. The overwhelming inflammation that can accompany COVID-19 may be also related to the multisystem inflammatory syndrome in children with COVID-19 [64]. Longitudinal follow-up studies are needed to differentiate post-viral fatigue syndrome and ME/CFS from the lingering, if expected, effects of being in an intensive care unit or on a ventilator, which are also risk factors for long-term

morbidities [65]. The US National Institutes of Health and CDC should fund long-term research on COVID-19-survivors treated in intensive care units to identify the nature and extent of COVID-19-related morbidities, as was done with Zika virus infected survivors.

f. **Mental Health.** Pandemics and wars spur anxiety [66] in themselves, and job loss and financial devastations can lead to mental health and substance use disorder and their treatment needs [67]. Telehealth may be an effective way to increase access to mental health services. Of particular concern is that many locales have reported increased suspected or confirmed opioid overdoses. We must better address needs of opioid users and managing chronic pain during the pandemic [68].

5) **Promote Essential Vaccinations.** Increasing the number of vaccinated children is essential for preserving our gains in child survival. However, only about half of Americans say they would get a COVID-19 vaccine, and most are appropriately skeptical that one will be available by January 2021 [69]. Federal and state agencies should provide and promote free or highly subsidized vaccinations for all Americans, such as building on the success of the Vaccines For Children program. Other potential initiatives include public campaigns on the safety and importance of vaccines; innovative delivery methods such as drive-by immunization clinics; strong reminder/recall systems utilizing immunization registries and a variety of alerts including text and phones. Strong vaccination programs are particularly necessary in low-income countries, such as in Pakistan and Liberia, to identify unvaccinated people and to re-establish community demand to improve vaccination rates. The Global Polio Eradication Initiative reports that Pakistan, for example, still has systematic barriers to providing polio vaccinations [70] with barriers linked to religious extremism and global political interests. In a growing number of countries, one of the most alarming barriers to providing polio vaccinations is the large number of parents who are unwilling to vaccinate their children [71].

6) **Advocate For Personal and Community Health Behaviors.** We will need comprehensive, non-pharmacological, interventions to reduce the social interactions that spread the virus. Additionally, many people opposed to social distancing and sequestration have interpreted “low-risk” to mean “no risk.” Lifting restrictions on businesses and other activities has in some places brought out crowds of people indifferent to calls for social distancing and face coverings. Many of the largest super-spreader events have taken place indoors—at a church in South Korea [72], an auditorium in France [73], a choir practice in Seattle [74], and a conference in Massachusetts [75]. The risk of indoor infections is almost 19 times higher than in outdoor environments [76]. Today, states are emerging from lockdown and entering a queasy period of re-opening [77]. But activities in offices, schools, stores, theaters, restaurants, bars, gyms, fitness centers, and museums will not return to normality until we learn how to keep people safe—and *feel* safe—indoors. Public behavior will have to be flexible and resilient to make it through the next year. Some guidelines:

- a. **Face coverings.** Everyone needs to wear them in public. They are exceptionally effective in stopping viral transmission when worn properly [78,79].
- b. **Social distancing.** Everyone needs to stay at least 6 ft apart, especially when near larger groups of people for long times [80]. Mass gatherings with uneven virus precautions will quite possibly seed new outbreaks.
- c. **Airflow awareness.** Every noncontact activity—talking, eating, exercising—becomes much safer when done outside. COVID-19 appears to spread through air by both large droplets, such as those from sneezes, and through smaller droplets, such as the occasional spray while talking [81].

7) **Maintain Educational Services for Children.** Millions of children

kept home from school have moved abruptly to distance learning, for which no child, school district, or teacher was adequately prepared. The risks posed by delaying school openings are real and sizeable, particularly for students from low-income families [82,83]. Some estimates are that children will lose 9 to 12 months of educational progress when they return to school in the fall, and these losses will increase if distance learning at home continues. Several countries that have reopened schools in the past 2 months have reported only small increases in coronavirus infection rates, which is encouraging for authorities contemplating how and when to safely return children to the classroom [84]. One reason for this low infection rate might be that children below age 10 have fewer ACE2 receptors in some cells in the upper respiratory tract where the virus binds and infection begins. The number of ACE2 receptors starts to increase after age of 10, making younger children comparatively less susceptible [85]. Increasingly, data have raised serious concerns about the effect of school closings on child mental health and development [86]. For schools to reopen there are several things to consider:

