Vaccination Nation

Vaccines in American Culture and History

A vaccine is a substance used to stimulate the immune response in an organism against a certain type of disease. Utilizing deactivated material from infectious particles to provide an immune system boost is one of the greatest breakthroughs in applied bioengineering in all of human history. As vaccination developed, in the 1800s and early 1900s, diseases that had been leading causes of mortality for centuries were defeated. As America and the rest of the world struggle through the COVID-19 crisis, journalists and researchers have returned to the history of vaccination and of global epidemics to compare this history with the modern debate over vaccination and civil liberties.

A Brief History of Vaccination

Thousands of years ago, societies facing infectious diseases came upon an important observation: people who recover after being infected by a disease are resistant or sometimes immune to reinfection. Though these people did not have a full understanding of the human immune system, they had essentially stumbled upon the phenomenon of immunity, which is the basis of all resistance to infections.

The human immune system consists of cells and proteins that are used to detect, attack, and eliminate foreign cells or substances within the body. However, a person's immune system does not automatically have the capability to fight all diseases. Rather, immune systems are typically programmed to fight diseases that are common in the region into which a person is born. If a person encounters a new and exotic disease, such as one imported from another part of the world, his or her immune system is unlikely to have the tools to respond effectively, and the result can be devastating. In order to gain immunity a person must be exposed to a disease, but this is dangerous, especially when dealing with potentially deadly or debilitating diseases. The disease known as "smallpox" infected Americans seasonally for more than a century. Those who survived infection had increased resistance to the next wave of the disease, but smallpox also killed nearly one-third of those infected. The solution to this problem came from the ancient discovery of how people develop immunity. In ancient Africa and the Middle East, physicians came up with the idea that a person might be purposefully infected with a disease to stimulate immunity. For centuries, physicians tried to come up with ways to cause minor infections that would not be deadly but might impart some degree of immunity. Efforts to protect against smallpox, for instance, included injecting people a tiny amount of fluid from an infected person. Although this method was effective, physicians lacked the

ability to control the intensity of the infections, and many patients died just as they might if they had been infected through traditional channels.

Edward Jenner, an English physician who noticed that dairy farmers did not seem to catch the dreaded smallpox disease, theorized that this was because dairy farmers were frequently infected with cowpox, a mild illness that is rarely fatal but also closely related to smallpox. Jenner conducted a set of experiments in which patients were infected with cowpox and, after recovery, were exposed to smallpox. His experimental methods, including infecting an eight-year-old child with a potentially deadly disease, would not be accepted in the modern world, but Jenner's theory proved correct, and he has since been credited with creating the science of vaccination. By infecting individuals with a less-severe, or related, form of disease it is possible to stimulate the immune system to develop resistance to other similar diseases or against more severe forms of a disease.[1]

Vaccination in American Culture

The smallpox vaccine was invented in the late 1700s, but for many decades few Americans availed themselves of vaccination. Many Americans were wary of vaccines. Pamphlets and articles published in the year when the smallpox vaccine was first introduced show that Americans were frightened of this new experimental medical treatment and also show how rapidly misinformation about vaccination spread through society.

Many Americans in the early 1800s believed that it was unnatural for humans to willingly be infected with cowpox, and anecdotal stories spread around the country about people who were vaccinated and then developed bovine characteristics, such as sprouting horns or tails. Fundamentalist preachers warned that God would punish those who subjected themselves to unnatural and un-Christian scientific treatments by deforming their bodies or infecting them with even deadlier forms of disease. Panic, misinformation, and paranoia were characteristic of the American response to vaccination in the late 1700s and early 1800s and remained a characteristic feature of American attitudes about science and medical innovation in the years that followed.[2]

Vaccination proved effective year after year, against a whole host of different diseases. The development and spread of vaccines were one of the key reasons that the infant mortality rate in the United States fell from close to 60 percent to well below 10 percent over the course of the twentieth century. Prior to vaccines, millions of American children died from preventable childhood diseases like scarlet fever, measles, and mumps, and parents in the first half of the nineteenth century could expect that fewer than half of their children would reach adulthood. The advent of vaccines freed American families from diseases that had been among the leading cause of child mortality for centuries. But the effort to vaccinate the American population was, and remains, a struggle.[3]

Until the late twentieth century, however, the antiscience and antivaccination movement had little political power, primarily because the observed benefits of vaccination outweighed the fear and anti-government paranoia that existed within a

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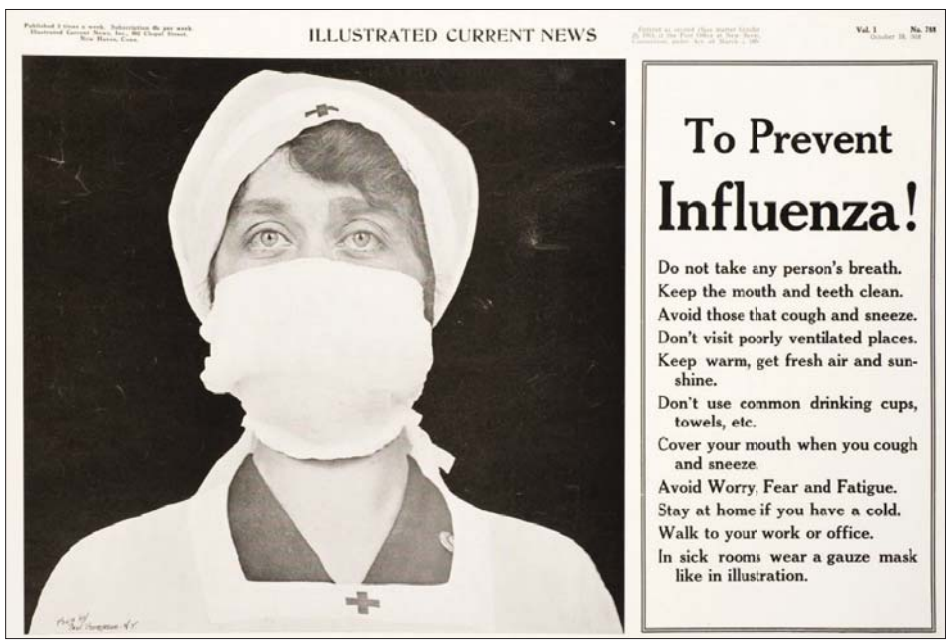
Vaccination and Pandemics



