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A Supposedly Developed Country's Response to a Healthcare Crisis: Lessons from the COVID-19 Pandemic for Future National Emergencies

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Abstract

The world has just suffered through a pandemic that was responsible for the 7 million deaths. The expectation prior to this devastation would have been those countries like the United States, which are considered "developed", would have been prepared and able to ameliorate the effects of such a catastrophic event. However, this was not the case. In fact, many countries not necessarily considered underdeveloped or undeveloped weathered this crisis by mounting a much more organized response. This chapter will review the history of similar episodic epidemics, the failures that led to over a million deaths in the United States, and most importantly what is necessary to a similar event in the future to be dealt preventing the devastation that did occur in a most "developed" country like the United States. These lesions and their possible extrapolation worldwide, hoping will prevent a recurrence of the devastation we have recently experienced in the United States.

Keywords: COVID19, pandemic, disease control, politics, developed, vaccine

1. Introduction

The COVID-19 pandemic has been a stark reminder of the need for effective preparedness and response strategies in the face of global health crises. It exposed various failures and challenges in the United States' response. In this chapter, we examine the lessons learned from the pandemic, emphasizing the importance of a coordinated and unified approach to mitigate the risks and impacts of such emergencies. This analysis highlights dismissive responses by politicians, poor public understanding, flawed testing, delays in accurate testing approvals, lack of national coordination, inconsistent mask guidance, healthcare disparities, and the decentralized nature of the U.S. government. However, it also acknowledges scientific achievements, the dedication of healthcare workers, and the need to learn from these mistakes. By analyzing

the successes and failures of our healthcare system, the role of politics, and the need for improved coordination between federal and state authorities, we intend to pave the way for a more resilient future.

2. Defining a developed country

One measure of a country's development is the health of its citizenry. The better the health, the longer the life expectancy and the ability to be productive. This results in economic progress and expanding wealth. The advantages of a high income "developed" country are related to an advanced healthcare system and are the foundation of the well-being of its citizens.

According to the United Nations, a *developing* country is defined as one with a relatively low standard of living and undeveloped industrial capability [1]. As measured by the Human Development Index (HDI) a developing county is considered low on the scale. The parameters of this index compare factors like poverty, literacy, education, life expectancy, and many others for individual countries around the globe. The numerical range used by the HDI index is 0.1 to 1.0. The United States has a rating of 0.921. Switzerland is at the apex with a 0.961 rating, while South Sudan is at the nadir with a rating of 0.635.

In order to evaluate whether the United States purported itself as a "developed" country in the face of the COVID-19 pandemic, we looked at the factors that are construed as being evidence of "developed". Did the confounding factors that resulted in questions about this end point, and the consequences that resulted from the level of preparedness, exist? In doing so, our major goal was not to criticize, but rather to identify where changes could be made to deal with the next catastrophic event that nature will almost assuredly make us face as the twenty-first century progresses.

The provision of healthcare during a crisis, whether the mechanism is public, private or both, is largely dependent upon public health resources identifying disease threats at population levels. This leads to the question, are high income countries like the United States sufficiently equipped and prepared to address novel disease threats like the COVID-19 pandemic? And what does a developed country need to do to be prepared for those as yet undetermined infectious disease pandemics that are almost certainly in our future.

2.1 The pandemic toll in developed countries

The World Health Organization first described the COVID-19 as a pandemic on March 11, 2020 [2]. Very few scientists or governmental officials understood the potential consequences of this deadly disease. Public health measures were instituted such as closing of some borders, but not all. Authorities issued strict stay-at-home orders, and public activity ceased. Individual nations treated the problems in different manners, but with limited resources, they were unable to deal with the overwhelming number of cases. The previously unknown virus, labeled SARS-CoV-2, an airborne virus, was transmissible prior to the presentation of symptoms in the individual. In some cases, the carrier of the virus never developed symptoms, making contact tracing more difficult. COVID infection caused severe, often fatal, disease in the elderly and vulnerable individuals (e.g., obese, diabetic, cardio-pulmonary disease patients). It was not evident how severe the illness could be until the mortality statistics began to reflect that a horrible crisis was at hand.

