



PERSPECTIVE

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# History of Vaccine Hesitancy

*From smallpox to COVID, people have resisted a tool that saves millions. Why?*

Vaccines are inarguably the most important medical advance in human history. Scientists at Emory University [summarized](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5402432/) (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5402432/>) their tremendous power this way: Ten historically fatal diseases have been reduced by 92-100% since the 20th century. Smallpox has been eradicated and polio is nearly gone. Extrapolating over the decades and around the world, it is no exaggeration to say that vaccines have saved literally tens of millions of lives and prevented hundreds of millions of cases of disease, if not more. The overwhelming scientific consensus is clear—vaccines are safe, effective, and necessary.

So why are people avoiding vaccines?

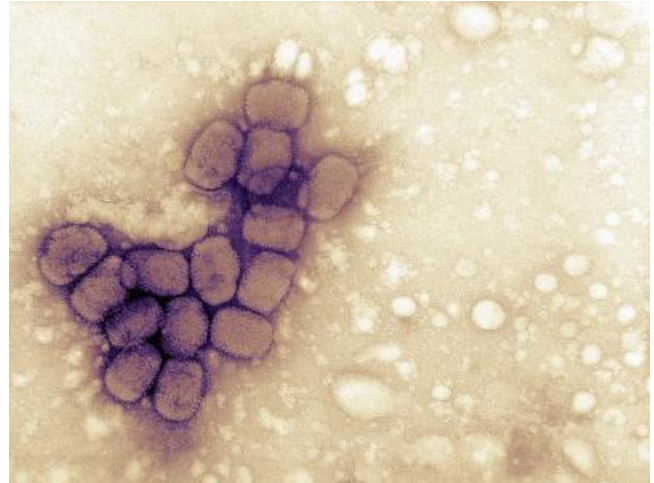
With the rise of social media and the Internet, vaccine hesitancy and vaccine denial may seem to be new phenomena. However, since the first vaccine was administered over 200 years ago, some form of vaccine hesitancy has existed. By examining these historic vaccination campaigns, perhaps we can learn to address concerns and use this knowledge to inform the rollout of new vaccines.

## Smallpox and the Rise of Vaccine Hesitancy

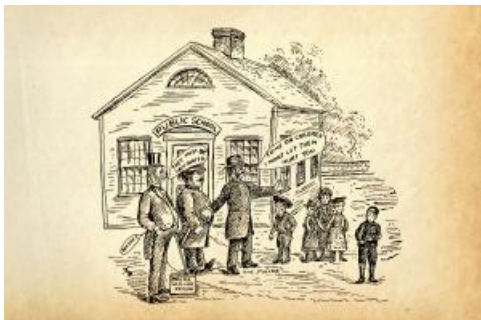
Smallpox is an ancient disease, likely emerging when humans first started to settle into cities. Egyptian mummies have evidence of smallpox scars and it was likely first described in text by Thucydides in 430 B.C.E as the Plague of Athens. Mortality rates can reach as high as 80%. Astute scholars in China as early as 1000 C.E. noticed, however, that if you recovered from smallpox, you never redeveloped the disease and developed the practice of variolization as a rudimentary vaccine.

The first formal vaccine for smallpox was developed in the 1790s when English physician Edward Jenner noticed that exposure to a less serious version of the disease, cowpox, could protect against smallpox.

When Dr. Jenner developed his vaccine, it was initially met with skepticism. Some decried it as being opposed to God's will. Others played on the public's misunderstanding of the vaccine and fears of putting foreign substances into one's body by publishing cartoons satirizing people morphing into cows after being vaccinated (sound familiar?). Nevertheless, as its efficacy was demonstrated, scientific and public support grew, and vaccination began to spread, first in Europe and then around the world.



It wasn't long before the United Kingdom and the US introduced laws mandating smallpox



Historic cartoon opposing mandatory vaccination of school children against smallpox

vaccination—and organizations rose up to protest those laws. Yet despite two centuries of opposition, the vaccine would prove to be one of humanity's greatest success stories. In the early 1950s, smallpox was gone in North America and Europe, and by 1980, it was eradicated from Earth, thanks to an intensive campaign led by the World Health Organization. Today, no one need be vaccinated for smallpox nor fear this disease that had plagued humanity for over 10,000 years. Empowered, scientists began to turn their eyes towards exterminating the next virus.

