THE MEASLES CRISIS IN AMERICA: IDENTIFYING PROBLEMS AND SOLUTIONS

Introduction

Measles is a highly contagious viral infection caused by MeV, a single-stranded RNA virus with no animal reservoirs. The disease can affect individuals of all ages and conditions of health, but it remains a leading cause of death for young children in particular.

Measles is believed to have derived from rinderpest, a now-extinct virus affecting cattle and other related even-toed ungulate species sometime between 1000 and 1100 B.C.E (Furuse et al., 2010). Measles is exceptionally infectious, with a basic reproduction rate of fifteen. If one person gets infection with the virus, nine out of ten people who share space with that person will catch it as well if they do not demonstrate immunity (Perry and Halsey, 2004).

There is no specific cure or treatment for measles, but effective preventative vaccinations do exist. The first measles vaccine began circulating in 1963, and over the past 50 years its widespread use has reduced the morbidity and mortality of the virus
across the world (Goodson, 2015). Measles deaths have decreased 78% globally between 2000 and 2008, and have been declining exceptionally quickly in less-developed nations where recently implemented national vaccination programs have proven very effective. However, reports by the World Health Organization have indicated that a global measles resurgence looms in the near future (WHO, “Global Measles Deaths Drop”), even in the U.S. The principal cause of such a resurgence will undoubtedly be an overall decrease in vaccination rates.

Given that the only approach to combatting measles is the preventative vaccine, there cannot be too much emphasis on keeping to prescribed vaccination practices in our global effort to eradicate the disease. In order to prevent a global resurgence, efforts must be made to galvanize the vaccination effort-- especially in developed nations, which tend to control the resources necessary to eradicate a disease and are dominated in turn by an out-of-sight-out-of-mind attitude toward issues that aren’t immediate crises.

**Defining Measles**

The measles virus, a single-stranded RNA virus called Measles morbillivirus, causes measles. There is no known animal reservoir; humans are the only natural host. The pathogen is transmitted through direct contact with contaminated substances and objects, as well as airborne respiratory droplets that are released while coughing and sneezing (WHO Measles Vaccine Summary 2017).

The most common symptoms of measles include a cough, high fever, and the onset of a maculopapular rash. Clustered white lesions known as Koplik’s spots can be
found on the inner walls of the mouth in the earlier days of infection, and may be used to
diagnose the disease before it reaches the height of its infection (Chiew et al.,
2015). Complications are relatively common and can affect almost every organ system.
Pneumonia, otitis media, diarrhea, and brain inflammation are the most commonly
observed of these. Children, pregnant women, and immunocompromised individuals are
most at-risk for developing severe complications (Perry and Halsey, 2004).

Measles is one of the most contagious diseases of humans, and in the absence of
vaccination, about 95% of the human population would be infected with the virus by the
age of fifteen (“Measles Vaccines: WHO Position Paper - April 2017”). It has been
estimated that before the advent of the measles vaccine, measles caused around 2.6
million deaths annually.

“Curing” Measles

There is no specific treatment for measles, so most patients are relegated to receiving
supportive treatment: rest, fluids, and over-the-counter medication to relieve fever and
respiratory symptoms.

Measles is, however, preventable by vaccine. Currently only live attenuated
vaccines are available, but both monovalent and combination have proven effective in
protecting against measles. Nearly all viral samples originate from the same Edmonston
isolate, but there has been no clear evidence of genetic variation between different viral
strains (Goodson and Seward, 2015). As the virus has retained its monotypic, antigenic
structure, there has been no observed change in vaccine effectiveness. Along with the
measles virus itself, a single vaccine may also contain the antibiotic neomycin as well as stabilizers albumin, sorbitol, and hydrolyzed gelatin (“Measles Vaccines: WHO Position Paper - April 2017”).

Although it may be impacted by environmental factors, the measles vaccine generally maintains a high efficacy rate of about 97% (“Measles | Vaccination | CDC.”). Its effectiveness lies in its ability to act like a weaker version of wild-type measles. The vaccine induces similar cellular responses as a wild-type measles infection would, but with lower antibody concentrations. IgG antibodies still persist in the body for years after vaccination and measles-specific killer T cells are induced as well. Wild-type measles have been known to permanently affect immunosuppression, but because it’s not as strong, the measles vaccine doesn’t necessarily do as much damage (Clifford et al., 2017).

Keeping to official vaccination schedules is key in maintaining a high efficacy rate against a disease that most strongly impacts children. Licensed immunizations are intended for use on children as young as six months old, but the WHO recommends parents vaccinate their children between 9-15 months of age; children living in countries where the disease is more common should get vaccinated on the earlier part of that spectrum, but children who don’t can afford to wait a little longer. A second dose is necessary to guarantee immunity, as 95% of children develop protective immunity after a second dose of the vaccine. Differences in timing between children of different nations are typically due to differences in endemic measles rates, healthcare system infrastructure, and vaccination accessibility, but the CDC recommends the second
vaccination to be administered somewhere between four and six years of age (Chandra, 1975).

Not everyone can or should be vaccinated against measles, however. People who have proven allergic to a previous dose of the measles vaccine or to one of its components should not be inoculated, nor should anyone who has demonstrated short-term or long-term immunodeficiency. Herd immunity can only take effect when 95% of a given population is immune to a disease, so it is up to those who are able to maintain a safe, healthy environment to get vaccinated for the sake of those who are not.