One of the most striking findings was that the United States had more illness and a greater number of mortalities than most developed countries. The trend was noted early in the pandemic and seemed to continue. As of this date, according to the Kaiser Family Foundation statistics, the COVID-19 virus has caused approximately 7.6 billion cases of disease and 6.85 million deaths worldwide [3]. This is equivalent to 1.4 deaths per 15 thousand cases. The population of the United States (roughly 340 million) has suffered approximately 103 million cases of disease but has had more than 1.1 million deaths. This roughly translates to one death per 100 cases, a markedly higher mortality rate.

Epidemiologic data demonstrated that the COVID-19 pandemic had a significantly higher prevalence and death rate in more developed and higher income countries, even after accounting for significant underreporting in less developed countries. Moshen Bayati used data related World Meter and per capita income from the World Bank which indicate that the COVID-19 death and prevalence rates between high income and other countries was three times higher in the former group (17,371 vs. 6180 per 1 million population). The same relationship appeared when analyzing critical cases. Dr. Bayati concluded, from simple regression analysis, that the prevalence and deaths from COVID-19 are significantly correlated to countries' per capita income. The richer a country was, the greater the loss of life. He could only surmise that high income countries had populations with more risk factors, more diagnostic tests performed, more air transport completed, and more information available. Higher reported prevalence and more deaths from COVID-19 surpassed lower-income countries [4].

2.2 A historical look at development

The ability of a country to support public health management services depends on coordination of multiple components including government health agencies at the central and local levels, donor organizations, civil society groups and directly with affected communities. These relationships are meant to provide the services necessary for successful healthcare but must also be responsible for planning for future needs and for executing programs to recognize and deal with emergencies. The Corona virus pandemic highlights the latter function as a determinant of which nations are adequately resourced, specifically prepared for this type of "attack" and which have yet to achieve that status.

Although there are a long list of parameters for defining a developed country, the observer must look not only to the present but back in history. The purpose of this exercise is to assess whether our definitions and practices have kept pace with the state of knowledge, as well as whether our actions and responses have evolved with those definitions. Surely, one of the measures of how a society has evolved is their response to an emergency, such as a pandemic. This is a reflection of their ability to learn from the past and whether those lessons and their remediation have been put into action. The COVID-19 pandemic appears to have answered the question for our global society, and the answer is that we have failed.

This type of failure is nothing new to mankind. Each time we move forward we take a step back, perhaps to re-organize, or perhaps to take a breath and reassess where we have come, and where we might want to go. Looking back for clues may be the answer. In the 2nd millennium BCE, the developed world was under the control of Egypt and Babylonia. During this period communication between groups improved significantly with the development of the alphabet. These advancements, evidence of

a developed culture, allowed for transfer of information and improved commerce and the creation of a better financial status for the state. World population rose to over 100 million people, reaching a milestone that portended the potential for massive expansion, not actualized until the twentieth century [5, 6].

However, despite the developments of this period, by the end of the 2nd millennium BCE Barbarians destroyed these existing cultures and instituted social change, not necessarily improving the conditions of society.

Development waxes and wanes throughout history. Periods of rapid improvement of a given society were often followed by times of repression and ignorance. This is seen during the magnificent advances produced by the Roman Empire that were followed by the period referred to as the Dark Ages. There was an inability to carry forward the advances in all areas of human endeavor at the heights of civilization, resulting in periods of backsliding and failure to learn from the lessons of history.

2.3 Enter the Spanish flu

One only has to reflect at the events of the last 100 years to see a dramatic example of man's failure to learn from history and prepare for the devastating events that is to come. Regardless of a country's development level, effective preparedness requires proactive and cost-effective strategies. Strengthening core public health infrastructure, such as water safety measures and rapid response capabilities, is crucial. The experience of the 1918 influenza pandemic reminds us that these measures have been well-established for decades, and yet, similar mistakes were made during the COVID-19 crisis. It raises the question of why, after a century, our supposedly advanced healthcare system still faced significant challenges.

The 1918 influenza pandemic was the most devastating healthcare crisis of the twentieth century. It also demonstrated our lack of incorporation of the knowledge of past similar crises into our healthcare planning. The etiologic agent was an H1N1 virus. Although there is no universal consensus regarding the origin of the virus, its worldwide spread was catastrophic between 1918 and 1920. In the United States, it was first identified among military personnel in the spring of 1918 and spread rapidly across the country (**Figure 1**).

