

Historical perspectives on vaccine hesitancy: what variolation teaches health professions education

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Abstract

Disease prevention has always depended on more than biomedical efficacy, and the history of variolation offers a useful humanities-based case for health professions education. Before Edward Jenner pioneered the smallpox vaccine in 1796, variolation—a technique that deliberately exposed individuals to smallpox material to produce a milder infection and, later, immunity—was applied. While this technique widely lowered the mortality rate, there was still a great risk of death, continued severe illness, and further transmission. When Lady Mary Wortley Montagu brought back the knowledge of variolation from the Ottoman Empire to Britain, she was met with hesitation or even direct opposition. As this method spread to the New World, George Washington mandated variolation against smallpox among his soldiers during the American Revolution. Therefore, trust, effective risk communication, and the surrounding social context were

important in convincing British physicians of this new technique. By examining these historical examples, this discussion seeks to help learners analyze the various reasons for modern vaccine hesitancy or resistance beyond mere ignorance or other reductive interpretations. Health profession educators can use this history to encourage learners to investigate who communicates risks; why certain audiences trust or distrust specific messengers; how individual fears intersect with collective responsibility; and to make comparisons with current vaccination debates (such as those on coronavirus and measles) through a historical analytical lens. Consequently, the history of variolation can serve as a valuable case study in healthcare humanities, public health ethics, and clinical communication.

Keywords: historical problem-solving, health professions education, vaccine hesitancy, public health communication, variolation

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Introduction

Before the development of modern vaccines, societies sought ways to combat the scourge of smallpox, one of the most feared infectious diseases in human history. Caused by the variola virus, it could cause permanent scarring, blindness, and even death.¹ Variolation was an early method of creating immunity before vaccination. This method deliberately exposed a healthy person to material from a smallpox sore, such as pus or scabs, to cause a milder case of smallpox, thereby conferring immunity afterward.^{2,3} It reduced the risk of death compared with contracting smallpox naturally. It was often performed in the Ottoman Empire by ingrafting, or by transporting scabs or pus from other patients into a healthy individual's skin through cuts or punctures.^{4,5} Other regions performed it in slight variations; for example, in

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China, the powdered scabs were blown into a healthy person's nostrils.

However, it was still dangerous, as some people died from the procedure or could still spread the disease to others.^{2,3} For this reason, variolation could both protect people *and* harm them. Because of this risk, acceptance depended on both social credibility and the perceived health effect. This method was used in places such as India, China, and the Ottoman Empire in the 1700s, and later in Europe and America.²⁻⁵ In the context of healthcare training, this history is important because it shows how preventive medicine often yields to factors beyond scientific evidence alone. As variolation became more widespread, it demonstrated that public health interventions fail when authorities treat hesitancy as mere ignorance rather than seeking to build public trust.

Variolation, Inoculation, and Ottoman Practice

“Inoculation” is the broader term for the practice of deliberately introducing an infectious agent into a scraped, punctured, or otherwise absorptive part of the skin to induce immunity against that agent.^{2,6} In the 1700s, people often used “inoculation” and “variolation” interchangeably, but now inoculation can also refer more generally to vaccines or other procedures.² Variolation derives from *variola*, the virus that causes smallpox, and specifically refers to inoculation with smallpox material.¹⁻³ The word “inoculation” expanded beyond smallpox over time, becoming a broader term encompassing variolation, vaccination, and other methods of inducing immunity.

Lady Mary Wortley Montagu played a major role in introducing variolation to Britain. While living in the Ottoman Empire in the early 1700s with her husband, the British ambassador to Constantinople (now Istanbul), she witnessed the Ottomans practicing variolation.^{4,7} Women in the empire would take material from a mild case of smallpox and insert it into small cuts in the skin, usually in children.^{4,5} This would produce a controlled infection and later immunity to smallpox.

