Final Paper

Student X

12/10/14

Professor Martin

Should we vaccinate children?

Part 1

To say that mankind often tries to "do what is best" for one another would be an accurate statement. One of the many ways we do this is through our use of modern medicine which include vaccines designed to prevent infection from various viruses. However whether or not these vaccines are what best for our children is a hotly debated topic, and the one that our class chose to explore this semester. In our class we came across many issues some of the more discussed ones were the credibility of the CDC, What really is herd immunity?, Is the current vaccine schedule safe?, and the ultimate weight of weather or not vaccinating for the greater good outweighs the rights of individuals? Although we all seemed to agree that the health of children is quite important, as well as the fact vaccines have eliminated several diseases and eradicated smallpox from earth, we want transparent and trustworthy organizations and industry when it comes to vaccines, and that some vaccines do carry risks.

Americas government lead organization that specializes in disease is the Center for Disease Control also known as the CDC. Arguably one of the worlds best health and research organization. One would believe they have credibility and a straightforward purpose. However in our class' research we came across instances where the CDC did modify or omit data such as the case when the CDC modified data regarding MMR and autism “Data was gathered on 2,583 children living in Atlanta, Georgia who

were born between 1986 and 1993. However, CDC researchers did not include any children that did not have a valid State of Georgia birth certificate – reducing the study's sample size by 41% . Dr. Hooker explains that by introducing this discretionary criteria into the analysis, the cohort size was sharply reduced, eliminating what would have been a higher statistical finding. This minimized the strong MMR-autism link in African American boys." (Focus Autism, 2) accusations of some CDC employees being in the pocket of pharmaceutical companies also arose although those cases seemed to be less documented or credible. It seemed that the CDC for the most part did provide some credible data and could be trusted to an extent, But we concluded the organization was not as transparent or as trustworthy as initially suggested.

One of the most cited reasons for people to vaccinate is herd immunity, Herd immunity is the theory that when a large percentage of the population is vaccinated they are not able to contract the disease making it harder for them to spread the disease to those that are not vaccinated (whether by choice or due to the inability to take a vaccine do to age). This argument however has some detractors some say the percentage of people that are required to obtain herd immunity are too high "The required percentage that would have been required to establish herd immunity against previous influenza viruses ranged from 13% to 100% for the 1918-19, 1957-58, 1968-69 and 2009-10 pandemic viruses, and from 30% to 40% for the 2008-09 epidemic virus. The objectives of vaccination coverage proposed in the United States - 80% in healthy persons and 90% in high-risk persons - are sufficient to establish herd immunity, while those proposed in Europe - only 75% in elderly and high-risk persons - are not sufficient. The percentages of vaccination coverage registered in the United States and Europe are not sufficient to establish herd immunity." (NNii 1) While others suggested that the idea of herd immunity

only works with immunity that is obtained by actually being sick and not from vaccinations although the sources that presented this information was neither credible or plentiful.

One that seemed to be the hardest to decipher was whether or not we are giving the right amount of vaccines at the right times. Many of us agreed that the schedule appears to be quite crowded and tests/ reviews of the schedule would do much to put us at ease.

Our class agreed on many things however. The first of which was that the wellbeing of children is all of our focuses. We also agreed that many diseases have been eliminated from our nation as a result of the use of vaccines, and Smallpox has been completely eradicated from the wild (CDC Smallpox 1) . So despite the possibility of risks from vaccines they do work. We all felt that pharmaceutical companies, government and other health organizations should be transparent with their findings and products in order to build trust with the public and to prevent the use of unnecessary and unsafe vaccines. Lastly we all agreed vaccines like all medicines carry some level of risks. Although what these risks are and how frequent and what causes them varies based on a large amount of variables.

To summarize what we covered in class, we argued the ideas weather vaccines are or are not safe for children. It was a topic that had many disagreements covering government organizations, herd immunity, vaccine schedules, and the ultimate role of vaccinating children in a community, however we all agreed on the need to keep children safe, keep the industry accountable, and the fact that vaccines work even though they have some risks.

Part 2

After considering all that we have learned I am a proponent of vaccination. Many factors lead in

to my standpoint and I only came to this conclusion after observing both sides of the issue at great length, both researching on my own and with my classmates. I have come to the conclusion that we should vaccinate our children because vaccines are proven to prevent harmful diseases and are made with safe ingredients. I will elaborate on these points and the counter points respective to each issue using historical data and information from a variety of sources I came across in my research.

