

Is the United States Prepared for the Next Pandemic?

PROBLEM

In 1999, the CDC released a report on the greatest public health advances in the United States during the 20th century. In this report, the CDC named the following as some of the greatest accomplishments: eradication of smallpox due to a better understanding of vaccinations; normalization of behavior regarding seat belt usage; clean water and better sanitation; access to contraceptives and family planning resources; fluoride in drinking water and standardized food safety laws; and the promotion of smoking cessation after understanding the impact and effect of smoking and tobacco use (1). The United States has some of the most powerful and efficacious federal agencies in the world, including the CDC who is the nation's leading health protection agency and committed to health, safety, and security threats, the FDA who is responsible for the efficacy and safety of drugs, and the NIH which is one of the world's premier medical research institutes. The United States holds over 113 trillion dollars in assets (2). Yet, the country is incredibly vulnerable to disasters and the threat of disease.

When Hurricane Maria, a Category 5 hurricane, devastated Puerto Rico in September 2017, the United States experienced a significant shortage in intravenous bags and saline due to the production and manufacturing of such supplies in Puerto Rico (3). IV bags are one of the most used products in hospitals. Without IV bags, providers, medical staff, and healthcare facilities were forced to inject saline and medications with syringes. This, subsequently, then caused a massive national shortage in syringes. The FDA announced in October 2017 that 80% of all drugs and drug products used by patients in the United States came from 80 different facilities in Puerto Rico, and that shortages affected patients in every state in the country (4). Other medical items that are made in Puerto Rico include Tylenol, surgical staples, orthopedic and cataract surgery supplies, Prezista (an HIV drug), and plastic tubing were all in short supply (5). What this means is that the United States is severely reliant on long supply chains with other countries.

The United States' capitalistic tendencies (such as finding cheap options for greater monetary outcomes) is now backfiring. We are no longer a self-reliant country, especially when it pertains to the healthcare industry. The proposed problem is that, due to the reliance on other countries with respect to climate change, decreased funding for public health programs, population growth and urbanization, the United States is not prepared for a pandemic and it poses a threat to national security.

EVIDENCE

In order to increase efficacious pandemic outcomes, a disaster preparedness triangle framework may be needed. The framework would involve inventory, detection, and capacity. Inventory would involve the stockpiling of healthcare-related supplies; detection would involve the recognition of novel pandemic strains of viruses; and capacity would involve the treating of infected patients (6). On paper, this model is ideal. However, it doesn't take into account the disaster that a pandemic can create. Stockpiling is only helpful if there is enough capacity. If there isn't enough capacity, there won't be enough detection. This model will then implode on

itself. What's crucial in understanding the magnitude of this country's vulnerability is that all plans are built on top of one another, so if one area (like funding, research, development, or supply chains) is ruined, the rest of the model is ruined.

The flu is a good first example of the thinning fabric of resources. Each new strain of the flu virus will kill over 500,000 people throughout the world (3). The CDC is constantly tracking new illnesses or evidence of new strains; however, the practice for growing the virus for vaccines is to do it inside chicken eggs, which is the same process that has been occurring for 70 years (3). The technique is simple, but would be incredibly problematic with an incoming pandemic strain. We saw this in 2009 when the H1N1 pandemic reached the United States. While it had better mortality rates than the 1918 flu pandemic, it took four months for a vaccination to be created (3). The United States increased its resources and surveillance in regards to influenza and created the Biomedical Advanced Research and Development Authority (BARDA); however, only 44% of adults will get vaccinated, on average, annually and the vaccine is only believed to be 50-60% effective (6). The non-profit Trust for America's Health proposed that a pandemic like the 1918 flu would cost the country \$683 billion (3).

Along with money and budgets, it's important to note that the United States does budget for preparedness. The Hospital Preparedness Program was created after the September 11th terrorist attacks; however, two years after its inception, the 514 million dollar budget was reduced by 50% (3). The Public Health Emergency Preparedness program was created as a means to education and create surveillance mechanisms for local and state health departments; however, that budget was reduced by 30% (3). The United States spends approximately \$500 billion on the military; however, a pandemic attack will have far more fatalities than the outcomes of militaristic attacks by other countries (8). As Bill Gates said during his 2015 TED Talk: "If anything kills over 10 million people in the next few decades, it's most likely to be a highly infectious virus, rather than a war. Not missiles, but microbes" (8). When the Zika virus created an outbreak in 2016, Obama asked Congress for \$1.9 billion to fight against the disease. The partisan reaction to this request was negative, and took seven more months of deliberation (3). Money from emergency preparedness budgets that were initially allocated for the flu and HIV needed to be redistributed to treat patients. In the last three years, Trump slashed 67% of the CDC's budget for international epidemic preparedness and 28% of the State Department and foreign aid budget which would have been used in international disease prevention efforts (3,9).