Lady Montagu had survived smallpox herself and was left disfigured from it, so she became very interested in the practice and wrote to her friend in England about it.^{7,8} She quickly became convinced that it was safer than contracting smallpox naturally, and had her own son variolated in Constantinople around 1718. After returning to England, she had her daughter variolated publicly in London in 1721 to convince the public of its potential. At first, many British doctors and religious leaders were skeptical—or even hostile towards this new practice, but the success of early trials helped promote the technique across Britain.^{4,9-11} Soon, the procedure gained wider acceptance among the British elite and gradually spread.

For health professions learners, Montagu’s role demonstrates that health knowledge does not become persuasive simply because it is effective; it must also be carried by messengers whom audiences consider credible. This illustrates that acceptance often depends on who presents the

intervention, how that person is socially positioned, and whether the audience trusts the messenger.

Historical Problem-Solving, Risk, and Public Trust

Sam Wineburg’s historical problem-solving approach asks us to examine sources, context, and perspective.¹² Montagu was a smallpox survivor, and she carried the physical scars and personal experience with the disease, making her especially receptive to variolation in the Ottoman Empire. Montagu was also an aristocrat, mother, and diplomat’s wife, allowing her to help make Ottoman variolation credible in Britain.^{4,8} This also shows that Britain learned from Ottoman practice, but the idea spread more easily because elites trusted Montagu.

Montagu’s advocacy further demonstrates how knowledge does not travel on its own, but rather through people. Her decision to have her own son variolated abroad and later her daughter variolated publicly in London served as a significant endorsement, especially because she was a member of the same social class as physicians, aristocrats, and other intellectuals. In Wineburg’s terms, her social position was the key reason her message gained influence, and the relationship between the speaker, her audience, and the broader social context was crucial.¹²

Even after Montagu promoted variolation, many British people remained suspicious because the risks were real. Some feared the procedure, as it could cause serious illness or death.^{10,11} Others saw it as foreign, unsafe, or religiously troubling. Even in societies where variolation was practiced, acceptance was not universal; although some people did not accept variolation, they were not opposed to smallpox prevention but rather feared the procedure. This distinction is crucial, as patients who question a preventive intervention may still value health and public safety but may distrust the messenger, fear the risks, or need clearer communication about uncertainties.

War, Authority, and Inoculation in America

The relationship between disease prevention and public authority also gathered momentum in the American colonies during the American

Revolution. General George Washington mandated that his soldiers be inoculated after the Battle of Quebec, in which the colonies lost many soldiers to smallpox rather than battle, allowing the already variolated Redcoats to defeat them easily.^{9,13} Disease could weaken the army more than battle, so inoculation became a military and public-health necessity.

Washington's policies raise an enduring ethical question for public health: When does collective safety justify limiting individual choice? As with later public health mandates, inoculation protected the group but also required individuals to accept risk. For health professions learners, Washington's policies provide a concrete historical example of the tension between individual autonomy and population-level protection.

This Ottoman practice influenced the later development of Edward Jenner's vaccines, which were much safer than variolation and would become one of the most influential public health developments in history. Jenner used cowpox rather than smallpox material, making vaccination safer.⁹ Variolation also made induced immunity more familiar. Healthcare progress often develops through recognition of earlier practices that are later revised, replaced, or ethically re-evaluated, and the transition from variolation to vaccinating against smallpox highlights this evolution.

Modern Comparison: Health Crisis, Misinformation, and Mandates

Although variolation and modern vaccination are clinically different, both demonstrate that disease prevention depends on both trust and science. Even in societies where variolation was practiced, acceptance was not automatic. A historical comparison can be made with vaccination debates during the early 2020s pandemic, when many people focused on the speed of vaccine development, potential side effects, government mandates, and conflicting information. Many individuals were uncertain about whether to trust pharmaceutical companies, scientists, and public officials. In both cases, disease prevention depended not only on health knowledge but also on public trust. People had to decide whether to trust healthcare authorities, how to assess risk, and

whether public health policies should limit individual choice.

