Vaccine Controversies

By: Julia Hannigan April 3, 2014

Abstract: *In recent years there has been speculation in the scientific community and popular media as to whether or not vaccines (though they have definitively proven positive effects) can be harmful to human health. This paper reviews the controversies that exist today in the medical community and popular media over vaccinations, emphasizing whether or not they contain potentially harmful materials, whether or not children are receiving too many vaccines, and whether or not vaccines can cause Autism Spectrum Disorder (ASD). Through analysis of scientific research I determined that there is an element in a small percentage of vaccines today, thimerosal, which should be removed because it has not been conclusively proven safe without any doubts. I also discovered no correlation between the number of vaccinations received and any harmful side effects, and that the vast majority of information disproves the causal link between vaccinations and ASD. It was also concluded that these controversies and their prominent presence as public knowledge has lead to decreased vaccination rates in this country. This decrease, if it escalates, has the potential to cause resurgence of diseases that have been controlled by the use of vaccination immunity. This paper can be used as a way for health care providers and organizations to support the removal of thimerosal from vaccinations and defend vaccination safety.*

Keywords: Vaccines, Vaccinations, Autsim Spectrum Disorder (ASD), Thimerosal, Antigens

Autism spectrum disorder (ASD) *is a complex developmental disorder characterized by abnormalities of verbal and nonverbal communication, stereotyped restricted interests, repetitive behavioral patterns, and impairment of socialization.*[1]

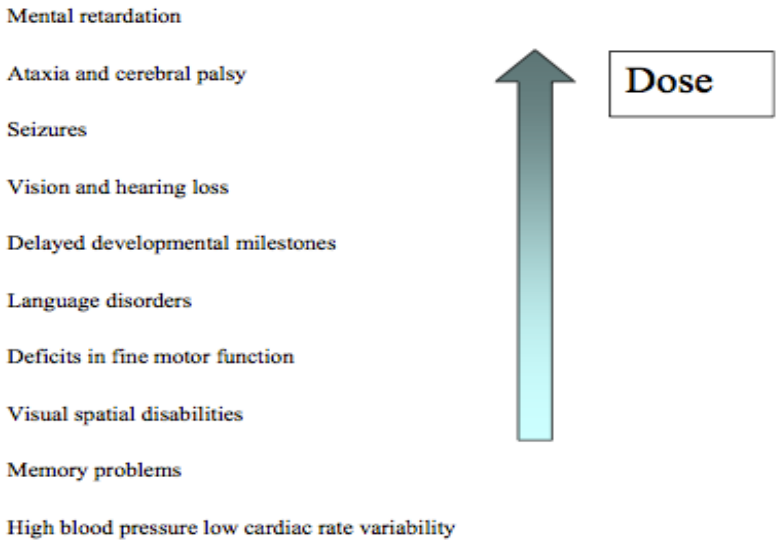
Within the last 100 years the number of mandatory vaccinations recommended by pediatricians increased from 1 to 11. Regardless of indisputable statistical information proving that vaccines are overwhelmingly beneficial and effective when it comes to disease prevention, in recent years many have expressed concerns relating to the safety of the vaccines that their children are receiving. There has been speculation and controversy within the scientific community, as well as in popular media, as to whether or not the potential side effects of vaccinations outweigh their benefits. This paper reviews the vaccine controversies that exist today emphasizing whether or not vaccines contain potentially harmful materials, whether or not children are receiving too many vaccines, and whether or not vaccines can cause Autism Spectrum Disorder (ASD).

Vaccines, Mercury, and Possible Side effects

Mercury has been proven to cause adverse health effects during any period of human development. It is a toxic element, and there is no known safe level of exposure. Research has suggested that ideally, neither children nor adults should have any mercury in their bodies because it provides no physiological benefit. [2]

Table 1 lists the adverse health effects mercury has been proven to cause according to level of exposure.

Table #1 Effects of Mercury Exposure



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Methyl mercury, an organic form of mercury, is the one most dangerous to human health, because it is better absorbed by the body and shows a higher rate of mobility in the body than other types of mercury that exist. Thimerosal is a mercury-containing preservative used in some vaccines to prevent bacterial or fungal contamination, and subsequent infection of those being vaccinated. It is an ethyl mercury, and while there have been very definitively proven negative health consequences associated with methyl mercury, the possible side effects of ethyl mercury are more undefined. There has been a significant effort made in recent years to determine the general effects of vaccine dose levels of ethyl mercury (thimerosal) on human health.