By Paul Thompson, via Wikimedia.

These public health recommendations appeared in the 1918 *Illustrated Current News*, New Haven, CT, during the 1918 flu pandemic. Studying past pandemics has been important to containing the spread of COVID-19.

Inoculation and Vaccination in U.S. History

For many Americans, vaccinations are a regular part of life, and a majority of children in the United States are vaccinated against some forms of disease. But the arrival of an epidemic or pandemic can throw the vaccination system into chaos. Public health experts concentrate their efforts to fight the current outbreak, meaning that vaccination, rather than being part of standard health and wellness programs, becomes part of an emergency response system. The COVID-19 pandemic, which killed more than 4 million worldwide and 600,000 in the United States, posed one of the greatest public health emergencies in history. The United States, and allied countries, struggled to create and distribute a vaccine to stem the tide of COVID-related mortality.

The Nature of a Pandemic

The world is filled with diseases, and humans are constantly encountering and fighting them off. Seasonal cycles of colds and flu are common in many regions and are related to climate patterns and other cultural variables. Public health experts and disease specialists are continually monitoring diseases that move through their focal region, but there are times in which the arrival of a disease signifies a more potent threat that requires more aggressive methods for intervention.

Disease experts use the term "outbreak" to describe a situation in which a disease causes more cases than would be expected. An outbreak might mean that a new, more contagious variant of a disease has emerged or that there is some pattern of behavior or climatic condition that is facilitating the spread of the disease.

When an outbreak occurs and the disease becomes widespread within a region, or a country, it is typically called an "epidemic." A disease classified as an epidemic is one that is spreading so rapidly and so far from the initial locus of infection that standard methods of containment are not working. Finally, if the epidemic spreads across a continent, or the world, it is known as a "pandemic."[1]

There have been many major epidemics and pandemics in history, and pandemic diseases have shaped many of the world's great societies and even contributed to the rise and fall of civilizations. The plague of Athens, which hit ancient Greek society around 430 BCE, lasted for five years and contributed to the fall of the Athenian civilization and their takeover by Sparta. The Antonine Plague of the second century CE was one of the predominant factors bringing about the end of the Roman Empire. Physicians and healers have been trying to combat infectious disease for as long as diseases have been affecting humanity, but no method was effective until the discovery of immunity.[2] Many of the modern methods used to stem the spread of disease, such as "contact tracing" and quarantining infected individuals, have

their origins in the Antonine Plague and the methods that the Roman Empire used to try and save their society from this annual killer.

Pandemic America

When the first European colonists arrived in the Americas, they brought pandemic diseases that killed millions of American Indians, and many historians have noted that had these epidemics never occurred, it is possible that British colonists may not have been able to colonize North America.[3] This was the first known pandemic in the New World, but there were many others, especially after the new European colonists in the Americans creating lasting connections between their society and other societies around the world.

Travel and merchant transport between nations also brings the potential for diseases to cross continental lines. A number of diseases have come to the United States in this fashion, developing into pandemics as they spread across the continents. Among the most serious in American history was the 1918 pandemic involving a type of influenza known as H1N1. This disease, inaccurately called the "Spanish Flu," is believed to have originated as a disease in birds before spreading to humans in Asia and Europe. The disease arrived in the United States in 1918, and more than 675,000 people died in the United States alone. Globally, the death toll was believed to be close to 500 million.[4]

At the time of the 1918 influenza pandemic, vaccine science was still in its infancy. Scientists had not yet learned to isolate genetic material, and only a few successful vaccines had been developed. There were no treatments available for this kind of influenza, and physicians were helpless in fighting the disease. The 1918 influenza pandemic was actually the second time that the H1N1 virus had come to the United States. There was a frenzied effort to develop a vaccine utilizing cultures of bacterial cells isolated from infected individuals, but there was little evidence to suggest that the vaccine was effective.

Media agencies and physicians were transparent about the fact that the causative agent of the 1918 disease remained unknown and, therefore, the vaccines being produced might not be effective. Vaccine hesitancy in 1918 America was very similar to what occurred during the COVID-19 pandemic of 2019–2021. However, some studies indicate that the vaccines might have, as some physicians at the time suggested, prevented some of the more common types of bacterial secondary infections that were often the direct cause of death for those suffering from H1N1 infection.[5]

While there were no effective vaccines developed to prevent the 1918 outbreak of H1N1, the patterns of infection in the United States provided an excellent model for public health professionals to understand how pandemics move through a society. The 1918 influenza continued to appear in successive waves that were difficult to predict. New waves were often connected to periods of significant social gatherings, such as when schools opened in the fall, causing students and adults to congregate. Likewise, holiday gatherings became a time for intensified transmission as families traveled and gathered together in larger groups. On the smaller scale,

restaurants, bars, concert venues, and other kinds of indoor public events became vectors for the spread of H1N1, and medical professionals have continued to see these same patterns in the nation's subsequent pandemics.