Misinformation also played an important role in both situations. Critics of variolation spread stories claiming that it was unsafe, foreign, or contrary to religious principles.^{10,11} Similarly, during the pandemic, social media allowed the rapid spread of rumors, conspiracies, false health claims, and misleading statistics. Although communication methods changed, fear and distrust continued to shape people's responses to disease prevention. These examples show that the social and political environment often influences resistance to disease prevention.

At the same time, the comparison shows why scientific uncertainty can easily be mistaken for misinformation. Intentional exposure to SARS-CoV-2 was rejected as a viable public health strategy to combat the virus. Some people have proposed that the use of face coverings, such as masks and face shields, might also reduce the viral dose (inoculum) received during exposure, thereby contributing to milder or asymptomatic infections.¹⁴ However, this idea should be approached cautiously, as outcomes are influenced by many factors, including age, health conditions, immune response, and viral replication after infection; for example, one study found no association between the index case's viral load and disease severity in secondary cases.¹⁵ Both historical variolation and modern pandemic prevention generated public debate over risk, trust, and the interpretation of uncertain clinical evidence. Healthcare professionals should therefore be taught to distinguish deliberate misinformation from reasonable uncertainty while still communicating clearly about evidence, limits, and risk.

Furthermore, the tension between individual freedom and social order can grow.¹⁶ As with Washington's inoculation order, public health mandates often raised questions about how to balance individual freedom and collective safety.¹³ During pandemics, debates emerged over vaccine mandates, mask and social distancing requirements, and restrictions in public places. These debates show why infectious diseases pose a special public health challenge. A person's decision may seem

individual, but infection can spread that risk to others. This is why disease prevention often raises difficult questions about freedom, responsibility, and public safety. In health professions education, these debates are valuable because they help learners appreciate the importance of analyzing present-day vaccine hesitancy through a historical lens.

Measles and Historical Memory

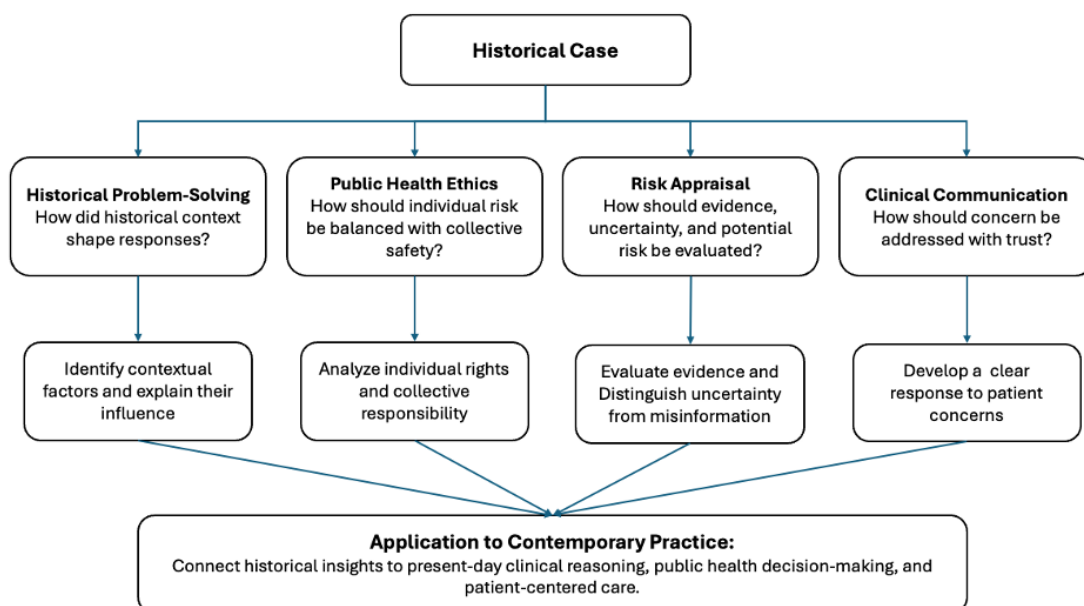
Similarly, the recent resurgence of measles has highlighted concerns about proper vaccination. Before vaccines, measles was a common and often deadly childhood disease, but with successful vaccination programs, measles cases have been reduced significantly. Like smallpox, measles spreads rapidly and requires high vaccination rates to prevent outbreaks. When vaccination rates decline, outbreaks can occur quickly. This example presents another important lesson: when vaccination programs succeed, public memory of the disease may fade. As the memory of the disease fades, fear of vaccination can become stronger than fear of infection.