In-utero Effects of Thimerosal

*The **GDS** tests neurodevelopment reflexes, voluntary reactions, motor development, and visual and auditory communication.*[2]

A study was conducted where 19 pregnant mothers did not have any exposure to thimerosal and 63 were given a vaccine containing thimerosal. **Gesell Developmental Schedules (GDS)** were administered on each child at age 6 months, and it was determined that there were no significant and presentable difference between the children of vaccinated and unvaccinated mothers. However, implications from the study did support the fact that organic mercury does cross the placenta quite easily. (There was mercury present in the hair follicles of the mothers and their children.) So even though it is still unknown at what level organic ethyl mercury would cause detrimental effects to a fetus, or if it would cause any at all, it is known that acquiring exposure in-utero is easy. Therefore there was no conclusive judgment was made in this study as to whether or not the vaccines are absolutely safe. [3]

Serotonergic *or* ***serotoninergic*** *means "related to the neurotransmitter serotonin". A synapse is serotonergic if it uses serotonin as its neurotransmitter.*[3]

Another study conducted shows that embryonic exposure to thimerosal can be related to abnormal location of **serotonergic** neurons in the brains of rats. The study claims that it cannot prove any direct or irreversible adverse effects of embryonic exposure to thimerosal.[4] But, it can be determined that there is some sort of a relationship present. In this situation I assert, as did the individuals who carried out this study, that further research is necessary into this topic in order to determine the exact link.

Neonatal and Pediatric Effects of Thimerosal

Psychomotor retardation *is a generalized slowing of physical and emotional reaction, such as that seen in major depression and in catatonic schizophrenia.*[2]

Some literature has suggested potential negative side effects of neonatal/early childhood vaccinations that contain thimerosal. In one study conducted, where 196 infants had their vaccine records examined, there was evidence showing that there were adverse **psychomotor development consequences** shown when children were given a thimerosal containing vaccine during the first 12 to 24 months of life. [3] The overall deficit in psycho motor development was significantly higher in the exposure group over the course of follow up studies conducted in the three years after the initial data was taken.

United States and Thimerosal

Having a preservative element in a vaccine becomes necessary in multi-dose vials. Most vaccines in the United States today (with the exception of flu vaccines) come in single use vials because this ensures sterility and eliminates the need for preservatives. In 1999 the American Academy of Pediatrics and the United States Public Health Service recommended removing thimerosal. Knowledge was not definitive then, nor is it now, as to what level exactly of Thimerosal is safe, whether any level is safe, or whether any level is unsafe. And due to the inconclusive nature of the evidence, thimerosal was removed as a precautionary measure. [5]

The use of single-use vials resulted from this recommendation. However this method of vaccine distribution is undeniably more expensive. Consequently, in wide scale vaccine campaigns (such as for the flu vaccine) and in many under developed and developing nations where there are large scale vaccine campaigns supported by a small budget, Thimerosal is the only cost effective way to administer the necessary number of vaccinations. [2] In these situations it remains as a preservative.

Vaccinations and Autism

Origin of the Vaccine vs. Autism Controversy

*The **MMR vaccine** is the measles, mumps, and rubella vaccination. The American Academy of Pediatrics recommends the first administration of this vaccine to be between ages 12-15 months.* [5]

In 1998 a doctor by the name of Andrew Wakefield published a study in the prominent British health journal the *Lancet* and in doing so was the first to ever link ASD to a vaccination. This study introduced and defended the hypothesis that the **MMR vaccination** causes intestinal inflammation. This inflammation was said to cause a loss of intestinal barrier function and allow encephalopathic (brain harming) proteins into the bloodstream, thus causing the development of ASD. Dr. Wakefield's study included twelve children with developmental delays (8 of whom who had ASD) who all had gastrointestinal complaints, and had the onset of their ASD symptoms within one month of receiving the MMR vaccine. This study sparked global hysteria amongst parents and health care providers alike. However, in 2010 this study was retracted from the *Lancet* not only because the scientific findings were refuted by later studies, but also because evidence was unearthed that Dr. Wakefield was committing fraud and purposefully altering his scientific findings in order to seemingly prove his hypothesis. It was revealed that lawyers who were suing someone over an alleged vaccine injury were paying Wakefield to provide scientific backing for their case. In addition, scientific investigation proved his findings incorrect. It has been shown by numerous studies, extending to the present day, that while there is a correlation between the onset of ASD and the administration of the MMR vaccine (ASD symptoms tend to become recognizable at approximately the same time that the MMR is given) there is no causal link. The author's main claim in this study was that ASD was a consequence of gastrointestinal inflammation, but upon further examination of the study participants this was proven false. All gastrointestinal symptoms were observed after the onset of ASD. [6]

