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Addressing the 21st Century Challenges to Herd Immunity

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Article Info

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The recent outbreak of measles in the United States highlights the challenge scientists and the medical community face when herd-immunity has been reached in most territories. While large territories may reach immunization rates that would suggest overall protection, local variations can create great risk for medically vulnerable individuals and communities. With herd immunity also comes increasing ignorance of the risk that vaccine preventable diseases pose. For example, most parents today do not know that measles can cause serious complications such as brain damage and death, that the virus is highly contagious and spreads through the air from coughs or sneezes and stays active in the environment for two hours, or that infected individuals are contagious four days before and after the rash appears. Measles is arguably the most contagious of all infectious diseases.

Most adults in the United States have never seen the devastating effects of vaccine preventable diseases so they fear the vaccine rather than the disease. Before the measles vaccine was licensed in 1963, 549,000 cases, 48,000 hospitalizations, and 495 deaths were reported annually in the United States with about 1000 individuals, mostly children, developing life-long chronic disability from acute encephalitis caused by measles.

Over hundred cases of measles have been confirmed in 10 states thus far in 2019: California, Colorado, Connecticut, Georgia, Illinois, New Jersey, New York, Oregon, Texas and Washington [1]. Over the last decade we have observed periodic outbreaks in pockets of communities in these and other states. In 2018, we saw 372 cases many of which are part of the current outbreak. In 2014, 667 cases or about 6 times the routine number annually were confirmed. All these annual outbreaks are linked to travelers who brought measles back from other countries such as Israel and the Ukraine, where large outbreaks have occurred. Measles outbreaks spread in the United States because of small groups of unvaccinated people in our midst.

Concerns about vaccine safety have led many American parents to delay or avoid vaccinating their children [2]. Hopes of avoiding rare reactions underlie these parental decisions. But, other barriers in our country such as lack of access to care, spotty health insurance coverage and increasingly complex immunization schedules may contribute to children being unprotected from vaccine preventable diseases longer [3].

Vaccine safety is complex and many people question it. Some of the most common concerns raised by parents include 1) children are required to have too many vaccinations, 2) combination of vaccines increases risks, and 3) fear of reactions or worse to vaccines. Certainly, one can imagine how these real fears could be manipulated because of misperceptions about vaccines that have persisted for decades and a poor understanding by the public about how vaccination works. The Centers for Disease Control schedule of childhood vaccinations suggests that some children may get five vaccines in a single visit and must return for more over various periods of times. If one is unfamiliar with

vaccines and how they work this could be alarming. But, delaying vaccines increases the time children are at risk of disease and potentially increases the risk of vaccine reactions. These fears have led to the expansion of non-medical exemptions or outright vaccine refusals world wide. So, trust in government and the scientific community to evaluate vaccine risk and communicate their safety are paramount to overcoming resistance.

Yet, trust in government by the American people has been declining over the last half-century. A year before the last presidential election only 19 percent of Americans said that they trusted government most of the time [4]. Most Americans, however want government to address and recognize the importance of government in addressing issues ranging from terrorism, disaster response, education and the environment. Local government, in particular is entrusted to protect the public's health [5]. So, the public's attitudes about government and its responsibilities is difficult to characterize. However, as vaccinations illustrate, even small pockets of major mistrust can upend public protections and create safety concerns.

Religion influences parental decisions on vaccination and is put forward as an excuse to not vaccinate their children [6]. This has led to the adoption in 47 states to religious exemptions which has contributed to the recent outbreaks over the last decade. Yet, there are no theological reasons against vaccination, per se [7,8]. The Roman Catholic Church strongly supports vaccination and considers it morally and ethically important to vaccinate against diseases such as measles. In fact, Christian churches have no scriptural or canonical objection to the use of vaccines. The only exception is the Dutch Reformed Church. Even Christian Scientists who believe that diseases are not real and can be healed with focused prayer from one of their "practitioners" do not object to vaccines but recommend they be used in combination with prayer to prevent any bad effects. Similarly, Jehovah's Witnesses who instructs its members to avoid whole blood and other blood components because it is a violation against their God, accepts the clinical value of vaccines and even strongly endorses them.

All major religions in the world and almost all minor religious groups or sects accept immunization. For example, Islam like Jewish and Christian authorities recognize the importance of vaccination for the well-being of the community. None of the four major sects of Hinduism have ever stated a concern with vaccination. Hindus advocate for the respect for life and support technologies that support people to live longer and healthier. Even the Amish, contrary to popular belief, do not prohibit the use of vaccines, although rates of vaccination vary between different communities.

More recently with a social movement largely among White college educated parents, 18 states have adopted the "Philosophical" or personal belief exemption. Basically, this exemption says that a parent does not believe in vaccines for their children. Since 2009, the number of these exemptions has risen with several "hotspots" identified in large metropolitan locations including Seattle, Spokane, Portland, Phoenix, Salt Lake, Provo, Houston, Ft Worth, Plano, Austin, Troy, Warren, Detroit, Kansas City, Pittsburgh and smaller counties in Idaho, Wisconsin, Utah. Low vaccination rates lead to measles outbreaks. So, pockets of unvaccinated adults and children render some in our communities vulnerable to vaccine preventable diseases, such as babies too young to receive vaccines, people who cannot receive vaccinations because of medical conditions and elders with poor immune systems.

Governments have seen over the last decade legal vaccination exemptions that include medical, religious and most worrisome philosophical reasons. The recurrent outbreaks in the 21st Century may be turning the tide of public opinion as well as government response to the vaccination exemptions and increasing efforts to educate parents and convince them to vaccinate their children. This year's outbreak in Israel has contributed to outbreaks in Europe and the United States.

In Israel, the Knesset has passed the first reading of a proposal for strict penalties on parents who do not vaccinate their children [9]. During this year's severe measles outbreak of adults and children who had not been vaccinated or came into contact with unvaccinated individuals, the Ministry of Health and religious authorities issued pleas to immunize. Most cases in Jerusalem were concentrated in sectors inhabited by strictly orthodox communities. Political leadership across parties have united without opposition from religious parties to move to this bill ahead. This bill uses negative economic incentives tied to income tax penalties to persuade parents to immunize their children after efforts to educate parents to do so should fail.

Similarly, in Europe particularly in France and the Ukraine where another outbreak of measles has occurred this year we see efforts to increase vaccination rates in pockets of resistant communities.

In the United States, we also see political sentiment turning toward eliminating or limiting exemptions. The anti-vaccination movement that succeeded in widening exemptions to include personal belief, often referred to as "Philosophical exemptions" is facing a turn in public sentiments and opinion as periodic outbreaks since 2000 threaten medically vulnerable individuals and young children across the nation [1,7]. Given that there are no theological grounds for religious exemptions then the case for philosophical exemptions is on even thinner ice.

Both Orthodox Protestant (especially in the Netherlands)) and Orthodox Jewish (particularly in New York and Israel) parents raise religious objections to vaccinations. Yet, some in these denominations chose to vaccinate their children. Ruijis et al [8] show that different types of decision making and parental education may be required for "traditionally non-vaccinating, deliberately non-vaccinating, deliberately vaccinating, and traditionally vaccinating parents. Parental decision making is a complex process that deserves the attention of those of us developing, encouraging the use of and offering vaccinations.

Medical and sociopsychological considerations are often at play beyond religious beliefs. Family tradition and fear of side-effects often play a central role in these communities. Families that deliberately vaccinate their children as well as those who chose ultimately not to vaccinate both see vaccination as a test of their faith. How might we encourage and support parents to deliberately decide to vaccinate their children given their fears that their God may punish them?

One of the greatest achievements of the 20th Century, creating a world free of vaccine preventable diseases which has saved millions of lives faces a 21st Century challenge. We are witnessing a refusal by some parents to vaccination and global fear of vaccines.

Publicly communicating the importance of vaccination often focuses on the importance for the health of the individual. However, the greatest contribution of vaccination is "herd immunity" and the protection of the medically vulnerable. These socially oriented messages are not highlighted enough by health professionals and scientists creating and testing vaccines in a world and society that is at times so individualistic. How might we truly communicate that we are all in this battle for safety from vaccine preventable diseases together? Do we really need governments to act in the interest of the public or can we create a culture that values the health and well-being of all in our society enough to recognize vaccination as a social obligation rather than an individual choice?

How do we communicate risk of adverse events without scaring the public? Certainly, watching commercials on television for new pharmaceutical products is scary once the potential risks are conveyed. I can understand why some parents have been scared by overblown messages of risks associated by vaccination or outright fabrications of adverse events. How do we meet our obligation to convey risks no matter how small while reassuring the public of our efforts to make safe and effective medications and vaccines available to the public?

Certainly, one way to increase the public's trust is to provide open and transparent information to those who seek it. The U.S. Food and Drug Administration (FDA) approve drugs used in the United States and assures their safety and effectiveness. However, all drugs may have some side effects. No matter how rare, the public must be informed of these risks as part of the FDA's safety mission. The FDA offers numerous resources for health professionals and the public to see reports of adverse events for pharmaceuticals and biologics. One of these is the FDA Adverse Event Reporting System (FAERS) dashboard. The dashboard is an interactive web-based tool that allows easy access to the FAERS data (FAERS Public Dashboard (https://fis.fda.gov/sense/app/d10be6bb-494e-4cd2-82e4-0135608ddc13/sheet/7a47a261-d58b-4203-a8aa-6d3021737452/state/analysis)). Improving data access and transparency drove the development of the FAERS. Knowing that the FDA and all vaccine stakeholders constantly keep under surveillance the potential for adverse events should bolster trust, if the system is truly transparent. We all have a stake in increasing the trust in government reporting systems. We all play a role in keeping vaccines safe.

Many resources – apps, websites, public health social media campaigns, and research articles - are available for scientists and health care professionals to educate the public that vaccines are safe and effective. We must all contribute to this effort to diminish the pockets of unvaccinated individuals in our communities.

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