Historical memory, therefore, matters in public health. Remembering diseases such as smallpox and measles helps explain why prevention is necessary, even when these diseases are no longer common.¹⁷ Historical problem-solving thinking also helps avoid presentism, which treats the past and present as if they were the same.¹² The better approach is to compare them carefully while respecting their differences. In a health professions education setting, this means using a historical lens—not as a simple analogy, but as a way to ask better questions about trust, risk, communication, and responsibility. Healthcare professionals can use historical memory to understand why patients may underestimate diseases they have never seen, while still fearing interventions that feel immediate, invasive or uncertain.

Implications for Health Professions Education

Historical cases can serve as a valuable tool for examining complex health challenges in health professions education. They provide that responses to disease prevention and healthcare interventions are shaped not only by scientific knowledge, but also by hesitancy that often reflects fear, distrust,

Figure 1: Educational framework for applying historical case analysis to contemporary health practice



Note. Historical case studies can help health professions learners connect and utilize historical problem-solving, public health ethics, risk appraisal, and clinical communication.

uncertainty, cultural context, and concern about risk. By studying variolation, health professions learners can examine how people in the past assessed danger, trusted or distrusted health professions authorities, and weighed individual risk against collective protection.

Variolation also supports historical problem-solving. Learners can examine who supported or opposed the practice, why particular voices were considered credible, and how an advocate's social position shaped the acceptance of health knowledge. Lady Mary Wortley Montagu's advocacy for the practice, for instance, shows that public health approaches do not spread solely through evidence, but also depend on credibility, personal experience, and public trust. Similarly, Washington's wartime inoculation policy raises questions about consent, authority, military necessity, and the ethical limits of public health action.

As shown in Figure 1, historical cases can be examined through historical problem-solving, public health ethics, risk appraisal, and clinical communication. The historical analytical lens encourages learners to avoid presentism, recognize ethical tensions, distinguish between misinformation and reasonable uncertainty, and address concerns about trust.^{18,19} These lessons extend beyond vaccine hesitancy to many contemporary health issues (e.g., artificial intelligence in healthcare, emerging infectious diseases, end-of-life care) in which individuals interpret evidence, risk, and institutional trust differently.

The educational value of the history of variolation lies in showing how, while scientific evidence remains essential, historical insights can strengthen critical thinking, ethical reasoning, and communication in modern practices.

Conclusion

Examining the history of smallpox inoculation and how the practice grew socially and politically offers valuable lessons for modern public health. The experiences of the Ottoman Empire, Britain, and other areas show that preventing the spread of disease depends not only on advances in health science but also on trust, effective risk communication, and the surrounding social context.

The history of variolation teaches that healthcare advances do not succeed on their own. Scientific knowledge can offer protection, but public trust determines whether that protection is accepted. From the Ottoman Empire to Britain, from the American Revolution to the present, disease prevention has required more than the right medicine. It has required communication, historical understanding, collective responsibility, and confidence in the institutions asking people to protect one another. For health professions education, this historical problem-solving skill is especially valuable because it trains future clinicians to view prevention as both a scientific and human issue. Health professions learners can better understand that responses to healthcare interventions are within a broader social context, and that a historical lens provides a valuable framework for analyzing complex health challenges across clinical and public health settings.

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