



The two trillion dollar barn: science, prevention, and the lessons of disaster

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Abstract

The unprecedented scale of the COVID-19 disaster will define public health failure for generations to come. Its causes include inadequate funding, hostility towards science in general and public health science in particular, a government culture steeped in deception and misinformation, and a disdain for collaboration for the greater good among the community of nations. The consequences have been devastating, but it is essential that the public health community uses its moment in the spotlight to promote the agenda of science-based policy, honesty and transparency in communication, and international cooperation to advance the common good of humanity.

Keywords Covid-19 · Pandemic · Centers for disease control · Environmental Protection Agency · Donald Trump · Prevention · Coronavirus · SARS-CoV-2

The abandonment of prevention

An ounce of prevention may be worth a pound of cure, but, as I used to tell my medical students, physicians get paid by the pound. Our economy lavishes money on those who cure our diseases, but no one has ever sent out an invoice for a disease that they prevented. We pay pediatricians for immunizations, but we don't pay for the cost of the polio that didn't happen. When a seat belt saves us from a crippling accident, we don't send a check for the cost of the surgery and physical therapy we didn't need to the National Highway Traffic Safety Administration. No one I know has ever sent a check to the EPA for the chemotherapy they didn't need because EPA regulations kept carcinogens out of the air and water. The heroic efforts of public health workers to contain the first SARS outbreak only succeeded in making the pandemic that didn't happen vanish from public memory. And yet, despite all of these successes, in the eyes of some policy makers everything we spend on prevention and public health often seems like wasted money.

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Until it doesn't. With deaths from COVID19 exceeding 100,000 and rising, we are now facing the most cataclysmic failure of public health in generations. The reasons for that failure are broad and deep.

At a superficial level, we have failed in terms of financial support. For every one of the 3.6 trillion dollars we spend on health care each year, we spend about 2.5 cents [1] on disease prevention, a number that has been declining since 2002. Roughly translated, for every ounce of prevention we buy, we are paying for two and a half pounds of treatment. That failure to fund prevention, coupled with a lack of universal health care, helps explain the fact that life expectancy in the US [2] is almost 4 years lower than that of comparable countries, despite that fact that we spend at least 50% more per capita [3] on health care than the next highest spender.

The failure of the Trump Administration to support public health has even more direct bearing on the pandemic. Just to catalog the specifics of this Administration's actions that set the stage for disaster:

- In 2018, they dismantled the National Security Council team [4] charged with preparing for a pandemic.
- In 2019, they shut down the USAID PREDICT [5] program for tracking zoonotic disease
- February 2020, they ignored a request from the HHS secretary Alex Azar [6] to replenish the national strategic stockpile of PPE and respirators.

Matters would have been far worse if they had succeeded in their efforts to reduce the CDC budget every year since taking office by an average of 16%. Even as recently as March 10, when people were already dying in the US from COVID-19, the Trump Administration was pursuing a plan to cut the CDC budget by 15% [7].

The war on science

A deeper dive reveals something more disturbing. At its core, disease prevention relies on science, particularly science that predicts what will happen if we don't act. Money spent to reduce airborne particulates, to keep carcinogens out of drinking water, or to study emerging pathogens in remote countries has no visible pay off, because understanding the savings in lives and money requires acknowledging that science, despite its limitations, is our only reliable tool for anticipating the future. Mandatory vaccination might seem like government overreach to anyone who has not seen a deadly disease outbreak in action. In a simplistic, business-minded perspective, these expenditures make no sense, providing no clear return on the balance sheet. In the short term, they might seem to be right, but in the long term, they are disastrously wrong (Figs. 1, 2).

Yes, regulations and interventions to protect public health cost money and create inconvenience. They only exist because of the counterfactual reality predicted by public health scientists. In a world of short-term thinking, they are tempting to ignore, particularly when those benefitting from public health expenditures are not necessarily those bearing the cost. And those bearing the costs often have



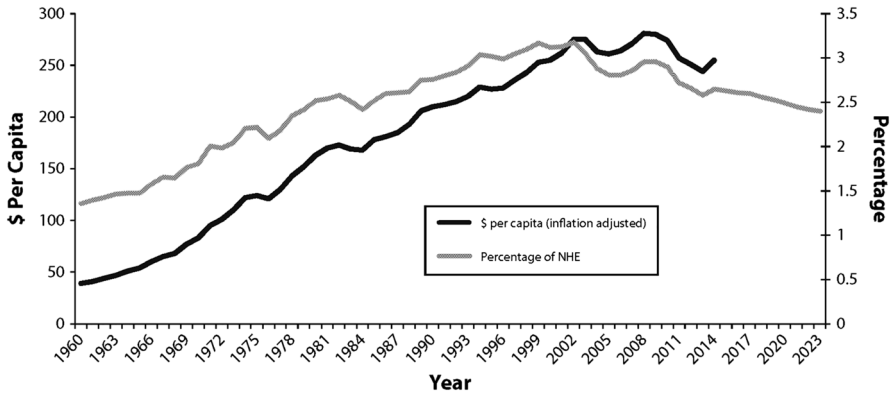


Fig. 1 Trends in US per capita spending on public health in constant dollars and as a percentage of total health care expenditures [1]