One of the most significant consequences of the 1918 Pandemic was the development of global monitoring systems for disease. These systems are made up of national and regional medical and disease control centers, which maintain communication with disease control centers in other regions or other parts of the globe. In the United States, the Centers for Disease Control and Prevention (CDC) and the U.S. Department of Health and Human Services (HHS) are the primary national nodes in this global pandemic prevention and awareness effort. Since World War II, these organizations have worked in conjunction with the World Health Organization (WHO) of the United Nations, and through this international body with hundreds of other national disease-prevention agencies in other countries.[6]

Vaccination Nation

In the years since the 1918 H1N1 outbreak, scientists and epidemiologists have learned a great deal about the nature of disease, and it has become possible to vaccinate against various strains of influenza, including the H1N1 strain that caused the 1918 pandemic. However, as new pandemics hit the United States, it became clear that fear of the disease was not, in itself, sufficient to convince Americans to embrace vaccination. During the 1950s, another strain of influenza, inaccurately known as the "Asian Flu," reached pandemic proportions, arriving in the United States in 1957. This time, the technology was available to create an effective vaccine, but the vaccines were not effectively disseminated. The U.S. response to the 1957 pandemic proved the effectiveness of the global information sharing network, and it was the first time that the United States managed to develop a vaccine during a pandemic. However, vaccine production was limited and, by the end of the pandemic, scientists had only managed to produce enough vaccine to vaccinate 17 percent of Americans.[7] During the so-called "Hong Kong flu" of 1968 and 69, the United States again managed to create a vaccine, but this agent wasn't available until after the peak of virus transmission. However, this effort proved important as it allowed public health experts to vaccinate against viruses in this group in the years that followed.

Most recently, the "swine flu" outbreak of 2009 tested the nation's infrastructure and preparedness to manage a potentially devastating outbreak, and the response was insufficient to develop a cohesive response before the "swine flu" or H1N1 virus spread across the United States. But the virus had a low level of lethality, and so even though 60 million Americans were infected, there were only 12,000 fatalities.

Later analysis showed that the Barack Obama administration and public health experts performed admirably in some ways, rapidly distributing public health equipment and providing clear public health messaging on the virus to the citizens. Further, then vice president Joe Biden managed a campaign in the US Congress that resulted in $8 billion to fund a national response to the disease. But vaccine manufacturing hit repeated problems, and there were only 11 million doses of the vaccine

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Vaccine Access

By Baltimore County Government, via Wikimedia.

Access to the COVID-19 vaccine has been uneven in poorer communities. Above, health officials distribute the Moderna COVID-19 vaccine to frontline health workers and first responders in Baltimore County, Maryland.

Equity in the Availability and Distribution of Vaccines

The COVID-19 pandemic is a global health crisis, and yet the efforts to combat the disease have been complicated by disparities in access to vaccines and other healthcare tools. As public health experts continue to fight successive waves of the disease, it has become important to analyze the areas in which vaccination and distribution have failed and to determine how to modify strategies to achieve relative global safety from the disease and its emerging variants.

The Income Gap

Infectious disease experts around the world have explained that the best way to mitigate the threat of the disease is to utilize vaccination to reach "herd immunity." When a new disease arrives in a population, few if any people in a population will be immune, and this means that the disease can rapidly move through a society. As more members of the population develop immunity, the virus cannot spread as easily. If 75 percent of the population is immune, 3 out of every 4 people won't contract the virus when encountering a contagious person and therefore won't transmit the virus.

The higher the proportion of immune people in a population the less likely it is that the disease will spread, and this provides indirect protection or "population immunity" for those who are not immune to the disease. This is essential, because there are many people around the world who cannot be vaccinated against COVID-19, due to allergies, pre-existing conditions, age, or other factors. The only way to protect those who cannot safely be vaccinated is to achieve population immunity.[1]

Scientists looking at patterns of COVID-19 infection have determined that approximately 60 to 80 percent of the population would need to be vaccinated to achieve population immunity. Infections in closed facilities, such as the infection at the San Quentin State Prison in California, support this basic threshold for immunity. The outbreak at San Quentin began to subside only after more than 60 percent had been infected.

During the peak of the pandemic in the United States, in late 2020, Donald Trump administration officials issued statements to the effect that the natural spread of the virus would eventually create herd immunity as Americans contracted and recovered from the virus. Some misguided Americans even suggested that individuals should purposefully contract the disease to hasten the process toward herd immunity. Some supporters of this idea cited the example of Sweden, where the government refused to issue lockdown orders or mask mandates. Some believed that the Swedish government was essentially counting on the country reaching herd

immunity through the natural cycle of infection. The result of Sweden's refusal to limit civil liberties in favor of public health was one of the highest COVID-19 death rates and infection rates in the world. While Norway, in which the government issued stay-at-home orders, mandated masks in public, and took other actions, there were 5.23 deaths per 100,000 people, Sweden's rate was 58.1 per 100,000. A lack of public health intervention therefore resulted in more than 10 times the number of deaths.[2]

Extending the example of Sweden to the entire world, or to the United States, it is clear that allowing infections to progress until "natural" herd immunity is attained would require allowing millions of people to die. Given this, all legitimate medical experts have argued that vaccination is the only effective way to achieve herd immunity and that every nation should strive to vaccinate at least 70 percent of their populations.[3]

Barriers to Vaccine-Generated Population Immunity

As of July 2021, only Canada has partially vaccinated more than 70 percent of their population, with the United Kingdom close behind. The United States managed just over 50 percent either partially or fully vaccinated, which is insufficient to achieve herd immunity. Even though most of the world's superpowers have yet to reach vaccination levels that would indicate population immunity levels, the world's wealthy nations have been able to vaccinate at much higher rates than developing nations. For instance, South Africa registered only 7 percent of the population vaccinated in July of 2021, while the African Nation of Mozambique had vaccinated just over 1 percent.[4]

One of the primary impediments to achieving herd immunity is the fact that vaccine distribution has been managed, in part, by pharmaceutical companies operating on a for-profit basis, and vaccination in poor regions and countries is essentially dependent on foreign aid or donations. The United States and a number of other wealthy nations have donated vaccine supplies to poor countries, but this effort is insufficient. A review of policies and politics surrounding vaccine distribution published in *Nature* stated that COVID vaccines are not expected to be available widely in the world's poorest nations until 2023.[5]

It is impossible for the world to achieve population immunity until the world's poorest nations have also achieved vaccination rates above herd immunity levels. For one thing, travel and the exchange of materials internationally means that any existing pocket of unvaccinated individuals is a global threat. For another, rampant infection in unvaccinated populations has the potential to spawn new variants, some of which might be capable of infecting individuals who have been vaccinated.

The wealth gap in COVID vaccine distribution is not just a matter of the difference between wealthier and poorer countries, but it is also impacting vaccination rates within countries. In the United States, wealthier states and communities were able to provide enough vaccine doses and to distribute them more rapidly. Poorer states, and states with large rural areas or underserved urban regions, struggled to obtain and to distribute vaccine doses. As a result, wealthier Americans received

vaccines sooner and a larger share of the wealthy population were able to get vaccinated. Further, even when state officials struggled to make vaccine rollouts equitable, wealthy people in some cases utilized their wealth and privilege to gain first access to vaccines, leaving poorer people to face vaccine shortages.[6]

There are many conditions that impact a person's ability to get vaccinated. Poorer individuals are less likely to have access to high-speed Internet to access appointments or news about vaccine availability. They may have difficulty reaching vaccination sites due to a lack of public transportation options, inability to find childcare, or inflexibility in their work or childcare schedule. All of the increased difficulties faced by poor and disadvantaged people have been intensified during the pandemic because of absenteeism, limitations on resources, and increased cost of basic household goods.[7]

The Cultural Barriers to Vaccination

After vaccination regimes began across the United States, media outlets reported that African Americans and Latino Americans were seeking vaccinations at a lower rate than white Americans and further that African Americans and Latino Americans expressed a higher level of skepticism about vaccination. Some analysts have noted that African Americans and Latinx individuals have a lower level of trust in the medical establishment overall, in comparison to white individuals in the same age groups, and that this is related to generations of exploitation by the government and other organs of the state. Famous incidents like the Tuskegee experiments, in which African Americans were not treated for syphilis in order to watch how the disease progressed, have created a cultural legacy of distrust. Skepticism not directly about vaccines but about the state therefore shapes the attitudes of people of color in different ways. This is only one of many documented instances in which state or federal medical institutions have exploited nonwhite individuals, creating a justifiable cultural legacy of suspicion and distrust.[8]

Further, media coverage of vaccine hesitancy in communities of color ignores that many people of color in the United States face higher levels of economic and logistical difficulties, challenges made more prevalent by the disruption of COVID-19. Medical anthropologists Elisa Sobo, Diana Schow, and Stephanie McClure conducted dozens of interviews and found that many unvaccinated people of color were not as much vaccine hesitant as they had run into specific difficulties that had made it more difficult for them to access vaccination, a condition that the researchers called "vaccine impeded." The authors argue that coverage of vaccination has been politically narrow, with individuals lumped into pro- and antivaccine groups that do not reflect the diversity of experiences. As a remedy, they recommend greater sensitivity toward the specific challenges of individuals and recognition of the structural and logistical barriers that many people face in accessing vaccines or otherwise accessing the healthcare system.[9]

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Vaccine Hesitancy

By Chairman of the Joint Chiefs of Staff, Washington D.C, via Wikimedia.

Vaccine hesitancy is preventing the United States from reaching herd immunity for COVID-19. Above, a U.S. airman receiving the vaccine in December 2020.

From Fear of Vaccination to Antivaccine Ideology

Since the first vaccines were introduced, there have been some in America and elsewhere who have refused to take part in the vaccination process. This ranges from mild fear of the complications that may arise after taking a vaccine, to politically motivated conspiracy theories and antiscience philosophy. In the United States, many view vaccinations as a civil liberties issue, arguing that the government should not be allowed to force members of society to be vaccinated. The counterargument is that vaccination is a matter of public safety. It has been argued, therefore, that while a government might not be justified in forcing an individual to take a vaccine, the government is within rights to prohibit unvaccinated individuals from participating in activities where they might place others at risk from contracting diseases.

Why Is Vaccination Needed?

Vaccination is a type of medical intervention that makes use of the body's natural immune system response to combat various forms of illness. The first time a person encounters a new kind of disease, the individual is not likely to have any resistance to it, potentially making the disease more severe or even life-threatening. If the person survives this initial infection, their immune system will develop "antibodies," particles designed to combat a specific kind of disease. When a person is said to be "immune" to a certain disease, that person's body has the necessary immune system equipment to fight off the disease without experiencing severe illness.[1]

Vaccines are substances that provide the body with instructions on how to fight a specific kind of disease. These substances typically contain materials that have been taken from virus or bacterial particles. Some utilize RNA (genetic material) derived from viruses or cells, while others use deactivated proteins taken from similar sources, and others use a modified version of a viral particle. While each of these works differently, the basic idea behind all vaccines is the same. The vaccine infects the body with a virus or bacterial disease but does so at a very low level. Just as would happen if a person survived an infection, the vaccine stimulates the body to produce materials needed to fight that kind of illness. If a person encounters a virus or bacterial agent that causes an illness that they have been vaccinated against, they will typically not be infected or will develop a mild illness.[2]

Humanity discovered immunity in the ancient world, where it was recognized that after a person survived an illness they typically did not contract the illness again or, if they did, contracted only a mild version. Prior to the innovation of vaccination, many common and often debilitating or deadly diseases circulated through the world every year. Some diseases, like measles, influenza, and scarlet fever, were so

common that nearly every American child could be expected to contract these diseases at some point. Because these diseases were seen as inevitable, parents would sometimes purposefully expose their children to illness out of the belief that it was better to get the illness over with as soon as possible, after which time the child would be immune. This practice is famous for the early 1900s "measles parties," in which parents would purposefully expose their children to an infected age mate in an effort to jumpstart immunity. Parents of unvaccinated children still, in some cases, attempt to reach immunity by throwing infection parties of various kinds, but this is a practice that public health experts universally condemn.

The problem with the immunity parties is that the kind of infection that develops in each child cannot be controlled. In the case of measles parties, for instance, some of the children infected in this way will suffer lifelong complications and others will die. Chickenpox is another disease that was once extremely common and resulted in "pox parties." While chickenpox is rarely fatal, full infection can have lasting or extreme complications. If a pregnant woman became infected, for instance, the disease can result in both physical and intellectual birth defects. Newborn babies born to unvaccinated mothers have a 30 percent chance of contracting the most severe form of the disease, which can be fatal. In cancer patients and individuals with suppressed immune systems, chickenpox infection can be deadly at any age.[3]

Purposefully exposing individuals to a disease, while well-intentioned, is not an effective strategy for building herd immunity and leads to many unnecessary illnesses and deaths. Vaccines, however, can help to build immunity in a safer and more controlled manner, because the kind of infection that results from a vaccine is tailored to be mild. While no vaccines are 100 percent effective, and a small number of vaccinated individuals might not achieve immunity or might still become seriously ill, the percentage is much smaller.

Until the twentieth century, around half of all children born in the United States died before the age of five, typically from disease. Americans had more children in part because they realized that not all of their children would make it to adulthood. Vaccination was a key medical breakthrough, along with better medicines and medical care in general, in reducing the high mortality rate in American children. In some cases, vaccination has even enabled public health officials to eliminate diseases, like polio, which once ravaged the U.S. population, crippling and killing thousands in each generation.[4] However, many other diseases that might be eliminated entirely have been allowed to remain within U.S. society because of the large number of U.S. citizens who refuse to be vaccinated or to have their children vaccinated.

Not only can vaccination save lives, but it is also important because there are always some people, within a society, who cannot be vaccinated for legitimate medical reasons. Individuals who are pregnant are advised not to take certain vaccines. Individuals who have compromised immune systems or who are undergoing treatment for certain conditions might also not be able to safely get vaccinated. If the entirety of a population who can safely get vaccinated chooses to do so, those who

are unable to still enjoy some degree of protection. If 70 or more percent of people are vaccinated against a disease, the disease will typically spread very slowly if at all through a community. Achieving this level of indirect protection (called herd immunity) is typically the goal of a vaccination campaign. One of the reasons that public health experts ask individuals who can be vaccinated to do so is because this is the best way to protect vulnerable individuals who cannot, for legitimate medical reasons, utilize the vaccines to protect themselves.

Vaccine Hesitancy and Vaccine Denial

People who refuse to be vaccinated do not all do so for the same reasons. When a person is frightened of vaccination or uncertain whether to trust medical experts, this is typically called "vaccine hesitancy." A person may become vaccine hesitant for a variety of reasons, but it is typically related to fear about side effects. For as long as there have been vaccines there has been a proportion of the population, in every country, who are fearful of taking the vaccine. While vaccines are safe, every vaccine has the potential to cause some dangerous side effects. For instance, with the recent COVID-19 vaccine, a small number of individuals who were vaccinated had a potentially dangerous allergic reaction. In the case of COVID-19 vaccination, approximately three people out of every million people vaccinated had an allergic reaction. To counter this, physicians asked vaccine recipients to remain in the area for at least fifteen minutes so that medical professionals could intervene. The potential for serious complications and even death, from a reaction to the vaccine, is far lower than the chance of death or serious complications from COVID-19 infection.

One of the factors that contributes to vaccine hesitancy is misinformation. Since very early in history, antivaccine activists have polluted the public discussion on vaccines by producing a variety of stories and fake scientific news items purporting to refute the claim that vaccines are safe and can be trusted. Historians have noted that this kind of misinformation was also common when the earliest scientists were introducing scientific medicines to society. Back then, a large number of people felt that science itself couldn't be trusted and felt that medications were unnatural. There are still Americans who hold this view, and there are religious cults and sects in which utilizing scientific medicine is forbidden.

In the modern world, false information about diseases and vaccinations can spread rapidly thanks to the internet. The proliferation of data through digital media has made it more difficult for individuals to determine whether or not to trust information that they encounter. Facebook accounts and online entertainment publications masquerading as news sources are primary vectors for this kind of misinformation. To provide one example, in the Summer of 2021 the entertainment website InfoWars published a series of articles claiming that the number of people who died from the COVID-19 vaccines was soon going to rival the number of people who died from COVID-19. There is no interpretation of data that could be used to give any legitimacy to this claim. Data from public health centers around the world

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Business of Vaccines

By National Institute of Allergy and Infectious Diseases, via Wikimedia.

The pharmaceutical industry developed a vaccine for COVID-19 with unprecedented speed. Above, research samples in a NIAID lab freezer in January 2020.

The Economics of the Vaccine Production Industry

The pharmaceutical industry is in the business of saving and improving lives but progress and development in pharmaceuticals is arguably based more on the potential for profit than on public welfare. In many cases, the majority of Americans must wait for intellectual property rights to be surrendered or to lapse and for generic versions of drugs to be developed. When a disease emerges that poses a threat to the general public welfare, as with the HIV/AIDS crisis or the COVID-19 crisis, the goals of the profit-driven pharmaceutical industry may not align with protecting public welfare.

The Critics of the Free Market

The American free-market system is based on the idea that competition between companies or other private producers drives innovation and improves quality and consumer benefits because companies are forced to offer better and cheaper products to keep up with their competition. The United States has privatized industries that comparable nations have nationalized, such as education and healthcare.

Because the United States is the only wealthy nation with a for-profit healthcare system, the United States provides an excellent opportunity to see how well the free market works for consumers when dealing with a complex, highly scientific discipline that is, by nature, a matter of public health and welfare. It turns out that the vast wealth of the United States coupled with a competitive healthcare environment has some advantages. The United States provides a higher level of access to the latest expensive healthcare procedures and tools, and high-paying salaries draw talented physicians to America's hospitals. However, these benefits do not mean that the United States has one of the world's best medical systems. Consider a Commonwealth Fund analyses of the 11 nations that make up the Organization for Economic Co-operation and Development (OECD), which includes the United States, Austria, Belgium, Canada, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, and the United Kingdom. The United States spends more than twice the average spent on healthcare of any OECD country and yet also has the lowest life expectancy. The United States also has the highest levels of chronic disease, obesity levels twice that of the average, and the highest number of preventable hospitalizations and deaths of all member countries.[1]

The free-market system fails to generate a functional healthcare system because the companies involved are concerned only with creating competitive products or services that maintain revenues and not on public health and welfare. As a result,

access to quality healthcare is based on revenue and individuals at the lower end of the economic spectrum cannot afford quality medical care. This means that while a high-income individual may be able to afford the best possible healthcare, on average the United States lags behind developed nations in providing for the health of the citizenry.[2]

The same free-market forces that dominate the healthcare industry overall are also at work in the U.S. pharmaceutical industry. Drugs manufactured by pharmaceutical firms are typically aimed at diseases that are more common among wealthier people and drug pricing reflects the market into which new drugs are frequently introduced. More than twice as much is spent on addressing male-pattern baldness, for instance, than is spent researching malaria or AIDS, both of which continue to claim millions of lives each year around the world.[3] Decades of public opinion polls have established, beyond any doubt, that Americans are less satisfied with their nation's healthcare than residents of any other comparable nation.[4]

The pharmaceutical industry is one of the most frequently critiqued subsections of the American medical establishment, for reasons ranging from alleged price gauging to exploiting foreign labor and recklessly funding the destruction of natural resources. It was only recently that the pharmaceutical industry developed into a free-market economic powerhouse, and this evolution shows how the drive for profit has shifted priorities in the industry.

The Evolution of Big Pharma

Until the nineteenth century, there really wasn't a pharmaceutical industry. Independent research organizations or individuals, often headquartered at universities, were typically responsible for coming up with new drugs, and many of them never tried to personally profit from their discoveries. Because educational and research institutions were often partially publicly funded, the creations of these institutions were seen as belonging to the public as a whole.[5] Though there were some attempts to patent various formulations of drugs, in general, the substances and the chemical reactions that led to new compounds were treated like public property.

In the 1840s, a Boston dentist named William Morton filed a patent on sulfuric ether, which he had recently discovered could be used to render a person unconscious during surgery (a process now called "general anesthesia). A number of physicians and public health professionals took issue with Morton's attempt to patent his discovery. One physician in Philadelphia wrote, "Why must I now purchase the right to use it, and use it as a patent medicine . . . it would seem to me like *patent sun-light* or *patent moon-shine*."[6]

The Morton patents passed through the courts, and soon many new drug creators were doing likewise. While the wealthy were able to obtain the latest pharmaceutical breakthroughs, affordable versions of many drugs were only manufactured after initial intellectual property rights lapsed or once it became clear that lower price versions were needed to obtain revenues from poorer subsets of the population. However, prior to the late 1960s, anything developed in public university with public revenues needed to be turned back over to the government, or the National

Institutes of Health (NIH), and this meant that publicly developed drugs were typically available to consumers at more or less affordable prices. In 1968, NIH general council Normal Latker spearheaded a program that enabled nonprofit organizations to retain the rights to those drugs, which effectively meant that the universities sold drugs created by staff researchers to the highest bidder. A series of new laws in the 1970s, 1980s, and 1990s further freed pharmaceutical agencies and development companies to increase their monopoly on new drugs and, by the end of the twentieth century, almost all pharmaceutical development in the United States was dominated by a handful of multibillion-dollar corporations.[7]

Since the 1980s, repeated studies have shown that the for-profit model in the pharmaceutical industry negatively impacts consumers, especially at the lower end of the income spectrum. Lobbyists working for pharmaceutical companies and allies have argued that the high costs of developing drugs are the primary reason for high drug prices. A number of independent analyses have proven that pharma industry lobbyists use inflated and exaggerated manufacturing and development costs as an excuse to justify exorbitant pricing for consumers.[8]

Pricing and Public Welfare

Many of the vaccines in regular use in the United States have been in production for decades, and many are now affordable thanks to the manufacture of generic versions of those vaccines. However, vaccination can be expensive for those who do not have adequate healthcare coverage and/or who lack income. This issue came to the forefront of the public debate as scientists working for universities and pharmaceutical companies struggled to create vaccines to prevent the spread of the COVID-19 virus.

Because the COVID-19 virus was a major public health hazard that threatened commerce around the world, the U.S. government and other wealthy governments invested billions in developing vaccines to combat the emergency. When the vaccines hit the market, they were provided at no cost to American citizens, but this did not mean that the American people had not already paid for the vaccines they received. Tax revenues were used to fund "Operation Warp Speed" and other vaccine-production efforts and this meant that Americans.

CNN business reported that nine pharmaceutical industry executives had become billionaires thanks to profits earned from manufacturing the vaccines.[9] Economists also reported, in late 2020, that drug companies Pfizer and Moderna were expected to earn no less than $32 billion in COVID-19 vaccine sales in 2021. Moderna, a relatively unknown drug manufacturer that claimed $60 million in revenues in 2019, saw their shares and revenues grow exponentially, with at least $62 billion in revenues estimated for 2021.[10]

There are important unanswered questions about the degree to which these companies should be permitted to own and sell the vaccines that they created going forward. Given that enormous amounts of U.S. tax revenues were spent to fund the vaccine program, should the companies be allowed to retain IP rights to these drugs, or should other companies be allowed to use the formulas created to manufacture

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Vaccines and Personal Liberty

By White House, via Wikimedia.

Clear messaging in support of vaccination is important for public trust. Above, President Joe Biden visits a COVID-19 vaccination site at Walter Reed Medical Center.

Balancing Freedom and Collective Responsibility

As of July 2021, just about half of the U.S. population has been vaccinated against the coronavirus. This level of vaccination is insufficient to achieve herd immunity and, until the United States reaches herd immunity levels, new and potentially more dangerous variants will continue to spread through the population. This, in turn, means that at least some states will need to return to "mitigation" strategies, which might include school and business closures, mask mandates, or other measures.[1]

The reason that the United States has failed to reach the level of vaccinations required for herd immunity is that a large share of U.S. residents have refused to be vaccinated. While all Americans are free to refuse vaccination, the question remains, is it permissible for states or the federal government to make vaccination mandatory for those seeking to utilize public resources like schools, public parks, or public transportation? Further, to what degree is it permissible for private companies and institutions to make vaccination mandatory for those seeking to access company or institutional services or facilities?

School Vaccination

For centuries, public and private schools have commonly served as vectors for the transmission of disease. Influenza outbreaks and outbreaks of the cold virus are common within school districts for the simple reason that students attending schools spend long periods of time in enclosed spaces with groups of other students. If only one of the students attending a school is carrying an airborne disease, all of the other students are at risk. Students also act as vectors for the disease to enter the rest of the population as they may pass on the disease to their families, who might then carry the disease to other workplaces or other school systems. Research has found that there is typically a spike in infection rates once children return to school in the fall, and this is one of the primary reasons that closing school has long been one of the standard mitigation strategies in societies facing epidemics.[2]

Recognizing that students were an important vector for disease transmission, schools began establishing mandatory vaccination requirements for students in the early 1800s. The first such law was passed by the Commonwealth of Massachusetts in 1927 in an effort to fight smallpox. States like New York followed suit soon after, and by the late 1800s it was common for states to require mandatory vaccination for students. Other disease vaccinations were also added to the list of required vaccines later on in order to counter waves of new diseases moving through the United States or as new vaccines became available.[3]

Mandatory vaccination requirements for school admission has generated some controversy since the 1800s. Some Americans refuse to have children vaccinated because they are suspicious of the scientific claims made about vaccination and believe vaccines to be dangerous. Other Americans have claimed religious objections to injection or to utilizing scientific medicines. Some Americans object to mandatory vaccination for school enrollment simply because they see such measures as governmental overreach and a violation of civil liberties. Mandatory school vaccination provides an example of a situation in which public and private school administrators must weight civil liberties and parental choice against collective benefit and welfare. When unvaccinated students are allowed to attend schools, this places other students at risk, especially those who cannot be safely vaccinated because of some other condition. As of 2021, all states require students to receive five routine childhood vaccines before attending daycare or schools, though there are certain exemptions for allergies and various medical conditions.[4]

During the COVID-19 pandemic, many schools and institutions of higher learning suspended in-person education because of the threat of the virus. These institutions have faced considerable pressure from students and parents to return to the classrooms, but with vaccination rates below the threshold to avoid mass transmission, politicians and school administrators are debating how to safely return to in-person education. A number of colleges and universities established mandatory vaccination requirements for students returning to classrooms and, in response, conservative legislators in a number of states attempted to pass new laws that would prohibit mandatory vaccination requirements.