Thimerosal and Autism

Even after the discredit of Wakefield's study, the next controversy that arose in the vaccine vs. ASD debate was that of thimerosal. There has been speculation throughout recent years by health care providers and patients a like as to whether or not there is a link between the preservative and the disorder. There has been a great deal of attention driven towards this issue and consequently, a great deal of research has been done on the topic. The official stance of *Autism Speaks*, the world's leading autism science and advocacy organization, is that there is no causal link between thimerosal and ASD. [7]

While numerous studies have determined the same results as the following, the study *Autism Speaks* sites to prove this conclusion was published by the American Academy of Pediatrics in 2010. It was a case-control study that took 256 children with ASD and 752 non-ASD controls. Exposure to thimerosal during the prenatal, birth-to-1 month, birth- to-7-month, and birth-to-20-month periods of development was determined by analyzing the participant's immunization

records, medical charts, and parent interviews. These periods of development were chosen to counter questions not only about the general effects of thimerosal as a cause of ASD but questions about the effect of vaccinations during different stages of development. This study revealed no increased risk of ASD associated with receipt of thimerosal-containing vaccines either during the prenatal or postnatal stages of development. [8]

However, while this stance (that ASD is not caused by thimerosal) is the one officially supported by *Autism Speaks* and various other respected health organizations it is not without contradiction. The most recent study questioning this idea inquires about the possibility of thimerosal containing Hepatitis B vaccines to cause ASD. The creators of this study have made it clear that their evidence cannot prove a cause and effect relationship. But, they have noted that patients diagnosed with ASD were significantly more likely than members of the non-ASD control group to have had received Hepatitis B vaccines that contain thimerosal during their first, second, and sixth months of life. [1] This information is shown on the chart (Table 2) on the next page.

Table 2 shows that patients diagnosed with ASD were significantly more likely than members of the non-ASD control group to have had received Hepatitis B vaccines that contained thimerosal.

Table 2 A summary of organic-mercury exposure from Thimerosal-containing hepatitis B vaccine administration among ASD cases and controls in the VSD database

Group examined	Number of cases diagnosed with ASD (%)	Number of controls without an ASD (%)
Experiment I		
12.5 μg organic-mercury within 1st month	155 (50.49)	8,161 (31.84)
0 μg organic mercury within 1st month	152 (49.51)	17,471 (68.16)
Experiment II		
25 μg organic-mercury within first 2 months	154 (50.49)	8,172 (32.55)
0 μg organic-mercury within first 2 months	151 (49.51)	16,935 (67.45)
Experiment III		
37.5 μg organic-mercury within first 6 months	30 (76.92)	1,073 (49.54)
0 μg organic-mercury within first 6 months	9 (23.08)	1,093 (50.46)

1

Though there are studies (such as the aforementioned) that show evidence of a link between thimerosal and ASD, there is a significant amount of proof completely to the contrary. The most recently published research to that effect has examined the suggested possibility that ASD might actually cause sensitivity to thimerosal. This "sensitivity" is defined as a decreased level of mitochondrial cell growth and division. Research has shown a link between ASD and mitochondrial defects, and this same research has shown that mitochondria are the elements most likely to be adversely affected by thimerosal presence in the body. A study

conducted examined ASD individuals, and it was found that a third of ASD patients had a heightened sensitivity to thimerosal. The participants required a concentration of thimerosal 60% less than that of control patients to cause negative effects on their mitochondrial growth and division. This suggests that individuals with a mild mitochondrial defect (such as that caused by ASD) may be ultra susceptible to toxins like thimerosal that can already cause adverse mitochondrial effects. This would suggest that, in fact, thimerosal does not cause ASD, but that ASD causes sensitivity to, and increase in adverse effects of, thimerosal. [10]