## DPT and MMR -- Misinformation and Fraud

From the 1920s-1970s, many new vaccines were introduced that dramatically reduced the rates of devastating childhood diseases. In the 1950s, polio, with its ability to paralyze and kill children, became the disease of most concern to the public. The significant reduction in polio's prevalence following the introduction of the Salk vaccine in 1954 was a strong testament to its efficacy and helped to bolster the public's acceptance of vaccines.

In 1982, a news documentary called “DPT: Vaccine Roulette” began to change attitudes. It highlighted stories of parents and doctors claiming that children developed seizures and permanent brain damage after the diphtheria-pertussis-tetanus (DPT) vaccine. Seizures were a rare side effect of the vaccine, but no long-term effects from the vaccine had been demonstrated. The documentary took research out of context to attack the safety of the vaccine, leading to decreased vaccination rates and lawsuits against vaccine manufacturers. The litigation nearly destroyed the American vaccine manufacturing industry and led to the creation of the National Childhood Vaccine Injury Act in 1986, a no-fault system established by the federal government where claims of harm from vaccines could be filed.

In 1998, one of the most infamous studies in scientific history was published in *The Lancet*, a prominent medical journal. British physician Andrew Wakefield claimed that the Measles, Mumps, and Rubella (MMR) vaccine caused inflammatory bowel disease and autism. He specifically believed that the live attenuated measles vaccine reacted with the intestines to allow for toxic, autism-causing substances to enter the blood stream and eventually the brain. The work was quickly criticized, the *Lancet* retracted the article, other journals **investigated** (<https://www.bmj.com/content/342/bmj.c7452>) the



integrity of the research, and even many of the co-authors of the paper agreed that claiming a link between vaccination and autism was a step too far, unaware of Wakefield’s true intent. It was eventually revealed that Wakefield had been funded by lawyers who were working with the parents of the children in the study to try to find a reason to sue the vaccine manufacturers. Investigations made it clear Wakefield was a liar and a fraud, that he deliberately picked data to support the lawyers’ case, and falsified other data for financial gain. He lost his medical license but continues to stand by the original study. He remains a vocal anti-vaccine advocate today.

Despite two decades of medical literature showing there is no link between the development of autism and vaccination, many still believe this myth. Public figures, from actress Jenny McCarthy to former president Donald Trump latched onto the study and used their platforms to repeat vaccine misinformation. The rise of social media sites has created echo chambers where these views are shared and reinforced.

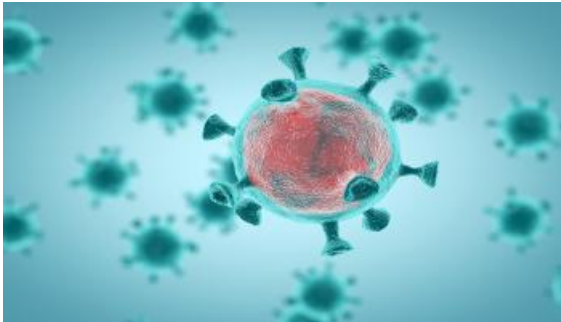
The effect of this has been alarming—a clear and dramatic downward effect on vaccination rates since the Wakefield study. In the UK, it took two decades for vaccination rates to recover. During this time there were 12,000 cases of measles, hundreds of hospitalizations, and at least three measles deaths. Europe experienced a 4-fold increase in measles cases and 35 deaths in 2017 alone.

### **New Outbreaks in the United States**

Impacts of this study and the rise of the Anti-Vaccine Movement also hit the United States. In 2000, the USA declared measles eradicated, but since then there have been over 3,000 reported measles cases in the United States. This has coincided with a rise in the national rate of vaccination exemptions due to personal or religious views. In California, the exemption rate exceeded 20% and directly led to a measles

outbreak at Disneyland, prompting the state to pass a new law removing parents' ability to opt out of vaccinating their children due to personal beliefs. In 2017, an outbreak (<https://www.cnn.com/2017/06/02/health/minnesota-measles-outbreak-bn/index.html>) of ~70 measles cases in Minnesota resulted in over 8,000 people being exposed. The Minnesota outbreak was tied directly to non-vaccination rates as high as 42% in Somali-American communities, due to a perceived link between autism and the vaccination. 2019 was the worst year for measles in the United States since 1992, with 1,282 cases reported (<https://www.cdc.gov/measles/cases-outbreaks.html>), the vast majority among non-vaccinated people.

## COVID: A Perfect Storm



Almost immediately after the emergence of COVID-19, work on a vaccine began, building on decades of previous vaccine development research. In less than a year, four vaccines were developed and distributed around the world to combat a global pandemic that had claimed millions of lives. In communities with high vaccination rates case numbers have decreased

(<https://www.washingtonpost.com/health/2021/06/14/covid-cases-vaccination-rates/>). As of July 27, 2021 (<https://covid.cdc.gov/covid-data-tracker/#vaccinations>), 67% of the American population above 12 years of age has received at least one dose of a COVID vaccine and 58% are fully vaccinated (children under 12 years are currently not eligible for vaccination). However, COVID-19 vaccination rates in the US have also started to fall in recent weeks. Not surprisingly, areas of the country with surging COVID cases are those that have the lowest vaccination rates and could become breeding grounds for new variants that could break the protection vaccines are currently giving.

Nearly every reason to avoid vaccines discussed so far, and more, have played a role in the current COVID vaccine roll out. The fact that the vaccines have been effective in those that have received them, combined with a reduction in mask mandates and social distancing requirements, have created a perception among many Americans, including the unvaccinated, that COVID-mitigation practices are no longer needed. This perception has held despite rising infection rates in early summer and the emergence of more infectious variants. Vaccines remain scarce in some communities. Some populations, particularly Black and Latino communities have low rates, hypothesized to be due to the historic medical injustices done to these communities creating a sense of mistrust. False information and conspiracy theories continue to circulate online and are given support by many public officials seeking to rile up their bases. Others do not believe COVID is a serious threat and that the risk is “over”. Some believe the vaccine was rushed, despite the fact it was properly vetted by the regulatory authorities prior to distribution. Others refuse vaccination on the grounds that it violates their personal liberties.

## What lessons can history teach us?

The issues impacting vaccination rates today are largely the same as those first raised in response to the smallpox vaccine: the perceived short- and long-term side effects of vaccinations, concerns about

government intrusion into personal health decisions, the loss of knowledge of the devastation these diseases can have, and a general mistrust of evidence-based science in favor of non-scientists in the public media.

At a high level, we need to be upfront about vaccine side effects and diligent about reporting adverse reactions. Downplaying or hiding this information would do a disservice to patients and would only strengthen anti-vaccination claims. This has been done well so far in the COVID vaccine roll out. One vaccine was associated with very rare cases of severe allergic reactions shortly after injection, which were easily treatable by the vaccine provider with epinephrine. As a result, a 15-minute waiting period following vaccination was instituted. Another vaccine was associated with around half a dozen cases of blood clots, primarily in women. The use of the vaccine was appropriately and temporarily put on hold, the cases were examined, and it was concluded that for most populations the vaccine did not pose a risk. A warning was added to alert those in the risk group to consider an alternative vaccine.

History has shown that the most strident critics are unlikely to be swayed by any evidence and arguments. Those with large audiences must recognize the impact that they can have and encourage their followers to be vaccinated. Together we must tell the stories of vaccine successes to preserve and strengthen the foundational support for vaccination.

We were able to overcome centuries of hesitation to eradicate smallpox via vaccination. By having rational discussions and sharing vaccine success stories, we can put concerns into perspective and help to sway those hesitant about vaccines into full-fledged supporters.

*In addition to the links in the text, the following articles were used to compile the information presented in this post:*

#### **AMA Journal of Ethics**

**(<https://journalofethics.ama-assn.org/article/new-media-old-messages-themes-history-vaccine-hesitancy-and-refusal/2012-01>)**

, New Media, Old Messages: Themes in the History of Vaccine Hesitancy and Refusal.

#### **The Conversation**

**(<https://theconversation.com/from-smallpox-to-polio-vaccine-rollouts-have-always-had-doubters-but-they-work-in-the-end-161803>)**

, From smallpox to polio, vaccine rollouts have always had doubters. But they work in the end.

David Callender, **Human Vaccine Immunotherapy**

**(<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5027704/>)**. Vaccine Hesitancy: More than a movement.

#### **Science News**

**(<https://www.sciencenews.org/article/vaccine-hesitancy-history-damage-anti-vaccination>)**, Vaccine Hesitancy is nothing new. Here's the damage it's done over centuries.



**Smithsonian Magazine**

(<https://www.smithsonianmag.com/smithsonian-institution/history-shows-americans-have-always-been-wary-vaccines-180976828/>)

, History shows Americans have always been wary of vaccines.

**Time** (<https://time.com/5175704/andrew-wakefield-vaccine-autism/>), The vaccine-autism myth started 20 years ago. Here's why it still endures today.

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Christoph Eberle, PhD

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Matthew Pennington, PhD

[\(/eureka/viral-vector-vaccines-animal-diseases-are-common\)](#)



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Rodney Dietert

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