Vaccines exist to prevent the spread of dangerous infectious viruses, ones that were or are killing off, injuring, or disfiguring much of the worlds population. Vaccines have eliminated many diseases from the majority of the population and have even eradicated smallpox from the face of the earth "the disease is now eradicated after a successful worldwide vaccination program."(CDC, vaccines 3) The difference between being eradicated and eliminated being that when you have eliminated a disease it may no longer occur in one particular segment of the world but it can and does occur naturally in other parts of the world, eradicating it like we have done to smallpox means it no longer exists (outside of laboratories) to infect people and be spread.

Smallpox was a disease that killed people for centuries, when infected in children it had an 80% death rate, and was responsible for 300-500 million deaths the 20th century. (History, 3). Obviously not the type of thing one would wish upon any child. The vaccine was introduced in the early 1800s and as time went on and the vaccine and health care in general progressed it became clear it was effective. Although there were variety of campaigns to get the vaccine circulated through communities the World Health Organization (WHO) arguably pushed the most aggressive vaccination pattern in the late 1960's and by 1979 the disease had been eradicated from the world with stores existing in laboratories as the only known examples of the disease. (CDC, Smallpox 1). By using the vaccine millions of children's

lives were saved, proving that vaccines can in-fact prevent spread of dangerous virus. Although the vaccine is not without side effects 14-52 people out of every one million people may suffer life threatening conditions but only 1-2 of those people actually suffer death as a result of these complications (CDC Smallpox 1). Meaning that yes there is some level of risk while taking the smallpox vaccine but over all the risk of death or harm for a child was much higher if one was to not vaccinate for the disease. Because of the widespread use of the vaccine even after it was eliminated from many nations, children today don't have to face the deadly disease that is smallpox. A prime example of why vaccinating kids is something we should do as it saved millions of children and continues to positively impact all of our lives.

Another disease that has been greatly affected by our vaccines is Polio. Polio has again been around for ages but unlike Smallpox has not been eradicated from the world. "Polio used to be very common in the United States and caused severe illness in thousands of people each year before the polio vaccine was introduced in 1955" and "Most people should get the Polio vaccine when they are children" says the CDC (CDC Polio fact sheet, 2). The reason polio used to be so common and vaccines were recommend amongst children were because Polio is spread "with the stool of an infected person and may also be spread through oral/nasal secretions." (Vaccines and Immunizations: Polio, 3), To put in layman's terms snot ,spit and feces are the primary vehicles for the disease to be spread, all substances children have been known to be less than tidy with. The CDC describes the symptoms in the following quote "Most people who get infected with poliovirus do not have any symptoms. A small number of people (4 to 8 people out of 100) will have flu-like symptoms. These symptoms usually last 2 to 5 days then go away on their own." (Vaccines and Immunizations: Polio 2) However the best known and more

disabling symptom of polio, the one that can ruin a child's quality of life is explained in greater detail in the following quote from the same passage "In rare cases, poliovirus infection can be very serious. About 1 out of 100 people will have weakness or paralysis in their arms, legs, or both. This paralysis or weakness can last a lifetime." (Vaccines and Immunizations: Polio 2). These symptoms can cause permanent disabilities that may cripple a child for the rest of their life. However a simple vaccine protects children from this disease and has virtually eliminated the disease from the USA. Again in 1955 when there were over 14,000 cases of polio by 1956 the number of cases dropped to slightly over 5,000, (History 4) a dramatic decrease that continued until polio was officially eliminated from the USA in the mid 1990's as a result of vaccines. However Polio still exists in Afghanistan, Nigeria and Pakistan although it is currently on the loosing end of an eradication schedule similar to the one that wiped out smallpox (CDC, Smallpox 1). Polio should be of special concern to parents as it primarily effects children five or younger and one in two hundred cases lead to paralis and five to ten percent of those paralyzed die as a result. (WHO Poliomyelitis, 4). Despite the dangers of contracting Polio some parents favor avoiding this vaccine in their children. Two reasons are commonly cited for this, the first being that we have been polio free in the united states since 1994 (WHO Poliomyelitis, 4) so why vaccinate your child for something they won't be exposed to? Second being the oral polio vaccine was shown to cause polio in about 1 out of every 2.4 million doses administered, so why expose you kid to something that is shown to infect some people when you can simply live with your chances in polio free America? To answer the first question, yes we are polio free in America, but as mentioned earlier there is still polio in other parts of the world and if someone infected with the disease were to visit or move to the united states they could easily give the disease to those not vaccinated which could easily spread