Antigens and Autism

***Antigens** are the antibody stimulating proteins and polysaccharides found in vaccines.*[10]

Another concern expressed by providers and patients alike is that too many vaccines are being administered during the first two years of life and therefore that children are being subject to too many **antigens** at one time. This "overload" of the immune system is feared to cause adverse side effects, such as ASD. Research based on data collected randomly from the CDC's Vaccine Safety Datalink (a public source of data) analyzed the relationship between the number of antigens injected in the first two years of life with the incidence of various neuropsychological outcomes in a randomly selected patient population and found no correlation. There was no evidence of an association between the number of antigens received from vaccines in the first 2 years of life and any neuropsychological disorders, including ASD.[10] In accordance with this, another study compared antigen exposure data from the first two years of life of an experimental participant group of children diagnosed with ASD and a control group of non-ASD participants. There was no evidence found to indicate a correlation between exposure to antigens contained in vaccines during the first 2 years of life and the risk of acquiring ASD. In fact, some of the data collected indicated that the non-ASD control group had, on average, greater antigen exposure than the experimental group. [11]

Vaccine exemption and Disease Rates

There is absolutely no denying the fact that vaccination rates are dropping in this country, and surveys have shown that the number one reason for parents to deny vaccination is concern about safety or efficacy. [12] More and more parents are choosing to allow their children to be "exempt," or non-vaccinated, and this has been proven by sources ranging from small-scale studies to nation wide surveys. [13,14] While in some states there are laws to prevent this, today more and more states are making it easier for parents to not vaccinate their children.

Figure 1 shows an increase in exemption rates in Arkansas after a law passed that made exemption easier than it ever has been.

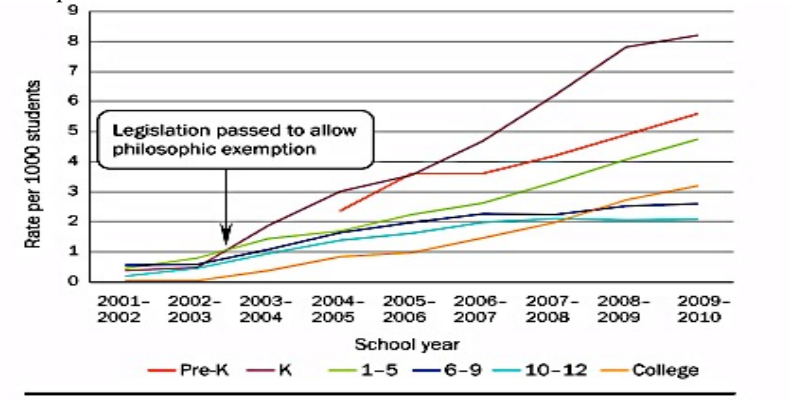

Figure 1. Immunization exemptions per 1000 students by grade categories, Arkansas
K, kindergarten; Pre-K, pre-kindergarten

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Herd immunity *(or* ***community immunity****) describes immunity that occurs when the vaccination of a significant portion of a population provides a measure of protection for individuals who have not developed immunity.* [15]

It is true that on a small scale vaccine exemption is not detrimental to public health, at least to the point where disease resurgence can occur, due to the factor of **herd immunity**. [15] However, once a significant part of a population (>10%) is not immunized, this community immunity is no longer reliable as a method of disease prevention. We have not reached this percentage on any sort of widespread national or global level. (The national vaccinated level hovers between 90-92%.) But if we were to, contagious diseases that could be prevented through the use of widespread vaccine generated immunity have the potential to cause serious threats, especially in the cases of diseases that have not been seen for many years, for which the majority of the public harbors no natural immunity.

Synthesis

Through the observation of many different resources revolving around vaccine controversies it appears to me that while some of the concerns have a basis in fact there are others that are disproven by scientific research. The original study linking ASD and the MMR vaccine has been proven fraudulent, and its hypothesis, that there is a link between GI issues, the MMR vaccine, and ASD should be disregarded.

There is a great deal of controversy and debate in the scientific community regarding whether or not vaccines cause ASD. There is also no evidence to suggest that you can overload an immune system with the antigens found in vaccines and cause ASD in that manner. Thimerosal has been seemingly linked to higher rates of ASD in some studies, but others have shown that ASD itself might cause sensitivity to thimerosal related side effects. The vast majority of information accepted by the scientific community today asserts that there is no causal link between thimerosal and ASD, merely correlation.

While the known detrimental effects of organic methyl mercury have been proven, the possible (non-ASD) side effects of ethyl mercury, the variety that thimerosal contains, are not as definitively known. Therefore, I support the American Academy of Pediatrics recommendation to remove this preservative from vaccines as a precautionary measure. I also believe that it should be removed from all vaccines because it cannot be proven definitively that it is safe. Further research should be conducted to discover a preservative method that is cost affective, allows for the use of mutli-dose vials, and does not harbor any ambiguity about its potential to cause risks for human health.