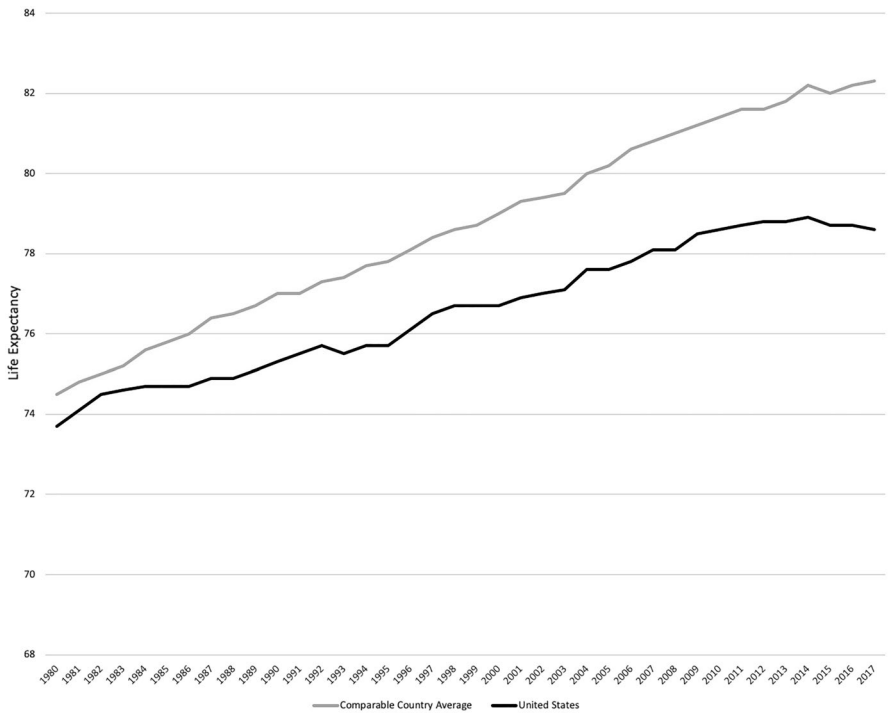


Fig. 2 Life expectancy in the United States as compared to comparable developed countries [2]

money. Lots of it. Couple that reality with the uncertainties inherent in predictive science and one has the basis for the war on science that has risen to blitzkrieg proportions under the Trump Administration.



The assault on public health science is being perpetrated with Machiavellian ruthlessness, most of it out of public view, timed and orchestrated to allow for minimum oversight. Throughout government, serious scientists have been excluded from review panels and those within the agencies have been terrorized and marginalized. The Administration has sought to slash the EPA budget in every funding cycle since taking office. I once asked Ruth Etzel, MD, PhD, a pediatrician and superb epidemiologist who was forced out of her role as Director of Children's Health on trumped-up charges by Andrew Wheeler, what it was like to work as a scientist at the Trump EPA. She described it as living in a house infested with termites. It only looks like it is still standing. The story repeats itself in every federal agency charged with protecting public health.

In this pivotal moment, the entire global economy depends on the work of the world's scientists. Their insistent warnings have directed actions that have been critical, not only in flattening the curve, but in defining that as a goal. Everything the U.S. has done in response to the pandemic from understanding the basic biology of the virus, to creating diagnostic tests, to developing and evaluating innovative treatments, to painstaking efforts to trace the spread of the mutating virus across the globe, has come as a consequence of the methodical, relentless efforts of scientists all over the world. It is critical that non-scientists understand not necessarily the science, but rather the key elements of the process that makes it work.

Science in COVID time

As I write this, the scientific community is releasing an average of more than 300 papers a day with almost half appearing as pre-prints prior to peer review [8]. Science is happening in real time. It is advancing at a stunning pace, driven by a desperate need to know now.

In my 35 years in research, I have never seen science happen with this much speed and draw this much attention. Every scientist with a remotely relevant skillset from economists to physicists has suddenly learned basic epidemiology, often demonstrating that good epidemiology is much harder than it looks.