The 1918 pandemic, despite its name (i.e., Spanish flu), is believed to have started in the United States. Initially being reported at Fort Riley in Kansas in March 2018, it was most likely carried across the Atlantic Ocean to Europe by American soldiers on the way to fight in the Great War. Conditions like overcrowding and poor sanitation that the soldiers encountered were the perfect setting for the virus to spread like a wildfire. In fact, at Fort Riley, 522 men were diagnosed from the same severe influenza. This was soon followed by outbreaks of the flu in the army camps in Virginia, South Carolina, Georgia, Florida, Alabama, and California. The transfer of infected soldiers to Navy ships resulted in outbreaks of severe influenza and pneumonia among their crews.

2.4 The impact of politics

The initial impressions were that the flu was essentially a military personnel disease. This resulted in the impending disaster being first underestimated, then underreported and most importantly, to be spread by war in Europe. In fact, the American government intentionally suppressed press coverage of this rapidly spreading infection to avoid public panic. The flu traveled from military camp to military
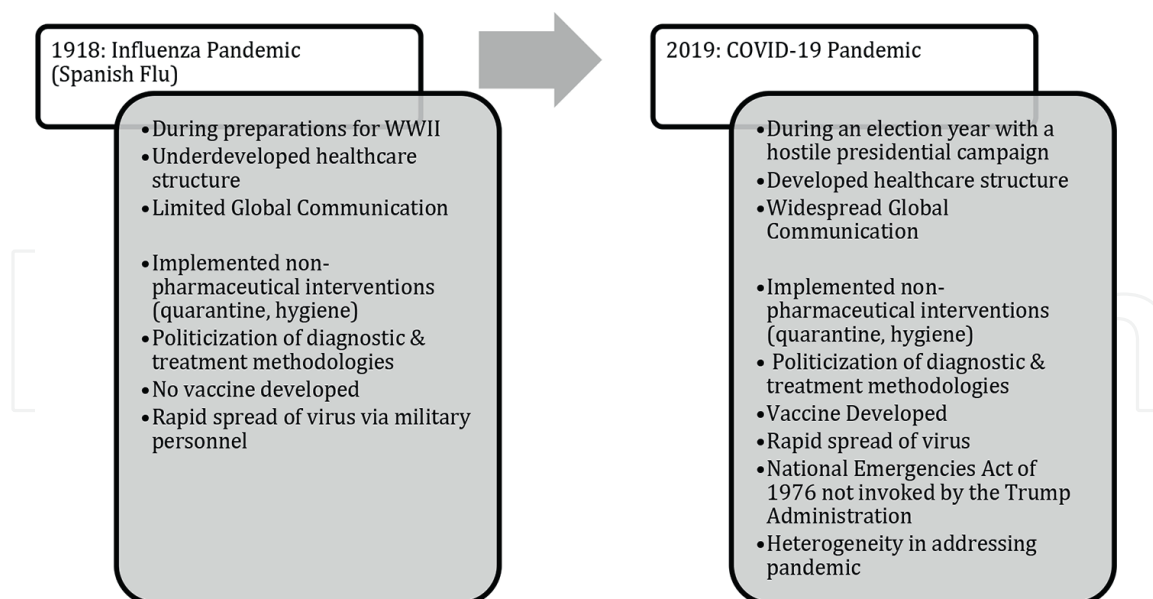
1918: Influenza Pandemic (Spanish Flu)	2019: COVID-19 Pandemic
•During preparations for WWII •Underdeveloped healthcare structure •Limited Global Communication •Implemented non-pharmaceutical interventions (quarantine, hygiene) •Politicization of diagnostic & treatment methodologies •No vaccine developed •Rapid spread of virus via military personnel	•During an election year with a hostile presidential campaign •Developed healthcare structure •Widespread Global Communication •Implemented non-pharmaceutical interventions (quarantine, hygiene) • Politicization of diagnostic & treatment methodologies •Vaccine Developed •Rapid spread of virus •National Emergencies Act of 1976 not invoked by the Trump Administration •Heterogeneity in addressing pandemic

Figure 1.
Comparison of influenza and COVID-19 pandemics.

camp and then across the Atlantic. From September through November 1918, sickened 20–40% of U.S. Army and Navy personnel were sick [7]. This left American soldiers en route to the battlefields of France and Belgium to unwittingly deliver the deadly influenza virus. In this case, public health principles were based on politics. This is an error that has been repeated multiple times in history, including in the most recent pandemic of 2019.