Deconstructing Vaccine Hesitancy

Vaccine hesitancy presents a mounting obstacle for immunization programs around the world. The term refers to delay in acceptance or refusal of safe vaccines despite availability of vaccination services, and it limits the benefits of the vaccines at our disposable considerably. Vaccines can only improve health and overall quality of health if they are used, after all, and nearly everyone needs to buy in in order for herd immunity to work as it should.

Globally, around one in five children still do not receive the life-saving vaccines they need, and an estimated 1.5 million children die every year of vaccine-preventable diseases (“WHO | Vaccine Hesitancy.”). In the United States, a high national vaccination rate is reported, but uneven distributions mean that 26 states do not report the 95% minimum coverage rate for the MMR vaccine (Seither, 2014).
Vaccine hesitancy is a multi-pronged issue, and a number of issues may contribute. Vaccine safety is perhaps the most widely reported concern explain what this is before so quickly turning to other causes, but is by no means the only deterrent to vaccination. Misinformation about the function and capability of vaccines as well as mistrust of pharmaceutical companies and the biomedical model are major factors too (Phadke et al., 2016).

In the U.S., much of the vaccine hesitancy involving measles is rooted in a study executed in 1998 by Andrew Wakefield, a British gastroenterologist. It focused on eight children who developed autism within one month of receiving a combined measles-mumps-rubella vaccine, and it was concluded that vaccine contained inflammatory agents that induced brain inflammation. The study was debunked almost immediately, and its findings have never been able to be replicated. Gastrointestinal inflammation isn’t connected to autism diagnoses, and autism isn’t an inflammation-induced condition in the first place. It is also worth noting that Wakefield took at least £400,000 in bribes from lawyers to produce false data (Plotkin et al., 2009). Despite all of this, the myth persists today. Among vaccine-hesitant parents in the United States, 57% cite concerns about autism as a primary cause (Seither, 2014).

Another major contributing factor is the notion that vaccine schedules should not be adhered to because they require too many vaccines. The idea is that the administration of too many vaccines at once will overwhelm the immune system, and potentially even damage it permanently. This is also largely untrue, as vaccines are incapable of overwhelming the average non-immunocompromised baby (Smith et al., 2011). It is true
that the number of recommended childhood vaccines has doubled since 1980 from seven to fourteen, the overall immunologic load has actually decreased so that the 14 vaccines given today contain <200 bacterial and viral proteins or polysaccharides, compared with >3000 then (Plotkin et al., 2009). Furthermore, the immune response triggered by attenuated vaccines is much less than that of nonattenuated wild-type viruses.

It is worth noting that vaccine hesitancy means that these individuals have access to vaccines and opportunities to get vaccinated, but they are choosing not to. Surveys show that American families against vaccination tend to be headed by non-Hispanic white, English-speaking married couples with college degrees and private healthcare coverage. On average, they report incomes four times the poverty line (Seither, 2014). Monetary or geographic barriers do not limit these individuals; rather, they have largely unfettered access to professional doctors and vaccines. The anti-vaccination movement thrives on placing belief over fact, however, and many people choose their heart-driven belief that vaccines are damaging over scientific evidence that may be presented to them.

**Future Directions**

In the future, national governing bodies, public health organizations, and the biomedical community must work together to address the measles crisis in America, because solving the crisis will require different tactics than other public health crises the nation has faced in the past. It is not an issue of increasing accessibility or awareness. It must somehow communicate the factual importance of vaccinations to a group of individuals who are suspicious of fact.
More work can and should be done to study the vaccine itself so that it may be better understood, and so that it can be ameliorated. Some NGOs and biotechnology firms have begun the work of synthesizing and testing a measles microarray patch, a new mode of administering the measles vaccine. Microarray patches are painless topical bandages that use microscopic projections to deliver vaccines through the skin (PATH, “Microarray Patches for Vaccine Delivery”). They are reportedly cheaper, safer, and easier to administer than the shots we have come to associate with vaccines. It is thought that their increased safety compared to intravenous immunizations, as well as the novelty of a new format, will increase their popularity even among individuals who are skeptical of the measles vaccination in its current form.

It is also important to disseminate what information we do currently possess about measles so that people might make the most informed decisions possible. It is my belief that much of vaccine hesitancy stems from fundamental misunderstandings about the measles virus, MMR vaccine, and immune system work. Many parents would be more comfortable with the measles vaccine if their personal medical professional would take the time to explain the contents of the vaccine, how it works, and how the immune system responds. Effective communication is key in dispelling fears and addressing concerns.

Unfortunately, a smaller but vocal contingent of the anti-vaccination movement knowingly reject the facts that have been presented to them so education cannot be the main mode of combating their vaccine hesitancy. For them, scientific evidence is not and may never be enough to sway them from their beliefs. Right. In these cases, laws
governing exemptions seem to be most effective. Evidence has shown that vaccination rates are highest in states that permit minimal or no exemptions. For example, only 82% of children of children in Colorado have demonstrated immunity to measles compared to 99.7% in Mississippi. Mississippi is one of two states where neither religious nor philosophical exemptions can be legally granted, so only residents who are physically unable to receive the vaccine remain vulnerable. Colorado permits religious and philosophical exemptions as well as medical, and as a result, no one is legally bound to vaccinate themselves or their children if they decide they don’t want to. Although detractors often argue that they infringe upon the rights of the individual, rigid laws that mandate vaccines and block loopholes have a significant impact on vaccination rates.

WORKS CITED