These controversies have been proven in numerous studies to cause parents to choose not to vaccinate their children. Herd immunity is only applicable if the majority of a population is vaccinated, and disease transmission becomes more likely the more vaccine exemptions occur in a specific area. Refusal of vaccination poses potentially serious side effects, if not for the children that are not being vaccinated, then for the whole community. I acknowledge that there are some ambiguities about vaccine safety, especially in the case of thimerosal. Therefore, I believe that there should be greater efforts on the part of medical professionals and respected health organizations to combat this ambiguity and send the message that vaccines are safe, and necessary. Vaccines are one of the most effective preventative public health interventions that our society has ever seen, and it appears to me that these controversies hold the potential to prevent them from being efficient.

Acknowledgements

Grace Innamorato
Taylor Brown

References

1. Geier et al.: A two-phase study evaluating the relationship between Thimerosal-containing vaccine administration and the risk for an autism spectrum disorder diagnosis in the United States. Translational Neurodegeneration 2013 2:25.
2. Bose-O'Reilly, S., McCarty, K. M., Steckling, N. Mercury Exposure and Children's Health. *Current Problems Pediatric and Adolescent Health Care* 2010;40:186-215.
3. *Peters, K. Rhoades, S., Ezzell, D., Weatherspoon, D.* Environmental Mercury Exposure during Pregnancy and Lactation: Practical Advice to Minimize Risks. *International Journal of Childbirth Education* 2013;28.
4. Michiru, I et al. Embryonic exposure to thimerosal, an Organomercury Compound, Causes Abnormal Early Development of Serotonergic Neurons. *Neuroscience Letters* 505 (2011) 61–64
5. Orenstein, W., Paulson, J., Brady, M., Cooper, L., and Seib, K. Global Vaccination Recommendations and Thimerosal *Pediatrics* 2013;131;149
6. American Academy of Pediatrics. Autism and Andrew Wakefield. Online http://www2.aap.org/immunization/families/autismwakefield.html
7. Autism Speaks. Vaccines and Autism. Online. < http://www.autismspeaks.org/science/policy-statements/information-about-vaccines-and-autism>.
8. Price, C., Prenatal and Infant Exposure to Thimerosal From Vaccines and Immunoglobulins and Risk of Autism. *Pediatrics* Volume 126, Number 4, October 2010.
9. Sharpe, M., Gist, T., and Baskin, D. B-Lymphocytes from a Population of Children with Autism Spectrum Disorder and Their Unaffected Siblings Exhibit Hypersensitivity to Thimerosal. *Journal of Toxicology* Volume 2013, Article ID 801517, 11 pages.
10. Iqba, S. Barile, J., Thompson, W., and DeStefano, F. Number of antigens in early childhood vaccines and neuropsychological outcomes at age 7–10 years. Published online 12 July 2013 in Wiley Online Library.
11. DeStefano, F., Price, C., and Weintraub, E. Increasing Exposure to Antibody-Stimulating Proteins and Polysaccharides in Vaccines Is Not Associated with Risk of Autism. *J Pediatr 2013*.
12. Allison Kennedy, Katherine LaVail, Glen Nowak, Michelle Basket and Sarah Landry Confidence About Vaccines In The United States: Understanding Parents' Perceptions. *Health Affairs*, 30, no.6 (2011):1151-1159.
13. Haytham Safi. Vaccine Policy and Arkansas Childhood Immunization Exemptions A Multi-Year Review. Am J Prev Med 2012;42(6):602– 605.
14. Smith, P., Humiston, S., Parnell, T., Vannice, K., and Salmon, D. The Association Between Intentional Delay of Vaccine Administration and Timely Childhood Vaccination. *Public Health Reports* (1974-), Vol. 125, No. 4 (JULY/AUGUST 2010), pp. 534-541.
15. Omer, S et al. Vaccine Refusal, Mandatory Immunization, and the Risks of Vaccine-Preventable Diseases. *N Engl J Med* 2009;360:1981-8.

Assessment Sheet
Unit 4: Writing Academic Documents

Intimate understanding of scholarship in a specific field
Effectively conveyed description of current research and concerns of this field, including an introductory list of keyterms or keywords
Tone, diction, and style appropriate to an academic audience
Careful attention to differences among positions in the field, evaluating these differences and possibly raising prospects for further research
A fair and ethical representation of the work of others in the field, including formal acknowledgements
Proper length and structure and proper presentation of visual material (if appropriate)
Proper citation, grammar, syntax, and punctuation.
Constructive and specific responses in Revision Club

Grade: