

Required Vaccinations for Children from Birth to Adolescence

By Elizabeth Akselrod

It was another regular day in Brendalee Flint's house when her bouncy, curious, and fully vaccinated 15-month-old daughter, Julieanna, all of a sudden stopped being able to move and speak. After rushing her to the hospital, Brendalee was informed that Julieanna had Meningitis, a disease brought on by *Haemophilus influenza B*. Meningitis, an inflammation of the brain meninges, is not only a rare and fatal disease, but is most commonly prevented by vaccinations. In fact, Julieanna was one of 5 children diagnosed with meningitis in 2008 in Minnesota. It was after the diagnosis that they discovered that Julieanna has a rare form of immune deficiency and her body rejects vaccinations [1]. So, how did Julieanna contract this disease? Another child, whose parents didn't vaccinate against Meningitis (Hib), became ill and then passed it on to Julieanna. To this day, Julieanna walks but falls constantly, cannot speak much other than screaming, and still suffers from the brain surgery. She receives weekly injections and her mother fears that Julieanna will never be able to live a normal life [1]. Is it fair for Julieanna to suffer because other children have opted out of receiving immunizations? Should childhood vaccinations be required for the sake of Julieanna and all kids alike? Can steps toward herd immunity eliminate cases such as this one?

Massachusetts law states in Chapter 76 that "No child shall, except as hereinafter provided, be admitted to school except upon presentation of a physician's certificate that the child has been successfully immunized against diphtheria, pertussis, tetanus, measles, poliomyelitis and such other communicable diseases" [2]. Schools across the state set their standards around this law, and some schools even recommend additional vaccinations for diseases such as Hepatitis B, Hepatitis A, *Haemophilus influenza B*, and Pneumococcal for children before the age of 6 [3]. Flu vaccines are also recommended every year because the virus mutates constantly into a newly active strand. Yet, it is important to remember that all these vaccines are not currently strictly mandated. Although doctors' offices monitor which vaccines are administered, a parent can refuse a vaccine at any time. Then, the doctor has to sign a certificate of health after a physical examination in order for the child to attend school. If the health physician at the school disagrees with this choice, the decision then goes to the department of public health [2]. This means that children can attend school in Massachusetts unvaccinated and without the proper defense systems and thus pass on diseases to other children.

The Department of Health and Human Services has partnered with the Centers for Disease Control and Prevention to set up guidelines outlining which vaccines should be administered at specific ages for children entering schools in Massachusetts. The vaccinations that are given between birth and late adolescence have strict timelines and are crucial to a healthy development of the brain and immune system. Below (Figure 1) is an overview schedule of the recommended vaccines and doses, but none of these are enforced by Massachusetts Law. The CDCP also clearly states that if students wish to decline the Meningococcal vaccine, they need to sign a waiver form that is provided by the school or university [3]. With such abstract guidelines and the ability to decline childhood vaccinations can Massachusetts successfully minimize the spread of these diseases and create herd immunity?

Massachusetts School Immunization Requirements for School Year 2011 - 2012*

	Child Care/Preschool ¹	Kindergarten	Grades 1-6	Grades 7-12	College ²
Hepatitis B ³	3 doses	3 doses	3 doses	3 doses	3 doses for all health science students and full-time undergraduate and graduate students
DTaP/DTP/DT/Td/Tdap ⁴	≥4 doses DTaP/DTP	5 doses DTaP/DTP	≥4 doses DTaP/DTP or ≥3 doses Td	4 doses DTaP/DTP or ≥3 doses Td, plus 1 dose Tdap (See Phase-In Schedule)	1 dose Tdap (See Phase-In Schedule)
Polio ⁵	≥3 doses	4 doses	≥3 doses	≥3 doses	NA
Hib ⁶	1 to 4 doses ⁶	NA	NA	NA	NA
MMR ⁷	1 dose	2 doses	2 doses measles, 1 mumps, 1 rubella (See Phase-In Schedule)	2 doses (See Phase-In Schedule)	2 doses (See Phase-In Schedule)
Varicella ⁸	1 dose	2 doses	1 dose (See Phase-In Schedule)	2 doses (See Phase-In Schedule)	2 doses (See Phase-In Schedule)
Meningococcal ^{9,10}	NA	NA	NA ¹⁰	1 dose for new full-time residential students ⁹	1 dose for full-time residential students ⁹

*These requirements also apply to all new "enterers." NA = no vaccine requirement for the grades indicated.

Figure 1: Department of Health and Human Services. Center for Diseases Control and Prevention. Recommended Immunization Schedule for Persons Ages 0-18. December 21, 2010. Available at <http://www.mass.gov>. Accessed 27 September 2011

Herd immunity refers to the control of contagious diseases through vaccination and therefore eradication of the disease [4]. Examples of diseases that researchers are trying to eradicate are Measles, Mumps, and Rotavirus. If a large portion of the population is immunized, then there is less chance of the disease spreading. If the disease is kept from spreading, the existence of the disease decreases. If a population reaches an immunization level near or equal to 100%, then the disease is eradicated and few to zero individuals are affected [5]. The United States has successfully eradicated Smallpox since 1977 by vaccinating the majority of the environment. Other reasons why we were able to eradicate Smallpox are that it only exists in one form; it is not an asymptomatic disease that can survive in the body in a latent form; and every country participated in the mass immunization of its residents [5]. The diagram (Figure 2) from the National Institute of Allergy and Infectious Diseases shows three different types of communities: the first depicts a community in which no one is vaccinated, and although only 2 people are ill, the disease spreads to the population as a whole. The second picture depicts a community in which a few individuals are immunized; the majority of the population gets ill with the exception of a small portion. The third picture depicts what herd immunity really is: the majority of the population gets immunized; thus, the rest of the community is protected, and over time the disease ceases to exist [4].

