Save the Children... Vaccinate!

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Less than a month into 2015 there was an infectious outbreak that sent many kids home from Disneyland with what initially appeared to be the common cold but quickly turned into a full-body rash—measles. By July 24, 2015, the CDC reported 183 cases of measles across 24 states and Washington, DC. But the outbreak has left many Americans asking, how and why did this happen?

A quick Google search can tell you that a measles vaccine is readily available. In fact, measles is vaccinated against along with mumps and rubella in the immunity concoction known as MMR. MMR was licensed in 1968 and became officially recommended for all children in 1977. The introduction of this vaccine led to a dramatic decrease in measles infection rates and has proven to produce immunity in 90-100% of inoculated children.

So, how does an outbreak like this occur? It starts with herd immunity. Herd immunity is the protection a population receives from an infectious disease when a certain percentage of the population is appropriately vaccinated. For measles, herd immunity can be achieved when 88-92% of the population receives the MMR vaccine. However, when this threshold is not met, the population becomes at risk. It's a simple probability problem. An infected person has a greater chance of coming in contact with an unvaccinated person if the herd immunity threshold is not met. The newly infected person has the potential to infect many others, and from there it is an exponential equation summing up to an outbreak. Now the question becomes, why is our population not meeting the herd immunity threshold?

There will always be members of the population that cannot be vaccinated—the designated 8-12% that public health statisticians allow for in their herd immunity threshold calculations. Many of these people are immunocompromised. Whether they have received transplants and must take immunosuppressants or have an autoimmune disease, vaccination is a health risk these patients cannot afford to take. In the case of measles, many older Americans have a lifetime immunity from childhood infection, but this elderly cohort is dying without being replaced by a younger, vaccinated cohort.

Since Dr. Andrew Wakefield's 1998 publication in *The Lancet*, many parents have chosen not to vaccinate their children, particularly with MMR, for fear of a link between vaccines and autism. Wakefield published a study of twelve children who had been vaccinated with MMR and were diagnosed with autism. Immediately after its publication, the

validity of the study was questioned for ethical and logistical reasons. Many subsequent studies have been published that disprove Wakefield's publication, causing *The Lancet* and ten of the thirteen authors to retract their claims. Nevertheless, the fear persists in American parents' minds.

The NIH recognizes that the prevalence of autism has increased in conjunction with the increase of infant vaccination rates but also cites two reasons for this apparent correlation. First, new diagnostic mechanisms for autism have led to hypervigilance in diagnosing. It is important to remember that autism is a spectrum disorder, meaning patients can express a wide range of symptoms. With this influx of diagnoses, children with more mild symptoms receive the diagnosis, leading to the statistics noting an increased prevalence of autism. Secondly, the NIH recognizes a temporal association between the age of autism diagnosis and vaccination. The first dose of MMR is given between 12-18 months of age, which is the same age that most children are diagnosed with autism. Yet, it is highly unlikely that such a disorder could develop to a diagnosable degree in such a short time frame. Ultimately, the most compelling piece of evidence is actually the lack of evidence. There are no epidemiological studies showing an association between vaccines and autism. Autism pathogenesis is strongly genetic and neurodevelopmental. A vaccine at 12-18 months of age cannot explain a disorder that has roots in embryonic development.

While it is unfortunate that many Americans, mostly children, contracted measles this year, most of them will also survive; they will suffer from the symptoms but eventually recover. Nevertheless, let us think critically about what has occurred here. The unfounded fear of a link between autism and vaccines has caused a drop in our herd immunity for measles that has put the population at risk. What would happen if our herd immunity for more deadly diseases dropped? Dare I mention polio? Hepatitis? Meningitis? We have received a warning sign from this measles outbreak. Parents, save us all from the infectious diseases the research community has worked so hard to put at bay. Vaccinate your children.