It is estimated that more than 500 million people, or two-thirds of the world's population at that time, became infected with this virus. The number of deaths was estimated to be at least 50 million worldwide with about 675,000 occurring in the United States. Mortality was high in people younger than 5 years old, 20–40 years old, and 65 years and older. The high mortality in healthy people, including those in the 20–40-year-old age group, was a unique feature of this viral illness.

While the 1918 H1N1 virus has since been synthesized and studied [8], the properties that made it so devastating are not well understood. Furthermore, no vaccine to protect against influenza infection and no antibiotics to treat secondary bacterial infections were available at that time. Control efforts worldwide were limited to non-pharmaceutical interventions such as isolation, quarantine, good personal hygiene, use of disinfectants, and limitation of public gatherings.

Both the 1918 influenza pandemic and the 2019 COVID-19 pandemic are among the most disastrous infectious disease emergencies of modern times. There were similarities in their clinical, pathological, and epidemiological features despite being separated by more than a century. They were each met with similar public health responses. Both pandemics had lasting, psychosocial effects related to loss and hardship. In considering these two deadly pandemics, we ask: what lessons have we learned over the span of a century. Did we apply those lessons to the challenges of COVID-19 [9]? Will we be better prepared for the next pandemic?

2.5 Politics 100 years later

Of course, when comparing the world during these two pandemics, we must acknowledge at least two major differences. First, the structure of healthcare was

underdeveloped and scientifically, health care systems were in their infancy in 1918. Second, these healthcare systems had limited ability to communicate on a global level in 1918. Surely 100 years later health care systems and global communication had supposedly improved dramatically preparing us for the COVID-19 pandemic.

Notably, there was one factor in both pandemics. That was the politicization of diagnostic and treatment methodologies. This was one of the major reasons that both pandemics were so difficult to confront, especially in the United States. Covid's politicization transcended the pandemic and contributed to a major rift in the political and economic stability of the United States and many other countries [10].

Even before the COVID-19 pandemic, widespread economic insecurity resulted in increasing distrust and popular discontent, ultimately damaging governance and sustainable development across the globe. It caused some countries to move toward extreme policies both on the left, (liberal) and others toward the extreme right, (conservative).

The COVID-19 pandemic eroded the veneer of social and economic security and exposed the extent of insecurity in the world. This has exacerbated societal and political instability. Even now, pandemic management should be a crucial policy priority to ensure economic, social, and healthcare security and rebuild trust. Failure to do this rapidly, will make the goals of the 2030 Agenda for Sustainable Development, the United Nations "plan of action for people, planet and prosperity", unattainable [11].

The COVID-19 crisis has dramatically signaled the extent of economic, social, and political insecurity, even in countries like the United States that previously considered themselves secure. This is likely to have profound consequences, threatening countries' ability to achieve the 2030 Agenda for Sustainable Development and its Sustainable Development Goals for developed and developing countries. If history repeats itself, as it usually does, this will impact the most vulnerable countries to the greatest extent [12]. Or at least that is the prevailing thought.

2.6 Disruption of developed countries

It is quite apparent that in one manner or another, these catastrophic world events have a significant impact on almost all aspects of society. However, the COVID-19 pandemic seems to have been particularly disruptive in developed countries. This pandemic had unique features that we must consider. First, we note a failure of traditional compartmental epidemiological models to predict the scale and dynamics of the infection in various countries. The course of an epidemic is often difficult to predict. This is especially true when it is a new emerging virus. The validity of most predictive models relies on numerous parameters, involving biological and social characteristics often unknown or highly uncertain. The COVID-19 pandemic characteristics were definitively unknown initially. Scientists who did not have a coordinated plan nor a central data center had to individually formulate an approach to gathering the necessary information and develop predictive models to understand the disease's spread [13].