amongst children who have not finished the series of Polio shots or those who do not have access to healthcare, causing an outbreak amongst the young and impoverished. As this CBS article states vaccination rates are high but follow ups that complete vaccination schedules are low amongst the poor. "Poor children are less likely to get booster shots, and the full series of polio, rotavirus and hepatitis B vaccines, according to the report" (Reinberg, 13**)**. Making it crucial for parents who can to limit the amount of children supseptable to polio. Now considering that there is a small but statistically measurable portion of those that received the oral polio vaccine to come down with the actual virus, perfectly explains why many parents would be skeptical of a polio vaccine for their child, however the Polio vaccine used in the United States today is not the oral vaccine. By the year 2000 the USA had moved from a reduced oral polio vaccine schedule to completely removing it and replacing it with the much safer IPV Polio vaccine. (SOURCE) In short the Polio vaccine has saved and estimated 1.5 million lives, and is one more example of how much more beneficial it is to vaccinate your child. however parents should focus on giving their kids the IPV Polio vaccine as it is much safer.

Vaccines like those used for Smallpox and Polio are great examples of how vaccines can protect children from infectious diseases, why they are important even when diseases have been eliminated from your area, and are safe for your child. But as I pointed out in the section on the Polio vaccine some vaccines do have problems with their ingredients, that may cause harm to children, however vaccines today have been modified to be safer and are tested to ensure safety for children and other users.

Many people are concerned about the ingredients in vaccines and how they affect children, especially infants as they have weaker immune systems compared to adults, and this concern is rightfully placed as good health is the point of vaccines in the first place. One ingredient that concerned

many people is Thimerosal. Thimerosal is a derivative of mercury and the FDA describes its use in the following quote "Since the 1930s, it has been widely used as a preservative in a number of biological and drug products, including many vaccines, to help prevent potentially life threatening contamination with harmful microbes." (FDA, Thimerosal 1) However people became concerned that Thimerosal was causing health issues as it is a derivative of mercury and mercury is shown to be toxic toward humans effecting us neurological and causing developmental issues in children as shown in the same FDA article. However those negative effects of mercury are related to methyl mercury so separate tests are being done for Thimerosal as it is based off of ethylmercury. However the FDA noticed that while none of the vaccines by themselves posed a threat in terms of mercury levels in infants the vaccines cumulative effects when taken in the then current vaccine schedule may pose a risk "At the time of this review in 1999, the maximum cumulative exposure to mercury from vaccines in the recommended childhood immunization schedule was within acceptable limits for the methylmercury exposure guidelines set by FDA, ATSDR, and WHO. However, depending on the vaccine formulations used and the weight of the infant, some infants could have been exposed to cumulative levels of mercury during the first six months of life that exceeded EPA recommended guidelines for safe intake of methylmercury." (FDA, Thimerosal 2) In short some individuals could possibly suffer the effects of being over exposed to mercury. As a result all theimerisol was removed from the american vaccine schedule by 2000 (with the exception of some seasonal flu vaccines). So by fully acknowledging the possibility that Thimerosal could be dangerous to some it was removed from our vaccines with the noted exception of some seasonal flu vaccines, meaning the risk of possible mercury related side effects caused by multiple Thimerosal vaccines in quick succession is virtually eliminated.

But what of the countless other ingredients used in vaccines? Many would contest that they pose just as much if not more of a risk then Thimerosal. however they go through a rigorous testing schedule. Although the responsibility for vaccines being safe should rest on the manufactures several organizations monitor weather or these are safe, the WHO, FDA, and CDC all are responsible for the quality of vaccines in the USA. As WHO states on their website "WHO first adopted recommendations for the national control of vaccines and sera in 1981. This regulatory oversight of biological medicinal products was revised in 1992 to include regulatory procedures for both manufacturing and importing countries, the function of the national control laboratory, and post-licensing monitoring. This guidance was further updated in 1994 to include recommendations for newly developing regulatory authorities." (WHO Regulation...Vaccines, 1). One of the many things WHO does to check vaccines is to check specific lots of vaccines and review the steps done by the company to ensure their safety as described in this passage on the WHO website "Independent lot release involves the confirmation that each lot meets the specifications in the approved marketing authorization for the product and includes, as a minimum, a review of summary protocols of the results on quality tests conducted by the manufacturer. In some situations, re-testing of some critical parameters by the National Control Laboratories of the regulatory authority may be appropriate." (WHO Regulation...Vaccines, 1) Although these guidelines are extensive there is more. When a company wants to introduce a new vaccine to the market in the United States they must go through extensive FDA testing. "vaccine clinical trials are typically done in three phases, as is the case for any drug or biologic. Initial human studies, referred to as Phase 1, are safety and immunogenicity studies performed in a small number of closely monitored subjects. Phase 2 studies are dose-ranging studies and may enroll hundreds of subjects. Finally, Phase 3 trials typically enroll

thousands of individuals and provide the critical documentation of effectiveness and important additional safety data required for licensing. At any stage of the clinical or animal studies, if data raise significant concerns about either safety or effectiveness, FDA may request additional information or studies, or may halt ongoing clinical studies." (FDA Vaccine...Process 1) In other words the FDA goes through a series of tests first involving animals then involving humans that increase in sample size as long as the tests are going safely. These trials however do not ensure the passing of the vaccine it is then reviewed by the FDA "To be considered, the license application must provide the multidisciplinary FDA reviewer team (medical officers, microbiologists, chemists, biostatisticians, etc.) with the efficacy and safety information necessary to make a risk/benefit assessment and to recommend or oppose the approval of a vaccine. Also during this stage, the proposed manufacturing facility undergoes a pre-approval inspection during which production of the vaccine as it is in progress is examined in detail." (FDA Vaccine...Process 1). Further more the FDA recognizes that it can not predict every possible side effect or outcome of one taking the vaccine until it it is taken by the general population as every individual has different reactions to a variety of things. The FDAs approach is further described in this quote from their website "Thus, many vaccines undergo Phase 4 studies-formal studies on a vaccine once it is on the market. Also, the government relies on the Vaccine Adverse Event Reporting System (VAERS) to identify problems after marketing begins." (FDA Vaccine...Process 1) So while there are risks when a new vaccine is introduced into the market the FDA has a intense system of testing prior to approval and continued testing after after after approval to make sure vaccines are safe. But outside of WHO and FDA approval the CDC also monitors vaccines. While the CDC doesn't do the same in house inspections the FDA is responsible for it does the following described on their website "Once vaccines

are licensed in the United States, CDC actively monitors the safety of these vaccines through several systems. If any vaccine is found to cause health problems, the vaccine may be withdrawn and no longer given to the public."(CDC vaccine quality 1) Although FDA monitors and controls similar aspects of vaccines the CDC also checks these things separate of the FDA providing overlapping and comprehensive monitoring of the safety of vaccines.

Vaccines can and have posed some health issues in the past, however they are safe, effective and our current system provides a flexible and effective system of monitoring vaccines that are taken by the public. This is showcased by Smallpox being eradicated the polio vaccines effective use, the US governments quickness to review thimerosal and remove it to ensure safety for children taking the vaccines, and the on going efforts of the FDA WHO and CDC. It's never bad for parents and others to question the safety of vaccines and other medicines especially when concerning children, but it is my belief that vaccines effectiveness and heavy regulation by the government make them not only a safe choice but the best choice for children, even in the face of possible risks, as those risks are mitigated and the alternative is much more dangerous.

Citations for part one

NNii. "Vaccines." *Polio Vaccine and Immunization Information*. 13 Feb. 2008. Web. 11 Dec. 2014. <http://www.immunizationinfo.org/vaccines/polio>.

Autism, Focus. "Focus Autism Releases Findings on 2003 CDC Autism Study – Higher Autism Rate Among African-American Boys Receiving MMR Shot Earlier than 36 Months."*Focus Autism*. 19 Aug.

2014. Web. 11 Dec. 2014. <http://focusautisminc.org/focus-autism-releases-findings-on-2003-cdc-autism-study-higher-autism-rate-among-african-american-boys-receiving-mmr-shot-earlier-than-36-months/>

CDC. "Side Effects of Smallpox Vaccination." *CDC Smallpox*. 7 Feb. 2007. Web. 11 Dec. 2014. <http://www.bt.cdc.gov/agent/smallpox/vaccination/reactions-vacc-public.asp>.

