



2025: new infectious diseases and the re-emergence of vaccine-preventable infections

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In our quest to conquer infectious diseases, we must honor the important contributions of pioneers such as Jenner and Pasteur. We must also recognize the recent and ongoing efforts of physicians, researchers, pharmaceutical companies and public health officials including the WHO that seek to improve health for all of humanity. Despite such accomplishments over the last 200+ years, infectious diseases remain a persistent global problem for several reasons.

First is the continued evolution of zoonotic diseases in which the pathogen acquires the ability to infect humans. A good example is the recent emergence of monkeypox with documented human-to-human transmission. This is well described in the study by Shulman in this edition. Another evolving pathogen is avian influenza that has infected employees at poultry plants in numerous countries over the last few years.

A second challenge is the shifting virulence factors of known pathogens such as influenza. On an annual basis, there is consternation by public health agencies and industry officials to deliver vaccines that provide protection against the ever-changing hemagglutinin (H) and neuraminidase (N) epitopes on the influenza virus surface.

A third reason is the effect of wars, corrupt governments and famine, all factors that greatly impede the efforts of physicians, public health officials and pharmaceutical companies to distribute and administer vaccines and medications. A recent example is the inability of the WHO and other nongovernmental humanitarian workers to administer polio vaccine to children in Gaza in 2024.

Fourth is the belief that vaccines are not necessary. This is largely born from the conviction that governments should not dictate how people live and that threats of potential diseases and epidemics are vastly overinflated. This reasoning leads some to conclude that the possible negative side effects of vaccine administration outweigh their benefits. Such beliefs often coincide with lack of trust in medical and public health officials, scientific methods and epidemiologic truths. Furthermore, some parents believe that acquisition of natural immunity via

childhood infection offers greater and longer-lived protection than vaccination.

A fifth challenge is vaccine hesitancy. In this case, people believe that vaccines in general are harmful. For example, some suggest that measles vaccine caused autism in children. This has been solidly disproven, yet even the slightest suggestion of a potential vaccine side effects has caused such individuals to avoid vaccinations for themselves and their children. In reality, today's vaccines are not only highly efficacious in preventing communicable diseases and but are also very well tolerated. Unfortunately, these antivaccination voices persist and are growing louder. Moreover, it is highly concerning that individuals who will hold influential health-related positions in the new presidential administration are proponents of this view. Currently, there is careful scrutiny of vaccine efficacy and safety by governmental agencies in every country, pharmaceutical companies in the US and abroad, the US Food and Drug Administration, WHO and others. The new US president's agenda suggests cutting or eliminating these agencies.

Clearly, vaccines developed and administered in the 1950s reduced significant diseases like polio and typhoid fever. Metropolitan water treatment plants also contributed by providing clean safe drinking water. As successful as the typhoid vaccine was, it did indeed have significant side effects. I personally can attest to this fact. While in fourth grade in Missoula, Montana in the early 1950s, our school nurse lined up all 25 students and gave each of us the typhoid vaccine. In those days, I do not know if parenteral consent was required. About 2 h later, I and probably a dozen otherwise healthy students vomited in the aisles and of course were sent home. It is no wonder we experienced this immediate side

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effect since the vaccine was essentially formalin killed *Salmonella typhosa*. Our innate immune system responded to this endotoxin-laden bolus with hyper-production of cytokines like TNF that caused fever, nausea and vomiting. Despite these transient side effects, the crude vaccine was effective. Modern vaccines are much more refined than this early typhoid vaccine and adverse effects are carefully evaluated and reported during clinical trials and following administration to the general public. Newer strategies against typhoid include the live attenuated *Salmonella* vaccines and the DNA derivative vaccines that are currently being evaluated in countries with continued typhoid fever outbreaks.

The re-emergence of older vaccine-preventable diseases like measles, mumps, rubella, chicken pox and pertussis is related to declining herd immunity necessary to prevent these diseases. It is generally accepted that 92–95% of the population must be vaccinated to prevent infection even in the unvaccinated population. Over the last 30 years or so, herd immunity was in part related to previous infection by these “old pathogens” plus the immunity derived from vaccination. After these old diseases disappeared, herd immunity became totally dependent on vaccination rates. As the diseases retreated, immunization rates declined. Younger individuals, many of whom now have children of their own, have never experienced these childhood diseases leading them to believe they no longer pose a threat, so why vaccinate your children?

Electing to vaccinate or not is an individual's choice. However, we do not live in a vacuum. Choosing not to vaccinate has caused community immunization rates to decline below the 92–95% herd immunity threshold and allowed these old vaccine preventable diseases to re-emerge. For example, some states in the US have seen vaccination rates in kindergarten age children drop to as low as 75% and those same states have seen a corresponding increase in pertussis and measles cases, virtually all of which were in unvaccinated children. It must be difficult for parents to realize they could have prevented these illnesses in their own children and

that they contributed to an epidemic involving other children in the community.

It is beyond the scope of this editorial to address geopolitical events that contribute to human disease and suffering. Instead, the purpose is to highlight the fact that even in countries considered “sophisticated, well developed, democratic, prosperous and financially stable”, the academic community, public health officials and others are being challenged, prosecuted and subjected to legislative inquiries. Increasingly, consumers get their health-related information via the internet where such information can be biased or contrary to the scientific evidence. Distrust of science and medicine abounds and pseudoscience flourishes. If this situation goes unaddressed, the progress made toward eradication of infectious diseases worldwide could be slowed or reversed, with a potential for immeasurable and unnecessary human suffering and death.

We, as Infectious Diseases practitioners, researchers and public health officials, must work to maintain research standards and to convince government officials as well as the general public that vaccines are necessary, safe and effective. Furthermore, we must stress that common sense public health measures such as face masks, social distancing, etc., do not constitute government “overreach”. We must capitalize on every opportunity to understand the public's concerns and to tackle misinformation in order to reestablish trust in medicine and science. Lastly, going forward we must preserve our healthcare infrastructure and ensure national funding for biomedical research and for global cooperative networks dedicated to eradication of infectious diseases.

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