3. Chaos: the best model

A different statistical approach was necessary for COVID-19. Researchers like Jones and Strigul predicted correctly that the unpredictability of this pandemic

could be one of its basic properties [14]. A chaotic dynamical system model matched the method of its spread. The fundamental principle is that unpredictability comes from the fact that very similar initial conditions can often lead to very different outcomes. These researchers emphasized that if their theory was correct and the pandemic was to spread in a chaotic fashion, that policy makers would have to use this dynamic data in decision making. Unfortunately, in the United States, 50 states made individual decisions regarding the handling of the epidemic without coordination of information and resources. This resulted in a disparate response and devastating results.

Once the work on chaos dynamics and the COVID-19 was established, many epidemiological studies were completed and published rapidly. One study by Necesito et al. described the chaotic behavior of COVID-19 using a methodology referred to as State Space plots [15]. It depicted the changes in asymptotic behavior and trajectory brought about by the increase or decrease in the number of cases that resulted from the easing or tightening of restrictions and other public health measures required by governments. The Stringency index, a composite measure based on nine response indicators including school closures, workplace closures, and travel bans, was the measurements used. The authors credited the chaotic behavior of COVID-19 and the effects of population density as a potential methodology to generate more accurate COVID-19 non-linear prediction models. This, they predicted, would be used at the local and national government level to plan strategic and directed COVID-19 policies. However, during the first year of the pandemic, efforts by epidemiologists throughout the world to create models that would predict the future behavior of the deadly virus were carried out in isolation, without a central data facility or a coordination of efforts.

3.1 Quarantine still works

Prior to the development of the vaccines, quarantine models were thought to be an important methodology for disease control. Of course, this approach was employed for centuries and was once again revived when the COVID-19 pandemic struck. Mishra et al. developed three quarantine models, based on the apparent transmission characteristics of the COVID-19 virus in the human population, taking into account the compartments: susceptible population, immigrant population, home isolation population, infectious population, hospital quarantine population, and recovered population [16]. These models, and others, enabled public health officials to predict situations that were ultimately confirmed, proving that these well-established tools could be efficient and useful for public health decision making in the face of a deadly pandemic [17].

4. Election year politics

Just as the response to the influenza pandemic of 1918 by an American government preparing to enter World War I was politically influenced, the COVID-19 pandemic response was even more burdened by political influence. The latter pandemic reared its ugly head in an election year and that appears to have significantly influenced the governmental response.

Recent studies indicate that COVID-19 cases decreased the electoral support for President Trump. A "what if/then" evaluation of election data indicated that, all other

things being equal, if COVID-19 cases had been 5 percent lower, President Trump would have been reelected. Data also revealed that the negative impact of COVID-19 on Mr. Trump's supporters was stronger in areas without a stay-at-home order. The impact was seen in swing states and urban counties where Trump won previously during the 2016 presidential elections. Deteriorating economic conditions did not appear to reduce electoral support for Trump. The Pandemic did. Statistical analysis showed that in most areas with increasing COVID-19 cases, candidate Biden won majority support for the election.

In searching for an explanation for the 2020 presidential election results, two possibilities emerge. First, Trump's handling of the pandemic, unlike other developed countries' leaders, was widely criticized. This reactive phenomenon is referred to as a retrospective voting approach, incumbents being punished for negative disruptions [18]. Second, the economic disruption caused by the COVID-19 pandemic most probably caused some voters to change their vote from Trump to Biden. As James Carville said in 1992, "it's the economy study". These negative economic events continue to influence our voting preferences.

There has been a continuum of negative healthcare and economic events like severe public health threats and major economic losses that have influenced local as well as national elections. These events have led to expansion of the social safety nets, including healthcare and unemployment insurance programs [19]. Of course, the underlying elements controlling the results of the 2020 election are far too complex to discuss here. It is extremely difficult to quantify which of these possibilities mentioned above was most impactful on the election. Factors like the exceptional voter turnout, which was quite high for the 2020 presidential election, voter heterogeneity in race, age, and other characteristics conditions voters' responses to the pandemic are all factors to be explored. Certainly, the COVID-19 pandemic played a significant role in the campaign for the presidency and the election results [20].

5. Many mistakes

Even though the disastrous nature of the pandemic and its enormous sequelae are relatively obvious, it is still difficult to look back and assess the major factors and their consequences that contributed to the horrendous effect on the U.S. society. Clearly, the United States had one of the highest Covid mortality rates in the world. Perhaps we can examine the factors and mistakes one by one and see how they affected the country as it struggled to deal with this new and terrifying disease that cost hundreds of thousands of lives. Tanya Lewis described many of these mistakes in her article in the journal *Scientific American* [21]. She had interviewed scientists and public health experts and teased out what they considered the biggest mistakes in the U.S.'s response. She also concludes that there are still some lingering questions that need to be addressed.