There are several key elements to the way science has unfolded in COVID time:

1. It is utterly open and transparent. Open exchange of data from genetic sequences to epidemiological datasets is routinely made available to other investigators.
2. It relies on absolute honesty. Few things are more destructive to the scientific process than a scientist misreporting data.
3. It is profoundly international in nature and scope. Initially, the majority of papers were coming from China, but researchers from all over the world are actively producing important papers.

In other words, the scientific process, the system that the entire world is counting on to understand, respond to, control, and ultimately provide a vaccine for this disease, relies on openness, honesty, trust, and global cooperation. Not only does



the Trump Administration exhibit none of these traits it has spent the last 3 years aggressively undermining the integrity of scientists throughout the government. It has tried to define an orthodoxy that attempts to bury, suppress, or deny any scientific evidence that contradicts the naked economic interests of its supporters, and has actively repressed the scientists who work on it.

Science is the place where alternative facts go to die. In its search for truth, it is not always right, but it has skepticism at its core. Errors in understanding are systematically exposed and corrected, moving the enterprise forward by successive approximation. Scientific research is a painstaking process of recording tiny slices of reality with meticulous accuracy. Data are the coin of the realm and counterfeiting is the cardinal sin. Falsifying data tears the fabric of the entire scientific universe, often with enormous consequences. Those who engage in it risk the termination of their entire career. A single alternative fact can terminate an entire career.

One of the most damaging consequences of the war on science has been the forced reluctance of scientists within the government to contradict the wishes and beliefs of the White House.

In response to a 2018 poll [9], 48% of CDC scientists reported that political interests were interfering with their ability to make science-based decisions. In the lead up to the pandemic, the Trump Administration not only ignored the results of a 2019 simulation [10] of a hypothetical pandemic, they even ignored warnings from the National Center of Medical Intelligence [11] in late 2019 concerning the seriousness of the Wuhan outbreak. Once the pandemic began, CDC scientists were prohibited from speaking to the press [12].

The failure of leadership

The US response to the pandemic has been a debacle. One of the reasons for the catastrophically slow response is the utter failure of central leadership. The states, which would normally look to the CDC for guidance in the face of a national public health emergency, were suddenly on their own and it took some time for them to recognize that the Trump Administration had abdicated this historic leadership role. The realization on the part of the states that they were going this alone and the effort to assemble the resources and personnel to make those decisions in the absence of strong federal guidance cost precious time. Delay in this context was deadly.

Not only has the US failed nationally, it has failed internationally. The go-it-alone attitude has severely damaged international ties and stymied cooperation at precisely the moment global trust and collaboration are most needed. In the heart of the pandemic, the US not only ceded its role as a leader in international public health, it became a laggard. Most recently, the defunding of the World Health Organization (WHO) [13], the most important organization working internationally to address the pandemic at this critical time, boggles the mind. The WHO's initial response may have been flawed, but it shines in comparison to the Trump Administration's failures. The effort to cast the WHO as a scapegoat is one of the most irresponsible acts of this entire exercise in mismanagement.



The Administration didn't simply leave the barn door open, it removed the latches from the entire building. Now it is shocked that the horses are out, claiming no one ever told them horses would do that. Buying new latches won't help much. Even a whole new door won't solve the problem, because, in this case, the horses not only left, they kicked over a lantern and burned the barn to the ground.

Now, an Administration that has sought to cut the CDC's \$6 billion dollar budget in every funding cycle to save a few hundred million, has signed off on a \$2 trillion dollar plan to rebuild the barn. As we stand in the smoldering ashes, let us remember that it was disdain for science that set it on fire.

Perhaps, the silver in this dark cloud of smoke lies in the lessons that COVID-19 has taught the people and governments of the world. The value of prevention and the scientific principles on which it rests have never been so clear. The pandemic will fade, but more daunting challenges lie ahead. Climate change, the most difficult of these will demand global cooperation on an unprecedented scale. We all inhabit the same small rock in space, and we must find a way to share it sustainably. We can only hope that the narrow-minded nationalism that pretends one nation can rise while others fall went up in flames with the barn. Choosing to arm ourselves to the teeth in an effort to ensure we are the last tribe standing on a warming planet will never secure a livable world for our children and grandchildren. Policy makers must learn that our collective survival demands cooperation on a global scale, reliance on the tools of science, and the resolution and willingness to change that the people of the world have demonstrated in response to this crisis. Advocates for public health must never hesitate to remind policy makers who balk at the cost of prevention that an invisible virus from the lungs of a bat brought the world to its knees.

Compliance with ethical standards

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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