With climate change, we will continue to experience severe weather patterns, and the loss of resources and supply chains, like in Puerto Rico, will be a continuous and life-altering issue. The last United States-based factory that produced penicillin was closed in 2004, and as of 2018, only 10% of generic drugs are made in the United States (10). 80% of the active ingredients found in medications in the United States are processed in India or China (10). If bad weather, faulty infrastructure, or changes in merchant ships were to change, the United States would have no alternative for processing their drugs on their own. This also brings to light the infrastructure and transportation in the United States. The country relies on "just in time" deliveries of goods, such as medical supplies and prophylaxis (11). This also includes humans, who have the capacity to travel anywhere in the world within 24 hours. Right now, there are approximately 60,000 cargo ships transporting goods across the world, and planes will carry over 9.54 million tons of goods every year (12). Global infrastructure is important for trade, communication, allies, and economies, which increases supply, market values, demand, and

profits. However, supply chains of this magnitude have the power to increase mortality rates when they are destroyed. This calls for greater and more robust supply chains in case primary chains are destroyed.

Our vulnerability is also rooted in a rise in populism and nationalism (13). Pandemics are not localized and can very quickly become the problem of multiple countries. In dealing with a pandemic, moral panic can occur which is the social reaction to crises. Moral panics have four characteristics which include moral entrepreneurs and visceral reactions, tend to be normatively ambiguous, and have two responses, either the medical establishment or expert communities take over the situation to approach the public (14). This means that, in times of crisis, our priorities as a country are skewed. Within Trump's administration, there is a strong sense that America is first, and due to this, we are more interested in creating a narrative that dramatizes our capabilities instead of honoring the central surge towards curing the disease at hand.

SOLUTION

We live in a time where technology makes everything easier, and with the rise of technology, there has been increased air travel, population growth, and mass migrations into urban areas globally. Along with these outcomes, our threat to pandemics has been significantly heightened. Bill Gates, along with the Gates Foundation, has created the largest coalition for the prevention of potential pandemics. The Gates Foundation proposes that the creation of efficacious vaccines is the best chance for survival against a pandemic attack (15). The Gates Foundation, along with a number of international foundations and companies, were granted 600 million dollars in funding. The Coalition for Epidemic Preparedness Innovations was created with the main purpose to rapidly develop and distribute vaccinations (15). The solution here is the dedication to research and development and international collaboration, as there is no such thing as a local or regional pandemic. The threat is universal; the Bill and Melinda Gates Research Institute, which was created in 2017, has the potential to improve the country's odds through the prevention of infectious diseases at home.

Aligning with the knowledge that threat is inevitable and universal, some research calls for the necessity of a universal flu vaccine as a solution to the most dangerous potential pandemics. In 2018, 160 million dollars in funding from the NIH's National Institute of Allergy and Infectious Diseases (NIAID) was granted to researchers who are hoping to create a vaccine that corrects for seasons and mutations in strains (16). NIAID is currently in phase 2 of its clinical trial (17). The sponsor is BiondVax, a pharmaceutical company based in Israel, with the United States-based Principal Investigator based in Houston at Baylor. Patients are randomized to the vaccine or a placebo, and receive two doses spaced between 22 days. The participants will then return 172 days later to receive an approved seasonal flu vaccine. Follow up is for seven months, and data endpoints are collected regarding the immune response to both vaccines (17). No research on its efficacy has been published yet; however, the researchers are finding early results to be promising.

Hospitals should be equipped with biocontainment units. Currently, only the University of Nebraska Medical Center, the NIH, and Emory University Hospital have such designated areas for patients (3). Nebraska, in particular, has a separate air system so no air is recirculated and the entire unit is negative pressure (18). The unit is ran by volunteers who are on call 24 hours a day and are trained quarterly with monthly refresher meetings. Patients with confirmed Ebola were transferred to this containment for treatment during the 2014-2016 epidemic in West

Africa. The units took care of three patients who created 3,700 pounds of contaminated medical waste, such as gloves and linens (18). While the unit has an autoclave for disposal of medical waste, the process cost over a million dollars (3,19). With federal emergency preparedness budgets being consistently cut, this calls for the need for smarter hospitals. New hospitals should be constructed with surveillance technology to detect body temperature, all doors should be secure, access to isolation rooms can only be granted to visitors if they are in correct and appropriate personal protective equipment, intercoms should be in all rooms housing patients with airborne diseases, traceability cards should be installed at every bedside to keep track of everyone in contact with the patient, and a smart reader should automatically distribute sterile gloves, masks, and gloves before entering rooms with the most contagious patients (20).