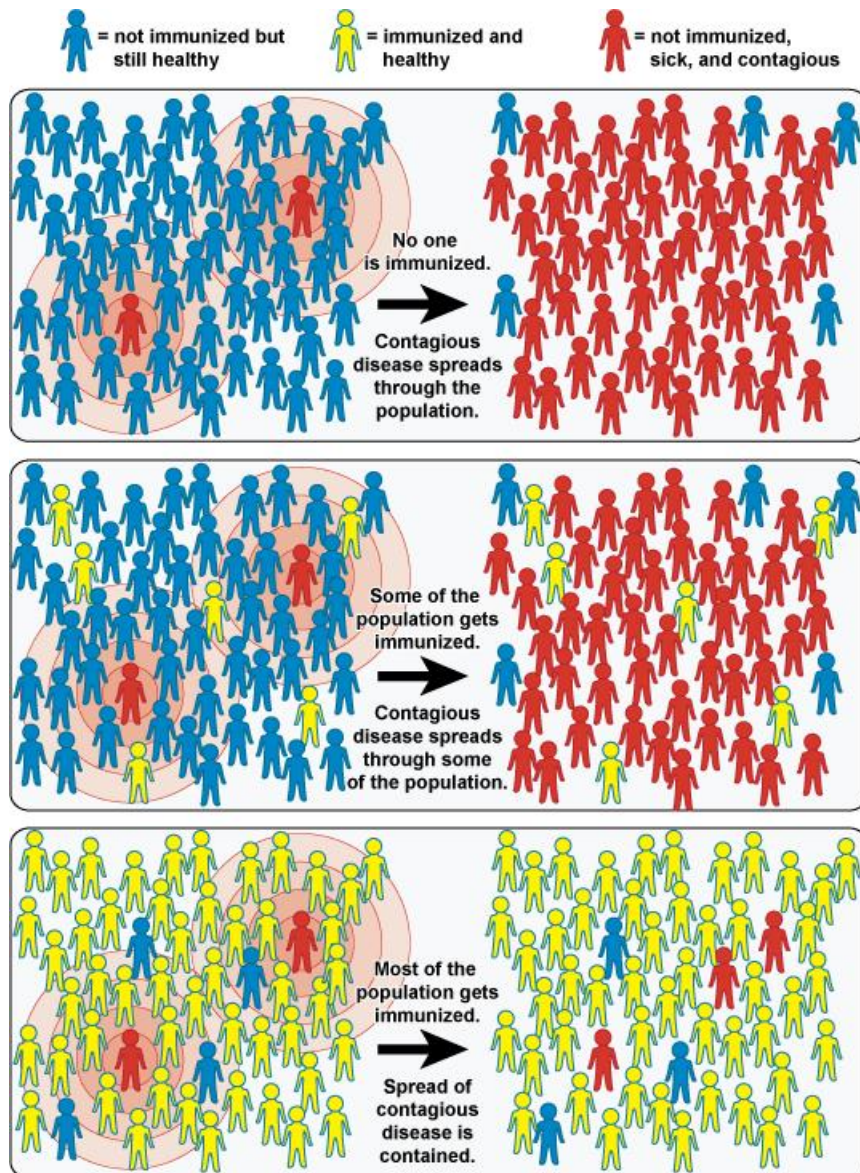


Figure 2: National Institute of Allergy and Infectious Disease. Community Immunity. 21 October 2010. Available at <http://www.niaid.nih.gov/>. Accessed 30 September 2011

It is important to know that not all illnesses can be eradicated. Most bacterial diseases are impossible to eradicate because the bacteria itself is present in many human bodies in an asymptomatic form. These small amounts of bacteria are passed on to the community, and some individuals have a reaction to it [5]. *Neisseria Meningitis* is present in the throats of 35% of the population and provides immunity to these individuals whereas non-carriers can contract the disease and become ill [5]. *Bordetella Pertussis*, another bacterial disease, affects children the most and works by blocking the airways and sometimes leading to young kids coughing themselves to death. Just because we know that bacterial diseases will never be eliminated, this does not mean that these vaccines should not at least be recommended. Pertussis vaccines have decreased incidences and the rigorosity of the disease by 95% in severe cases. Meningitis vaccines have decreased incidences by 64% in children under 2 years of age and decreased incidences by 73% in the entire population [5].

According to *The New England Journal of Medicine*, the number of unvaccinated children entering schools in 1994 in the United States rose by 50% since 1991 and made up 1.48% of all children [1]. The largest population was found in Ferry County, Washington where 27% of children entering schools were unvaccinated [1]. This means that the chances of diseases and fatalities in vaccinated and unvaccinated children have increased enormously in the past few years alone. Although vaccines are not 100% effective, especially in people who cannot genetically benefit from their use, it is important for everyone to be vaccinated to protect the population as a whole. The question still stands for parents: is it more beneficial to mandate childhood vaccinations or to have the choice to say “No” but risk endangering not only your children, but all the children in the community?

Why are some parents still refusing to vaccinate their children? Parents oppose the need for childhood vaccinations because they would rather their child contract measles, tetanus, or other vaccine-prevented diseases as opposed to the side effects like fever, malaise, inflammation, and Autism or mental retardation [1]. Although the link between Autism and vaccines is a widely debated subject, there is no research that has yet to link the use of Thimerosal, a preservative in vaccines, to Autism [6]. If parents question this data, it is important that they consult a physician before completely rejecting the vaccination. Some parents say there is simply no need to vaccinate their child with a new vaccine that they believe has not been tested enough, such as the HPV vaccine that was introduced in 2006 [7]. This vaccine immediately started to circulate in high demand, but is not even shown on the recommended list. Some parents have the intention to vaccinate their children, but end up waiting longer and spacing out the doses more than is advised. Others do not believe vaccinations are necessary because the diseases are so rare and pharmaceutical companies are creating this demand so they can make profits [7]. Yet, the truth is that children are much more susceptible to communicable diseases than adults and thus contract rare infections easily. Some parents feel that vaccines are against their religious beliefs because disease is a natural aspect of life and should not be interfered with. If the government forces parents to vaccinate their children, it would be against their 1st Amendment rights [7]. In the year of 2009-2010, there were 538 Kindergarten students who received vaccine exemptions because of religious reasons in Massachusetts [8]. The majority of parents, even those that do vaccinate their children, don't want to overwhelm their children's immune systems. Children are supposed to strengthen their systems by fighting off diseases on their own. Yet, it is believed that vaccines lower the body's ability to protect on its own, therefore making it more vulnerable to infection [7].

