



Global Public Health Threats

The Role of Vaccinations

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Globalization has connected people culturally, economically and socially in a highly mobile, interdependent world. The result: Infectious diseases spread geographically much faster than at any time in history. The World Health Organization has identified more than 1,100 epidemics worldwide in a five-year span.¹ The International Air Transport Association estimates 3.7 billion passengers will travel in 2016, a rate expected to double over the next 20 years.² The constantly increasing number of international travelers plus the continual presence of infectious diseases means an outbreak or epidemic anywhere could become an imminent threat across the world.

Infectious diseases not only spread faster, they emerge more quickly. Since 1980, approximately one to three newly emerging infectious diseases have been identified every year.³ In the last generation, nearly 40 new diseases have been identified.⁴ Existing diseases are re-emerging, causing greater numbers of cases than before, with some developing resistance to current treatments.⁵ The world saw a SARS epidemic in 2003, the spread of H1N1 influenza in 2009 and an Ebola virus outbreak in 2014.⁶ The Zika virus joined the ranks of mosquito-borne serious illnesses that include dengue fever and malaria. And every winter season brings influenza.

VACCINATIONS AND CONCERNS

Though technological and scientific advances have improved detection and response to outbreaks, vaccination to

protect and prevent disease transmission is a key principle.

As with anything, there are pros and cons, positives and negatives, risks and benefits for vaccinations from a clinical, ethical and social perspective. Vaccines generally are held to a higher standard of safety than other health care interventions and treatment — healthy people are immunized to prevent disease, not to treat or cure it. But vaccines are not perfect. People have turned out not to be adequately protected by an immunization, or they have had a harmful reaction.

Vaccine development is an extensive and arduous process, often lasting many years and involving a combination of public and private partnerships. The current system for developing, testing and regulating vaccines requires that the vaccines demonstrate both safety and efficacy

before licensure and that long-term safety is monitored.

Yet along with emerging diseases, basic human behavior is having an impact on public health.⁷ There has been significant and persistent public debate regarding a potential link between childhood vaccinations and subsequent development of autism, fueled by a British physician's published study linking autism and the MMR (measles, mumps, rubella) vaccine. The study later was retracted after it proved to be based on falsified research, and the physician lost his license to practice medicine.

A published 2014 meta-analysis found that vaccinations are not associated with the development of autism.⁸ WebMD also published that the AAP, the CDC, the WHO and the Institute of Medicine all agree that there is no relationship between vaccines and autism.⁹

Fears about vaccines have not gone away, however. An anti-vaccine movement has been strong enough in some communities that cases of vaccine-preventable diseases have gone up.

ANTIBIOTIC RESISTANCE

With infectious diseases among the leading causes of morbidity and mortality worldwide, vaccines and antibiotics are widely hailed as two of the greatest accomplishments of modern medicine.



Lorraine Tuson

Vaccines have been the health care intervention that has saved the most lives globally.¹⁰

Vaccines can increase life expectancy by protecting against diseases and subsequent untoward sequelae. In a published meta-analysis, individuals with a mean age of 67 years who were given influenza vaccinations were associated with a lower risk of major cardiovascular events and a lower risk of mortality from all causes compared to their unvaccinated counterparts.¹¹ With the population aging and heart disease being the leading cause of death for both men and women, vaccines have demonstrated a positive impact on longevity and quality of life.¹² On an ever broader perspective, vaccinations are tied to many of the important determinants of population health: life expectancy, death rates, disability and quality of life. As health care focuses on managing the health of patient populations, a role for vaccinations will be a top priority.

Health care providers also play a major role in answering questions, dispelling myths and educating people about the safety and effectiveness of vaccines. A provider's strong commitment to vaccinations can influence concerned or resistant parents and patients. The majority of patients accepted the provider's vaccine recommendations when they were presented as immunizations required to maintain optimal disease prevention.¹³ Addressing the anti-vaccine movement is done by refuting inaccurate allegations and providing scientifically reliable and valid data.

ETHICAL CONCERNS

Vaccinations long have been the subject of various ethical controversies. The key ethical debates have revolved around vaccine regulation, use of mandates, research and testing and access disparities.¹⁴

The burden of diseases, including vaccine-preventable diseases, falls disproportionately on the disadvantaged. Vaccination programs have removed some of the racial and socioeconomic disparities in select disease incidence.¹⁵ From a human rights perspective, vaccination equitably promotes and protects public health. A comprehensive vaccination program is a cornerstone of good public health and will reduce inequities and poverty.

"Distributive justice" concerns the nature of fair allocation of goods and resources that may be in short supply, such as vaccines.¹⁶ Resources

should be allocated with the aim of achieving "the greatest good for the greatest number." The allocation of a limited supply of vaccine calls for a fine balance between utility, equality and fairness.

Many vaccine-related ethical debates center on the evidence that access to vaccinations depends to some extent on socioeconomic and racial ethnic minority status. Implicit in these discussions is the question of whether or not all

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lives are of equal value and equally deserving of opportunities to be protected by vaccination.^{17,18} From an ethical perspective, increasing the number of vaccine producers would positively influence health. When vaccines are in short supply, health care providers must make decisions about who should be protected, therefore leaving others vulnerable to disease.

In the U.S., access disparities and challenges to receiving vaccinations can exist for all age groups and populations, including adults, elderly, low-income children and people without health insurance. Even after controlling for economic status, researchers have found that racial ethnic minority adults are less likely than others to receive preventive care including vaccination.¹⁹ Although getting vaccinated seems like an obvious choice, barriers to vaccinations remain a problem, and despite efforts, racial and ethnic disparities in vaccination rates still exist.

Global health disparities are even more extreme and highlight additional ethical dilemmas. Developing countries face threats from disabling and deadly infections often referred to as "poverty diseases" that are unknown to most persons living in the U.S. Among the diseases are malaria, measles and infections caused by poor sanitation and exacerbated by malnutrition.

Although vaccines can help prevent many such diseases, vaccine development in developing countries lags behind basic community health



needs.^{20,21} To further complicate matters, developing countries affected by “poverty diseases” often lack the infrastructure to support wide-scale vaccinations and face many competing health and social priorities.^{22, 23} Disparities in the U.S. and around the world signal the need for continued efforts to ensure equal opportunities for people to benefit from vaccination.

PUBLIC VERSUS INDIVIDUAL RIGHTS

An important characteristic of most vaccines is that they provide both individual and public protection. Most of the diseases against which we vaccinate are transmitted from person to person. When an adequately large proportion of individuals in a community is immunized, those persons serve as a protective barrier against the likelihood of transmission of the disease, thus indirectly protecting those who are not immunized.²⁴

Vaccination laws were enacted to control epidemic diseases, and the first such vaccination requirements were passed in Italy in 1806, France in 1810, and in Sweden in 1816.²⁵ Vaccination requirements, vaccination laws and vaccine

mandates are important tools for achieving the high vaccination coverage levels that have had a positive impact on population health. Proposals for vaccination requirements often precipitate vigorous discussions of ethical issues, especially among parents of children targeted to receive the vaccines. Some parents do not accept existing safety evidence. Others oppose the concept of mandatory vaccination or mandates for specific vaccines. Still others have religious or philosophical beliefs that conflict with vaccinations.²⁶

Many scientific and medical research studies have found that individuals who exercise religious and/or philosophical exemptions from mandated vaccinations are at a greater risk of contracting diseases, which puts themselves and their communities at risk. Thus, health care and public health advocates often struggle to balance the ethics of protecting individual beliefs and the public’s community health.²⁷

As new vaccines have been introduced with recommendations for use in select age groups, states have responded by expanding the scope of their vaccination laws. In the U.S., state policies

HISTORY OF VACCINATION

Vaccines save lives and prevent disease and disability; they are efficient and effective health interventions. In efforts to reduce the burden of infectious diseases, there are few things as important as vaccines.

The word vaccine comes from the Latin word *vaccinus*, meaning “of cow.”¹ The history of vaccination began in 1796 with Edward Jenner’s use of cowpox to create immunity to smallpox. His method underwent medical and technological changes over the next 200 years and eventually resulted in the eradication of smallpox, with the last case occurring in Somalia in 1977.² The WHO declared smallpox eradicated in 1979.³

In the late 19th century, Robert Koch’s germ theory of disease and Louis Pasteur’s work with attenuation in culture led to further vaccine devel-

opment. In 1885, Pasteur developed the rabies vaccine, first used successfully on a young boy who had been bitten by a rabid dog.⁴

In 1932, Max Theiler’s pioneering work resulted in a yellow fever vaccine and established a model for vaccine development that continued for the remainder of the 20th century.⁵ Yellow fever remains endemic in many parts of the world, infecting more than 200,000 people annually.⁶ The WHO and its partners are working to increase vaccination availability in high-risk regions.

Over the last decade, many diseases once endemic to the U.S. have been eliminated or the disease burden significantly reduced, in part because of routine vaccinations. Efficacious vaccines not only protect the immunized but can reduce disease among

unimmunized individuals in the community through indirect effects or “herd immunity.”

NOTES

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Health care and public health advocates often struggle to balance the ethics of protecting individual beliefs and the public's community health.

mandate certain immunizations, including school entry requirements, and are now being used to increase coverage with vaccines that are deemed important to protect the public's health, even in the absence of epidemics. This practice is increasingly being challenged through the anti-vaccine movement.

CONCLUSION

Vaccinations have had an enormous impact on population health and the prevention of disease and have been one of the single greatest public health achievements of the last century. However, over the past decade, acceptance of vaccines has been challenged by individuals and groups who question the benefit and safety. Clinical and ethical issues pertaining to vaccination activities and the public health versus individual rights debates are important in the implementation of and the public's response to vaccination programs. The debates will continue, and as health care professionals, our duty is to empower and educate consumers so that decisions can be made with the best interests of all in mind.

Although development and use of vaccines is the first step to reducing the infectious disease burden and related morbidity and mortality, investments in new technologies, vaccine development and improved accessibility — including affordability — are crucial. With the continued refinement of technology, communication and connectedness, the risk of embarking upon a new infectious disease has become and will remain a reality. Vaccinations will continue to play a role in ensuring the health and wellness of the communities we serve.

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