- a. Convene an expert task force to focus on the logistics of school reopening. The task force will need to address key issues including maintenance of some distance learning; staggered start times; reduced class sizes; and families of children with disabilities and medical complexity who will want to stay at home.
 - b. Such a task force should include epidemiologists, infectious disease experts, educational scientists, and child psychologists, among others. They should review the evidence for horizontal transmission between children and their families, the feasibility of prolonged distance learning, and the psychological implications of sheltering-in-place for long periods, as well as what other countries have successfully done to keep their schools open [87].
 - c. Provide financial support for school districts as many are grappling with sizeable budget deficits due to loss in tax revenue;
 - d. Support broadband access, electronic device loans, and related methods to increase access to distance learning.
 - e. Emphasize community partnerships to ensure that curriculum and learning is accessible and culturally competent.
 - f. Support and enforce maintenance of therapies and learning plans in Individualized Education Programs and 504 plans for how schools will support a student with disability and remove barriers to earning through equal access at school. These include having sets of accommodations or changes in the classroom environment to help children follow the regular curriculum.
- 8) **Counter Medical Misinformation.** People are desperately looking for options and even magical drugs to protect them from infection that can lead to collateral damage with unproven therapies that lead to no improvement and possibly lethal side effects [88]. In the 1918 pandemic, people rushed to purchase supposed cures for influenza, most of which had no medical benefits, such as alcohol and quinine, soda water, and even rubbing half an onion on the chest [89]. In 2020, shills are promoting colloidal silver, herbal remedies, and antiviral essential oils, vitamin C, zinc, and dangerous medications for other conditions such as chloroquine. Some also claim that drinking and even injecting bleach could kill the virus [90]. Poison control center calls for bleach ingestion increased markedly after this “cure” was recommended on national television [91]. Misinformation has been so prevalent that the World Health Organization has had to address these incorrect and unconsidered claims on its site [92]. Despite concerted efforts to counter misinformation, this info-demic in its own right threatens to destroy the carefully developed scientific guidance surrounding COVID-19 [93].
- 9) **Protect Health Care Workers and Improve their Workflow Performance.** Our health care systems can function only if health care workers are adequately protected from infection by the

coronavirus. According to the CDC, COVID-19 has killed more than 375 US healthcare workers [94]. Globally, more than 450,000 healthcare providers have reportedly been infected and over 1000 have died in dozens of countries, professions, and specialties [95]. Strict adherence to evidence-based protocols is paramount [96]. Healthcare workers need to be risk-stratified and their individual risks need to be assessed. These assessments should also collect data on the availability and effectiveness of PPE associated with the worker's role and work assignments [97]. Protective equipment is important, but comprehensive and well-implemented infection prevention programs are the most effective way to protect health care workers and patients [98]. We need health care workers to stay healthy so they can take care of all of the existing chronic disease. Only when health care workers are confident that they are protected from the virus can we reliably prevent the pandemic from overwhelming health care systems [99,100]. In addition, personal and financial losses and exhaustion from caring for critically ill patients during the pandemic degrades the ability of health care providers to take on any additional burdens, such as the huge backlog of surgical and non-surgical procedures, manage heart disease, cancer and immunizations [101]. The necessity to divert healthcare staff and resources to address the pandemic has resulted in suspension of cancer screening programs for asymptomatic patients in many countries. Some pre-crisis providers are currently making decisions about leaving the workforce and not returning to their pre-pandemic work roles of being care providers in the post-pandemic period. The healthcare system will need to tackle these emerging trends reducing burdens and burnout in workers including revising regulations improve workflow and barriers to documentation in current electronic medical record systems. Proactively supporting healthcare workers physical and emotional wellness is imperative to maintaining a sufficient workforce.

10) **Expand and Fund Population Health and Social Support Programs.**

Many fundamental flaws in the American healthcare system have been exposed and magnified by this pandemic, especially the widespread, severe, and persistent inequalities of care. We can learn much from those countries that have successfully managed the pandemic while also mitigating the economic crisis by protecting jobs and maintaining health insurance [102,103]. Taiwan added smartphone location-tracking to detect and sanction quarantine violations. In contrast, Israel's Ministry of Health used its national security legal authority to implement digital tracking until the Israeli High Court of Justice found that the surveillance, conducted as it was under an executive order and absent legislative approval, lacked adequate legal basis to continue [104]. The solutions in these countries using digital epidemiological measures to combat the pandemic depend heavily on public trust [105,106]. Although contact tracing programs are likely to be critical in minimizing spread of COVID-19, widespread deployment of electronic contact tracing [107] can be challenging, given privacy issues, and would be warranted only if pilot projects and modeling provide sufficient evidence of efficacy, privacy safeguards, and acceptable social and financial costs [108].

Telemedicine is an example of where a switch occurred very quickly and this nimble transformation bodes well for a new future. Healthcare organizations need to expand their population health efforts, including telehealth strategies, to serve vulnerable populations most at risk for coronavirus infection or its complications [109].