There are many dangers that come from not vaccinating children. Do parents know that unvaccinated children are 9 times more likely to contract chickenpox and 23 times more likely to contract whooping cough than vaccinated children [1]? According to the American Academy of Pediatrics, most vaccines are effective in 90%-99% of children, except those who are genetically incapable of responding to vaccines [7]. It is important to recognize that children have underdeveloped immune systems, so the only way they can fight off extreme diseases is through immunizations. If children contract Measles, Mumps, or even certain cases of the flu, the results can be fatal [7]. Children should be vaccinated against Hepatitis B because the disease causes scarring of the liver tissues and can lead to cancers [7]. Human Papillomavirus is one of the most communicable sexually transmitted diseases, and thus, teenage girls should be required to receive the HPV vaccine because it reduces the chance of transmission and development of

cervical cancer. In fact, HPV is the 2nd most frequent killer of women in the United States. The vaccine can protect against two specifically potent common strands [7]. Thus, it comes as no surprise that the majority of pediatric patients who contract serious illnesses like the Measles, Hepatitis, Tetanus, and Meningitis have incomplete vaccination records [1]. With the efficacy of vaccines and compliance of parents, herd immunity can exist amongst the child population in Massachusetts.

Parents should be informed about research that has been done about childhood vaccinations and the side effects. Many parents are concerned with how vaccines are established and make it to the market. It takes about 10-15 years to investigate each vaccine. It is tested first in a laboratory where scientists aim to create the cleanest most-effective vaccine. Before the vaccine can even be tested in humans, the manufacturer needs to submit an Investigational New Drug application to the FDA. This application contains hundreds of pages of data and research regarding the product. The FDA then monitors years' worth of data and decides whether the vaccine is safe and if it should continue to clinical trials. After approval, the vaccine is tested in clinical trials, first on healthy people to establish safe regimens and then on diseased individuals to establish the positive and negative effects. Once the clinical trials are proven safe and have been monitored, the vaccine is placed onto the market along with all the statistics for the public to see [9]. The FDA then monitors the vaccine use and keeps track of all its effects for years to come.

Although there has been research done on all the vaccines that are recommended, two of them are most important to review, because these diseases cause life-threatening circumstances and the vaccine should absolutely be mandatory. The first is the Hepatitis B vaccine. Hepatitis B is a unique disease that causes hepatocellular carcinoma, cirrhosis, fatigue, and fever. It is spread not through regular contact, but by contact with bodily fluids such as blood, mucous, or other fluids. Sharing needles, surgical procedures (such as dialysis), sexual contact (adolescents most susceptible), and perinatal transmission are also common ways that Hepatitis B is spread. 90% of babies whose mothers are carriers of HBV are symptom-free if they are vaccinated within 24 hours of birth. The risk of a chronic infection is 80-90% in infants and decreases with age. Thus, children are most susceptible to Hepatitis B and should immediately and regularly follow the vaccination schedule. 95% of pediatric patients and 90% of adults respond to the Hepatitis B vaccine by creating antibodies and becoming fully protected from acute and chronic cases. 5-10% of vaccinated patients do not create antibodies because of immune compromised effects. Younger children create more antibodies than adults which is why it is recommended that patients get vaccinated early on. Vaccines for Hepatitis B exist as the recombinant DNA form in which the HBsAg is placed into yeast or animal cells. The vaccine is rated safe because it causes very minimal side effects of fever, headache, and mild swelling. Patients aren't even required to have post-vaccine anti-body counts. *The Korean Journal of Hepatology* thus states that the only way our society can reduce the amount of Hepatitis B carriers and accomplish herd immunity is through vaccination and compliance with immunization schedules [10].