Citations for part 2

CDC. "Thimerosal." *Centers for Disease Control and Prevention*. Centers for Disease Control and Prevention, 29 July 2014. Web. 11 Dec. 2014. <http://www.cdc.gov/vaccinesafety/Concerns/thimerosal/index.html?s_cid=cs_748>.

FDA. "U.S. Food and Drug Administration." *Thimerosal in Vaccines*. 18 June 2104. Web. 11 Dec. 2014. <http://www.fda.gov/BiologicsBloodVaccines/SafetyAvailability/VaccineSafety/UCM096228>.

WHO. "Regulation and Quality Control of Vaccines." *WHO: Regulation and Quality Control of Vaccines*. WHO, 11 Mar. 2011. Web. 11 Dec. 2014. <http://www.who.int/biologicals/vaccines/regulation_and_quality_control_vaccines/en/>.

FDA. "Vaccine Product Approval Process." *Vaccine Product Approval Process*. FDA, 18 June 2009. Web. 11 Dec. 2014. <http://www.fda.gov/biologicsbloodvaccines/developmentapprovalprocess/biologicslicenseapplicationsblaprocess/ucm133096.htm>.

CDC. "Vaccine Safety Monitoring at CDC." *Centers for Disease Control and Prevention*. Centers for Disease Control and Prevention, 25 Sept. 2013. Web. 11 Dec. 2014. <http://www.cdc.gov/vaccinesafety/Vaccine_Monitoring/Index.html>.

History.com. "Children Receive First Polio Vaccine." *History.com*. A&E Television Networks, 1 Jan. 2014. Web. 11 Dec. 2014. <http://www.history.com/this-day-in-history/children-receive-first-polio-vaccine>.

NNii. "Vaccines." *Polio Vaccine and Immunization Information*. 13 Feb. 2008. Web. 11 Dec. 2014. <http://www.immunizationinfo.org/vaccines/polio>.

WHO. "Poliomyelitis." *WHO*. 1 Oct. 2014. Web. 11 Dec. 2014. <http://www.who.int/mediacentre/factsheets/fs114/en/>.

CDC. "Side Effects of Smallpox Vaccination." *CDC Smallpox*. 7 Feb. 2007. Web. 11 Dec. 2014. <http://www.bt.cdc.gov/agent/smallpox/vaccination/reactions-vacc-public.asp>.

NCBI. "Result Filters." *National Center for Biotechnology Information*. U.S. National Library of Medicine, 4 Mar. 2012. Web. 11 Dec. 2014. <http://www.ncbi.nlm.nih.gov/pubmed/22414740>.

CDC. *Centers for Disease Control and Prevention*. Centers for Disease Control and Prevention, 3 Oct. 2014. Web. 11 Dec. 2014. <http://www.cdc.gov/vaccines/vpd-vac/polio/>.

Norton, Amy. "How One Unvaccinated Child Sparked Minnesota Measles Outbreak." *CBS News* 9 June

2014. CBS. Web. 22 Oct. 2014. <http://www.cbsnews.com/news/how-one-unvaccinated-child-sparked-minnesota-measles-outbreak/>.

"Vaccines and Immunizations: Polio." *Centers for Disease Control and Prevention*. Centers for Disease Control and Prevention, 3 Oct. 2014. Web. 22 Oct. 2014.

"Polio Fact Sheet." *Centers for Disease Control and Prevention*. Centers for Disease Control and Prevention, 8 July 2013. Web. 22 Oct. 2014.

"Vaccines and Immunizations: Pinkbook." *Centers for Disease Control and Prevention*. Centers for Disease Control and Prevention, 7 May 2012. Web. 22 Oct. 2014.

"Polio Vaccine." *Wikipedia*. Wikimedia Foundation, 18 Oct. 2014. Web. 22 Oct. 2014.

"Vaccines and Immunizations: Vaccine Preventable Childhood Diseases." *Centers for Disease Control and Prevention*. Centers for Disease Control and Prevention, 25 Feb. 2012. Web. 22 Oct. 2014.

REINBERG, STEVEN. "Most U.S. Children Get Vaccines, but Some States Do Better than Others." *CBSNews*. CBS Interactive, 24 Aug. 2014. Web. 11 Dec. 2014. <http://www.cbsnews.com/news/most-us-children-get-vaccines-but-some-states-do-better-than-others/>.