Patients need to know when and how to access primary care for childhood vaccinations, cancer screenings, diabetic retinal exams, follow-up visits for chronic conditions, and behavioral health needs [110]. Additionally, all people need to be supported in receiving adequate nutrition and shelter—the foundations of good health and wellness—and, if necessary, to shelter-in-place when asked, then safe accessible shelter options need to be available if domestic

issues or homelessness arises [111]. Neither more funding nor more regulation is a sufficient response. We also need new multi-level, multi-jurisdiction strategies that fully support a range of population health programs. Specifically, federal, state, and local public health programs need to develop:

- a Apply the knowledge and data about the social determinants of health working with community partners to make services known and available, and to address deficiencies in food security, safe housing, and access to medical and mental health care [112]. We must maintain current programs to:
 - i Protect Medicaid, Medicare, the Affordable Care Act, and access to affordable, comprehensive insurance;
 - ii Protect important safety net programs such as the Supplemental Nutrition Assistance Program (SNAP, often referred to as “Food Stamps”) and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC);
 - iii Ensure availability of unemployment benefits for those that have lost their jobs; and
 - iv Address economic security issues including rent protection and hazard pay.
- b Support and grow clinical integrated pediatric care networks that focus on value-based payment models with clear and evidence based measurable metrics.
- c Develop new approaches to manage the range of acute and chronic conditions and providing post-acute care in the home and making skilled nursing facilities safer [113]. We need better care coordination, community-based care management, and community navigators to address the range of social determinants of health during a time when the health care system and access will be strained for years to follow [114].
- d Expand services to allow safe home care and to assure adequate capacity in hospitals and emergency departments during pandemic surges.

11) **Assess the Risks and Impact of Delayed Clinical Trials.** COVID-19 has resulted in the suspension of most clinical trials [115]. Analysis of data from [ClinicalTrials.gov](https://www.clinicaltrials.gov) indicates that over 200 interventional oncology studies were suspended in March and April owing to COVID-19 [116]. Halting these trials, for example for cancer care, will have long-lasting health and financial consequences. Beyond the loss of the potential health benefits for patients already enrolled in the trials, the cost of, for example, an oncology phase 3 clinical trial is on average at least \$20 million [117]. This could set back research discoveries by 1–2 years, and harm present and future patient care and could also jeopardize the pipeline of the identification and approval of new treatments. The US Food and Drug Administration [118] and the European Medicines Agency [119] have both issued guidance on this topic. Pragmatic steps that could minimize disruption to clinical trials include adopting technology-based interventions aimed at reducing on-site monitoring visits and in-person patient visits to minimize potential viral exposure and spread, including telemedicine, remote electronic medical record access for monitors and virtual monitoring of data and study documentation, and transferring study participants to other active sites of cancer care. This will require long term monitoring of potential effects and the concerted efforts by healthcare providers, researchers, regulatory bodies, and patients.

12) **Support Multi-Level, Multi-Jurisdiction Strategies in Health Care Delivery Reform**

COVID-19 has created a setting of uncertainty in how to continue to provide health care as has been historically done. The health care system in the United States is in need of an overhaul. The United States does not have an affordable, universal healthcare program, unlike most other developed countries. This creates uncertainty and constant stress. This uncertainty makes it challenging

for adult and child specialists to understand how to engage with institutional partners moving forward. Telemedicine works best when focused around building trusting relationships, to address what matters most to the patient, while promoting self-care for symptom management. Concerns remain about how third-party payers may react to maintaining support for telemedicine moving forward for the longer term. Will there be long term changes in the delivery of health care as a result of the pandemic? Will there be a need for as many physicians if telemedicine remains long term, since many telemedicine visits can take place with advanced practice providers practicing at the top of their licenses? New public policy and care models is needed to optimize care. The US public and increasingly the business community are becoming acutely aware of the rising costs and inadequacies of our current system. We will all benefit from interested parties working together to find better ways to deliver care that is more equitable, affordable and of higher quality.

More funding alone is not the answer. Nor is more regulation a sufficient response alone. Rather, we need a combination of funding, regulation, and new multi-level, multi-jurisdiction strategies that fully support a range of population health programs. The role and future look of health systems, children's hospitals and other health care institutions are unclear. To compound these issues, there has been a clear and palpable disruption of the primary care infrastructure. Numerous news reports have documented the disruption of clinical practices due in part to a fear and hesitancy on heart attacks, the part of patients to come in for very important well-child visits, a lack of available stockpiles of PPE, a lack of coordinated community engagement to support these independent practices and the lack of national coordinated response that would allow bridging support during times of crisis. In fact, many private practices are at risk of closing in the face of a maladaptive fee schedule and payment system and the reliance on State based Medicaid programs that already chronically under-reimburse them [120]. Uncertainty also relates to our current economic reality where in some regions there currently is 20% unemployment. The concern is that high unemployment may result in less third-party party coverage and reimbursements for medical care and, as a consequence, there may be more Medicaid reimbursements could result in a reduced ability to provide necessary child health care, which may be compromised. Further, as State and local governmental financial resources are stressed, straight Medicaid payments are at risk for not being made. We believe that a crisis is also an opportunity to come together and "think big," to address the uncertainty by breaking down longstanding silos and creating reliable integrated delivery models that will support health and wellness – and prepare us to not only weather the current storm, but to also be ready for the next one.

Declaration of competing interests:

The authors have no conflicts of interest to declare.

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