In the era of "Fake News" it is significant that scientists and public health officials failed to produce "real news" regarding the danger of the pandemic. The dismissive response by the politicians to key scientists and knowledgeable government health officials led to poor public understanding of the devastating nature of the problem and its long-term impact on American society. Using a flawed CDC-developed COVID test rather than the more robust and proven German test used by the World Health Organization, exacerbated public distrust of the U.S. government.

The FDA contributed to this failure by not swiftly approving more accurate tests and being equivocal about whether the rapid antibody test was sufficiently accurate. The United States public health services failed to nationally implement a standard for tracing, isolating, and quarantining, which are the fundamental techniques of epidemic control.

The mask guidance was particularly disorganized, the decisions being left to officials of individual states to decide rather than having a uniform national policy for an airborne spread virus. Public officials decided, without scientific support, that the spread of the virus was by large droplets, leading to the emphasis on handwashing and surface cleaning. They failed to "cover all bases" and they de-emphasized masks which are more effective in an aerosol-spread virus.

There were especially bad outcomes in remote areas and communities of color which suffered most. This can be attributed to two major factors: first, these communities have a high incidence of under-treated or non-treated comorbidities like obesity and diabetes; second, the pandemic exposed the structural racism in American healthcare, with minority communities receiving less quality care. Both these factors resulted in an increased mortality rate.

As a result of the failure of a coordinated centralized governmental response, state and local leaders made their own public health decisions and based them on inadequate data. This was due in large part to the national government's failure to have a well-conceived national strategy in place prior to the pandemic. In light the absence of a national strategy and solid scientific diagnostic and therapeutic guidelines, the states had little choice but to implement their own the pandemic plans, resulting in an uncoordinated, uncooperative, and ineffective containment of the disease. The effect was an eruption of COVID-19 cases in many locales, leading to health systems being overwhelmed. The unpredictable pattern of disease spread left no part of the country immune from this deadly disease.

Often decision makers created local and state policies that had no basis in public health. Some created policies that were often contrary to establish pandemic control measures. This enabled a self-centered approach to resource mismanagement, where in some cases, as in developing and resource poor nations, needed equipment was stored in warehouses in one state while other states were desperate for those items. A lack of national government oversight resulted in an unbalanced application of established public health measures in the United States that was not as dramatic as in other developed countries. The central administration did nothing to try to correct these errors. However, it must be remembered that our mechanism of governing is decentralized, and states individually have the right to manage crises like the COVID-19 pandemic. The President could have invoked the National Emergencies Act of 1976. Whether the political climate at the time would have allowed this, or whether it would have caused even more harm, is conjecture.

It also appears that there is a systems issue that resulted from the intrusion of politics into public health. Political affiliation emerged as a risk factor for COVID-19, evidenced by the fact that predominantly Republican counties had higher COVID-19 death rates than those with a predominantly Democrat-voting citizenry. This serves as evidence of the relationship between political party affiliation, vaccination views, and clinical cases and deaths from COVID-19 [22].

This is basically the result of the federal system of government under which we live. The states, rather than the federal government, hold the authority to make healthcare policy, independent of the federal government and other states. This creates an inconsistent and potentially dangerous situation where, in the face of a

crises like the COVID-19 pandemic, states can actually be working to undo federal guidelines of the Center for Disease Control and the National Institutes of Health. This division of authority led to errors on the part of both the federal government and the states. The lack of coordination resulted in higher mortalities in some areas and higher caseloads in others. It also caused a failure of vital distribution of resources, adding to the healthcare burden in some states, and unnecessary resources abundance in other states.

During the pandemic, over 30 states passed laws contradictory to basic public health measures. This was done without scientific basis and without any coordination with other states or national healthcare authorities. This was a situation fraught with danger and was definitely counter-productive in the midst of a pandemic. It was not their conclusions that were flawed but rather their rationale.

"They knew what was best" attitude, had unpredictable outcomes. In some cases, their decisions were proven correct, as in states that opened their schools and businesses in mid-2021, and in some cases, they were completely wrong, like Alabama. In March 2020, Governor Kay Ivey issued quite "soft" orders paralleling CDC recommendations without the strict enforcement measures. On May 31st, 2021, he issued a supplemental emergency proclamation transitioning the state from an amended Safer at Home Order to a new Safer Apart Order, the third phase of COVID-19 pandemic health orders. Masks were no longer mandated statewide, but individuals were strongly encouraged to wear a mask or other facial covering when in public and in close contact with other people. That order terminated on May 31, 2021, and the state of emergency in Alabama ended on July 6, 2021. Almost 2 years later the COVID-19 cases are still substantial in Alabama, especially in the southeastern part of the state. Statistics from Johns Hopkins University show 106 deaths were reported statewide daily over the last 7 days, although some of those could have occurred earlier because of a lag in reporting. Alabama's rate of 18 deaths for every 100,000 people is far above second-place West Virginia, which had 10 deaths per 100,000 people, according to the U.S. Centers for Disease Control and Prevention [23].

6. What a developing country did well

We have discussed at length the response to the pandemic in the United States, and its failings. Let us compare our developed country's (HDI 0.921) response to an undeveloped country. To that end we will focus on the Covid-19 response undertaken by South Sudan (HDI 0.635), which did not and does not have the extensive resources that exist in the United States. South Sudan is one of the countries that continues to face a huge burden of infectious disease as well as non-infectious diseases. The country confirmed more than 20,000 cases of Covid infection and over 150 deaths by the end of 2022.

The WHO mounted a coordinated response in concert with the South Sudanese Ministry of Health to bolster preparedness and provide interventions to suppress the pandemic. To be able to provide extensive testing, almost 100 teams were trained and dispersed throughout the country. These teams were fully equipped to establish laboratories and implemented infection prevention and control operations across the countryside.

As soon as a vaccine was available (including a significant contribution from the United States), the WHO in concert with the Ministry of Health and other partners created a program to provide vaccinations for the most vulnerable communities who

were plagued by floods, food insecurity, conflict and displacement. Over 1.9 million doses of the vaccine were administered by the end of 2022.

The vaccination campaign was supported by a major public campaign promoting the safety of the COVID-19 vaccines. Large numbers of South Sudanese citizens came to vaccination centers and a significant number of lives were saved.

What did South Sudan do right? First, they reached out for help to international agencies with the capability to assist them. They rapidly geared up to do testing and put public health measures in place. Public health ministry developed a program for vaccination of their population and supported this with a campaign to educate and encourage the public to be vaccinated. But most significantly, the South Sudanese government spoke with one voice through the Ministry of Health. This markedly decreased confusion and developed public confidence in the government's recommendations and participate in recommended pandemic suppression techniques and vaccinations [24].

7. Lessons from pandemics

Any comparison between the US and South Sudan is of course absurd. The authors do not believe that the complex developed United States could have achieved similar outcomes as in low-resource emerging undeveloped South Sudan. This leaves the question of what could have been done? Certainly, basic public health principles would, and should have been the very first approach to this pandemic. This was especially true when it became clear that the disease was extremely infectious leading to significant mortalities. The principles suggested here are not new and do not need further support. They have prevented a large number of cases of the disease for centuries, and a multitude of deaths. Jamison et al. described the mitigation of such an epidemic/pandemic, predating the identification of COVID-19. They wrote of "Pandemics: Risks, Impacts, and Mitigation in 2017 [25]. These principles included:
There must be:

1. *prerequisites for effective preparedness and response* to assess the problem and take steps to mitigate disease

2. Whether a country is developed or not, preparedness includes pre-emptive cost-effective strategies like *investing to strengthen core public health infrastructure*, including basic water safety and rapid response measures

3. A *coordinated response* is essential and should include situational awareness, public health messaging, transmission abatement, and care of the sick.

4. A healthcare system must have *surge capacity* proportional to the severity of the event, the pathogen, and the population at risk.

5. For many poorly prepared countries, *surge capacity often is delivered by foreign aid providers*, who may not be available in a global pandemic. This must be factored in when planning local pandemic mitigation.

These five strategies have been well established for decades. These measures were even instituted in the influenza pandemic of 1918. Mistakes were made then, as they were now.