We live in a time where our political beliefs are dividing the country more than ever before. Because of this, the expectation that the president or Congress, regardless of majority leadership, will prioritize emergency preparedness is minimal. Without united support, there is certainly not going to be prioritized funding either. To rectify this, the federal government should incentivize community-based programs and non-profits to create disaster medicine-related educational series in order to inform the general public at a grassroots level (21). Community-based initiatives can make sure that the general public is receiving information through in-person lectures, mailings, advertisements, or other events. Additionally, all workplaces, regardless of the company's focus or mission, should enforce mandatory safety training in the event of an emergency, such as an incoming pandemic. Workplace policies should be in place prior to an emergency or disaster (21).

PROPOSAL STRENGTHS AND WEAKNESSES

BARDA has the capacity to create 200 million doses of vaccinations; however, it would need six months to develop and disseminate after a pandemic (3). There are certain strains that BARDA believes has the capacity to demonstrate a pandemic outcome. Vaccinations for those particular strains are stockpiled, so healthcare providers, government officials, and the military can be vaccinated first. However, research shows that many public health emergency programs are not equipped to rapidly vaccinate critical personnel during a pandemic (22). Federal funding has been allocated for the research and development of a universal flu vaccine; however, the trial is only in phase 2 and would still need to go through the pre-market approval phase with the FDA after efficacy is determined. This might be an available vaccination in five years. What this amplifies is that fact that It can often feel like we continue to take the same five steps forward and backwards with no true pathway towards protection.

Research tells us that the inevitable is inevitable, and at our current place in the global economy, we are not prepared to overcome from a pandemic. Our supply lines are weak, our budgets are unfocused, and our inability to accept climate change is criminal. The solutions offered propose a greater commitment to international research and development, a pathway of funding and resources into trialing a potential universal vaccination, a modernization of hospital infrastructure, and community level awareness. Regarding the collaboration with the Gates Foundation, this is an example of collaboration between government and companies that can merge forces and resources in order to minimize perceptions of nationalism and reinstate our placement in the global community. However, 600 million dollars is not a lot of money based on the magnitude of aims. The mission is incredible, but the funding source is not lucrative. Regardless of how much the post-pandemic clean up will cost, preparing for something that may never happen is not a favored concept.

Regarding the quest to create a universal vaccination, this has the power to save lives and eradicate the fear and potential threat of death to over 500,000 individuals (3). Using American federal funding, we have the opportunity to make a global impact. However, along with the saving of lives comes the issue of population growth and the inability to successful care for everyone who is alive. Only 44% of adults get the flu vaccine every year in the United States and this is with countless strategies and mechanisms in place. We communicate to the public about the impact of the flu and make it easy to get vaccinated; however, less than half of the country will participate. This doesn't bode well for the incoming of another vaccination.

Regarding the modernization of hospitals, this is an opportunity to revise the infrastructure of this country. Smart hospitals will acknowledge the influence of technology in healthcare, and create a dynamic that each hospital is self-reliant and can care universally. If this is not fiscally possible, we can use the British healthcare system as a guiding light to establish regional smart hospitals that are federally funded and accessible to everyone. However, the cost of this will always be a problem. No public hospital system will ever be able to afford the upgrades needed to fulfill the standards of a smart hospital or even have a biocontainment unit.

Lastly, our president and his administration are hoping to enact policies and laws that better align with their political and social preferences. In doing so, budgeting for preparedness is not seen as fiscally smart or a population-level priority as the investment in knowledge, skills, and resources may never be needed. However, it is important to remember that a severe pandemic, especially one similar to the scale of the 1918 flu pandemic, could displace or kill a third of the country (3). Grassroots initiatives have the power to engage people at a community level. If the government is unwilling to prioritize, this is an opportunity to make sure each neighborhood knows where their point of dispensing is if mass prophylaxis needed to be acquired or how to protect oneself from infectious and communicable disease through proper protection. This is a means to educate individuals in hopes of having a significant population-level outcome. However, this requires good leadership. It is a common trend that the lack of money and good leadership are at the root of failure when it comes to potential pandemic awareness and protection. Incentivizing leadership promises to be difficult, especially if leadership is community board members who are likely already exhausted.

CONCLUSION

In short, the evidence demonstrates that the United States is not prepared for a pandemic of any proportion. The reasons for this vulnerability seem to be rooted in cyclical trauma, where we are not learning from our mistakes. Outreach and awareness are not enough. We do not budget accordingly for disasters or the probability of a pandemic. We have strayed from the pathway towards greater and more efficacious research and development. We refuse to accept the propensity of climate change, and how weather and relationships with other regions and countries have direct effects on our supply chains. We have elected a president who does not take emergency and disaster preparedness seriously, and demands that citizens honor nationalism. With this presidency, and the administration's subsequent effect on economy, society, trade, and healthcare, we are not prioritizing collaboration and because of that, we will fail in our times of greatest need.

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