There are several important points in the debate over mandatory vaccination for students. First, state or institutional policies making vaccination mandatory are establishing requirements for individuals who wish to access public or private educational services. Therefore, a person is not required to be vaccinated or to have their children vaccinated, but might therefore forfeit the ability to access certain services. Some critics have argued that education is a public right and so that institutions and states cannot take this right away from the unvaccinated, but this argument ignores the fact that institutions that allow unvaccinated students are placing other students and their families at risk.

Vaccination Passports

Another recent debate brought about by the COVID-19 disease is the idea of "vaccine passports," which are documents carried by an individual to prove that they have been vaccinated. There are a large number of Americans who feel that requiring individuals to provide proof of vaccination is a violation of personal liberties, and there have been proven cases of individuals faking vaccination cards or records in order to access services where vaccines are required.

Like mandatory school vaccinations, the idea of a vaccine passport is of considerable vintage. After the smallpox vaccine was developed and introduced in 1770, outbreaks of the disease continued across the United States for decades, primarily because unvaccinated people were continuing to spread the disease. To protect

those who could not be vaccinated, a number of states began establishing vaccine requirements for individuals seeking to travel by public or private mass-transit systems and for those applying for work. Crowded mass-transit systems and workplaces, like schools, can be hotbeds for disease transmission. Back in the late 1700s and early 1800s, public health experts recognized that smallpox was spreading largely through factory floors and also through transit systems. The idea of mandating vaccines for individuals seeking to access these facilities or for work was embraced by the majority of Americans out of fear of smallpox, which was a terrible disease with a mortality rate as high as one-third of those infected.

During the early 1800s, when businesses and transportation companies first started requiring proof of vaccination, there were many Americans who refused to get vaccinated, and there was an underground market for fake vaccination records. However, the majority of Americans embraced the vaccine passport idea and viewed the requirement of vaccination as preferable to the risk of infection with smallpox. Vaccine requirements also increased patronage of mass transit and decreased absenteeism from work, as Americans felt safer returning to public areas with vaccine mandates in place.[5]

During the late 1800s and early 1900s, there was not a widespread debate over the constitutionality and civil liberties implications of vaccine mandates, but this did occur on a small scale. In 1902, the city of Cambridge, Massachusetts, was suffering through a surge in smallpox cases and the city's board of health passed a law requiring all adults to be vaccinated. Refusal to be vaccinated carried a fine of $5 (around $120 in 2021). There were no policies in place for forced vaccination but only to collect the fine from those who refused. A man named Henning Jacobson refused to be vaccinated, claiming that he and his son had suffered from intense symptoms after an earlier vaccination. Jacobson was fined and appealed all the way to the U.S. Supreme Court.[6]

In the 1905 case of *Jacobson v. Massachusetts*, the Court ruled that the state's health board had the authority to issue a general vaccination requirement during a pandemic. None of the justices dissented. Justice John Marshall Harlan agreed that the U.S. Constitution prohibited the government from "restraining" an individual's civil liberties but also noted that the Constitutional protections of civil liberty are not an absolute guarantee of absolute liberty in all situations. Requiring citizens to submit to a draft, to pay taxes, and to obey laws are examples of situations in which governments limit civil liberties. As Harlan stated:

> There is, of course, a sphere within which the individual may assert the supremacy of his own will and rightfully dispute the authority of any human government, especially of any free government existing under a written constitution. But it is equally true that in every well-ordered society charged with the duty of conserving the safety of its members the rights of the individual in respect of his liberty may at times, under the pressure of great dangers, be subjected to such restraint, to be enforced by reasonable regulations, as the safety of the general public may demand.[7]

Websites

American Medical Association (AMA)

www.ama-assn.org

Founded in 1847, the American Medical Association (AMA) is a professional organization representing physicians, medical students, and lobbying for medical industry workers. The AMA supports programs and professionals involved in vaccination science and has been involved in funding and in other ways supporting local and national vaccination initiatives. In response to vaccine hesitancy, the AMA has participated in producing literature and other educational materials to promote vaccination, immunization, and medical literacy.

American Public Health Association (APHA)

www.apha.org

The American Public Health Association (APHA) is a Washington D.C.-based professional organization focused on health care and public health professionals. Founded in 1872 by a group of physicians, APHA now has members worldwide and acts as a lobbyist organization for healthcare professionals as well as funding and supporting research into healthcare industry welfare. The APHA maintains data on vaccinations and promotes vaccination as one of the most important basic healthcare measures in the United States and for health care and public health professionals.

Centers for Disease Control and Prevention (CDC)

www.cdc.gov

The Centers for Disease Control and Prevention (CDC) is the premier U.S.-based public health agency in charge of infectious disease, environmental and workplace health, and injury. The organization, under the auspices of the U.S. Department of Health and Human Services, established in 1946 to address the threat of malaria, produces research and maintains a database of information on a wide variety of infectious diseases and health concerns. The CDC also creates and maintains vaccination guidelines to be used by U.S. consumers.

Global Alliance for Vaccinations and Immunization (GAVI)

www.gavi.org

The Global Alliance for Vaccines and Immunizations is a nongovernmental organization (NGO) focused on promoting immunization and vaccination around the

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