However, one has to question why after a century, many of the same mistakes were made by our supposedly advanced healthcare system. To answer that question, we first should look at the positives our healthcare system did provide. First, we were able to produce multiple vaccines at "warp speed". The remarkable scientific achievement was unprecedented in history. The lives saved were a reflection of the ingenuity and skill of those research scientists acting unabated with essentially unlimited resources. Science prevailed.

Unfortunately, not everyone understood the benefit of the vaccines. The death rate in areas where the population was vaccinated with at least one dose and an additional booster was one quarter that of the non-vaccinated areas. This was a sad reflection of a socio-political bias imparted by ignorance and partisanship [26].

The public tried to ignore misinformation and follow health guidelines. The authors, it must be noted, have avoided any political debate in this chapter. It is for political scientists and historians to analyze and evaluate the effects that politics had on the governmental and public response to the pandemic. However, it is obvious, when speaking of public health measures, and vaccination for that matter, that information and adherence to guidelines, was inconsistently accepted and applied [27].

And lastly in the "plus" column, the healthcare workers of the United States truly stepped up when they were called upon. Through a crisis filled with uncertainties and mortal risk, these workers put their own safety aside and cared for an avalanche of patients with incredibly complex disease, many of whom were doomed from the moment of their admission to hospital. These heroes deserve a special salute for their efforts they exhibited, and the price, sometimes paid for dedication with their lives. We would be remiss if we did not note their remarkable commitment.

8. Conclusion: what now and in the future

There are many questions that remain from the pandemic that need to be answered. Will COVID-19 again mutate into a more virulent form and again cause widespread deadly disease? At the time of this writing, the virus still is causing approximately 200–300 deaths per day [28]. How often do we need to be vaccinated and will new vaccines be more effective at preventing a broader spectrum of viral illness? Why do a certain group of people develop long-term systems and how do we treat them? And, returning to our most critical question, will new animal-to-man transmitted pandemic-causing viruses appear, and will we be ready?

Clearly, some of these questions do not have immediate answers. As far as animal-to-man viruses, scientists tell us that there are hundreds of such viruses with the potential to become another COVID-19 pandemic [29].

Although our founding fathers put certain responsibilities into the hands of the states to prevent the federal government from becoming dictatorial, expanding federal powers in a defined emergency would provide a more coordinated response to such an emergency. To accomplish this Congress would have to update the Public Health Service Act. This would have to include making federal government financial support in a crisis dependent on each state adhering to established federal guidelines as dictated by the CDC and the NIH. This would allow for a seamless response of the country to such an emergency while providing necessary support to economically weaker states. This would include a refurbishing of the public health system and authority, while decreasing costly and laborious litigation regarding those established guidelines [30].

This would at least be a first step in taking politics out of pandemic response and encourage states and the federal government to work in a coordinated fashion.

Scientists around the globe are relatively sure that another pandemic or catastrophic natural disaster is in our future. If we fail to acknowledge the lessons of the COVID-19 pandemic and move to rectify the shortcomings we evidenced in our handling of it, we are doomed to repeat our errors. Albert Einstein is attributed with the quote, "Insanity is doing the same thing over and over and expecting different results." This witticism, referred to by some as "Einstein Insanity", is especially on point when speaking of the COVID-19 pandemic and any natural disaster we face in the future.

Our failures can only be forgiven if we take steps to avoid the mistakes of the recent pandemic. Lessons learned from the COVID-19 pandemic include the need for a unified, coordinated approach across the country, addressing healthcare disparities, updating legislation, and preparing for future pandemics or natural disasters. The first such step should be the acceptance that a pandemic-type event is a national problem, controllable only if we have a unified, coordinated approach across the entire country. Epidemic disease is not a problem that can be treated by government officials and politicians alone but must have the best scientists and public health experts making recommendations that have a solid scientific basis in view of the facts. Another pandemic cannot be prevented. However, only our best efforts as a nation, like those demonstrated in World War II, will allow us to avoid millions of people dying. If we do not accept this premise, it is very possible that the next disastrous event will be even worse. By rectifying shortcomings, the United States can strive toward becoming a truly developed country with a robust public health infrastructure that prioritizes the health and well-being of all its citizens.

Notes

In memory of Dr. Michael Gottlieb PhD, 1944–2021, who previously published with us on pandemic preparedness.

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