The Journal of Infectious Diseases states that the World Health Assembly is in the process of issuing a date for the goal of eradication of Measles. Measles is a respiratory infection that can lead to cold-like symptoms and rashes. It is spread through the air and extremely contagious. Measles becomes chronic if the infection leads to bronchitis or encephalitis, but this is rare. Since the vaccine is cost effective and currently in high demand, this goal is reasonable and can

occur within a sufficient amount of time. Research shows that the Measles vaccines are “saving more lives per unit cost” [11]. When the vaccine is administered to 12 month old pediatric patients, 95% of them create antibodies against Measles. When administered to 15 month olds, 98% of them create antibodies. Overall, 99% of pediatric patients that receive the vaccine are protected from the disease [11]. Parents shouldn’t fear to immunize their children with the Measles vaccine because of the very minimal side effects. The vaccine exists as a single Measles dose, a Measles and Mumps dose, and a third option of a Measles, Mumps, and Rubella (MMR) dose. Through the Measles Initiative, an effort that streams globally to eradicate Measles, the number of deaths from Measles has decreased by 50% from 1999 to 2005 [11]. Thus, it is extremely beneficial to administer the vaccine to all patients at a young age to avoid consequences and induce herd immunity.

Massachusetts children suffer from communicable diseases every day. Although the state has recommended schedules and regimens which doctors and nurses try to abide by, many times parents refuse administration for personal reasons or simply neglect doses. Since the doses are not required, many physicians do not contact patients about their need and necessity for immunizations. According to the Measles Initiative, the Korean Journal, USA Today, and a variety of other health sources, vaccinations are the number one preventative mechanism against deadly diseases. In order to save lives of children aging from birth to adolescence, Massachusetts must strive towards herd immunity. Vaccines for Measles, Hepatitis B, Tetanus, Polio, Haemophilus B, Varicella, and Meningitis should be a requirement for all children entering schools within the confines of Massachusetts. Physicians should take the time to educate parents on the effects of the diseases and corresponding vaccines and then evaluate whether the child is healthy to be immunized. Although not all diseases are eradicable, this enforcement would decrease the number of unvaccinated individuals who contract the disease and protect immune compromised children who are incapable of creating antibodies on their own. Let’s lower the percentage of unvaccinated children. Let’s protect our elementary, middle, and high schools from disastrous outbreaks. Let’s immunize our college campuses where living quarters are tight and diseases are rampant. Let’s do it for Julieanna and all kids alike, for every child deserves a bright healthy future.

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Works Cited

1. Szabo, L. USA Today. Missed vaccines weaken ‘herd immunity’ in children. 6 January 2010. Available at <http://www.usatoday.com/news/health>. Accessed 30 September 2011.
2. National Vaccine Information Center. Massachusetts State Vaccine Requirements. 2009. Available at <http://www.nvic.org>. Accessed 27 September 2011.
3. Department of Health and Human Services. Center for Diseases Control and Prevention.

Recommended Immunization Schedule for Persons Ages 0-18. December 21, 2010. Available at <http://www.mass.gov>. Accessed 27 September 2011.

4. National Institute of Allergy and Infectious Disease. Community Immunity. 21 October 2010. Available at <http://www.niaid.nih.gov/>. Accessed 30 September 2011.

5. Crislip, M. Science-Based Medicine. Herd Immunity. 5 June 2009. Available at <http://www.sciencebasedmedicine.org>. Accessed 30 September 2011.

6. Price, CS, Thompson, WW, et al. Pediatrics. Prenatal and Infant Exposure to Thimerosal from Vaccines & Immunoglobulins. September 13, 2010. DOI: 10.1542/peds.2010-03097.

ProCon.org. Should Any Vaccines Be Required For Children? 15 July 2011. Available at <http://vaccines.procon.org/>. Accessed 27 September 2011.

8. Morbidity and Mortality Weekly Report. Vaccination Coverage Among Children in Kindergarten- United States, 2009-2010 School Year. 3 June 2011. Available at <http://0-web.ebscohost.com>. Accessed 27 September 2011.

9. Harvard Health Commentaries. Health and Wellness Resource Center. New Vaccines: The Long Road to Official Recommendation. 21 August 2006. Available at <http://0-galenet.galegroup.com>. Accessed 27 September 2011.

10. Kwon, SY. The Korean Journal of Hepatology. Epidemiology and prevention of Hepatitis B virus infection. June 2011. DOI: 10.3350/kjhhep.2011.17.2.87.

11. Christie, AS, Gay, A. The Journal of Infectious Disease. The Measles Initiative: Moving Toward Measles Eradication. 15 October 2011. DOI: 10.1093/infdis/jir075.