

## Exploring Perspectives on Vaccinations and their Relation to Asthma

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### Abstract

It has been claimed that vaccines have been the most advanced step in preventative medicine, saving thousands of lives yearly [1]. However, in recent year's vaccination efficacy and safety policies have been called into question. This can be attributed to the anti-vaccination movement that has developed over the last two decades. The main arguments of this movement will be explored in this paper, focusing on the Measles Mumps and Rubella (MMR) vaccine and its link to autism. This paper will also review the growing vaccination industry and how cost effective immunization is, herd immunity and its benefit. Misinformation about vaccines is widespread, which causes distrust in the effectiveness and the motives of the recommendation to immunize against vaccine preventable infectious diseases. This paper will evaluate information and misinformation available to both pro and anti-vaccinators. Another factor that many patients have to take into consideration is their asthma. Influenza, MMR and diphtheria, tetanus and pertussis (DTaP) are the three vaccines evaluated in this research paper and their interaction with asthma.

**Keywords:** Vaccinations; Asthma

It has been claimed that vaccines have been the most advanced step in preventative medicine [1]. Creating a lesser burden on health care systems, preventing a total of 322 million cases of infectious diseases, 21 million hospitalizations, and 731,700 demises in the years 1994 - 2013 in the USA alone [3]. A big deterrent for many parents when it comes time to vaccinate their children is the dispute of the measles mumps and rubella (MMR) vaccine [4]. For other parents it's their child's asthma that affects the decision whether to vaccinate or not. Vaccinations have been the centre of controversy for many years. Despite differing opinions, it is important that those who do not follow the orthodox views of society, such as those in the movement of anti-vaccination, continue to ask opposing questions so that research progresses and vaccination companies are held to high standards [10]. This paper will explore the two sides of the spectrum and the information that is available to pro and anti-vaccinators. Furthermore, it will review articles that discuss the link between allergic asthma and the following vaccines: MMR, influenza and diphtheria, tetanus and pertussis (DTaP) vaccinations. This research paper is limited by the sample size in each study reviewed and articles that are relevant to the scope of the paper and statistics that were written in the last ten years and available in North America.

### Pro and anti-vaccination perspectives

Before discussing the relation of vaccinations and asthma, it is important to first look at other factors that form beliefs as to whether people should be vaccinated at all. There are many contributing influences that form a pro or anti-immunizer.

### MMR and Autism

The biggest point of contention for the two perspectives is the discussion of whether or not the MMR vaccine increases the risk of a child developing autism [1,4]. In Jolley, *et al.*'s article, a poll showed that 20% of respondents believed that there is a link between

autism and the MMR vaccine [1]. This theory was first published by Wakefield., *et al.* in 1999 in his article researching 12 children with inflammatory bowel illnesses and regressive developmental disorders, mostly autism [1,4-6]. This paper was later discredited but yet the anti-immunizer population continues to endorse this belief. The two main points that can be used are: autism spectrum disorder (ASD) has increased significantly as the rate of infant vaccination coverage has increased, and that it has been found that ASD features become prevalent within a short span of time after the vaccination is administered [4]. However, despite these factors it is still unclear if the result in increased ASD is due to other aspects such as increased acknowledgment and changes in diagnostic standards [4]. ASD is typically diagnosed by 18 - 19 months old, this is also the same time that children are given their MMR vaccine (12 - 15 months) [4,5]. Since Wakefield., *et al.*'s paper publication, all other epidemiological studies have failed to link the MMR vaccination with autism [4,6]. The most in-depth study was conducted by Taylor., *et al.* in which the population involved 498 cases of autism (261 of core autism, 166 of atypical autism and 71 of Asperger's syndrome) were identified [5]. In the study the sample population was born anytime from 1979 to 1992 [5]. From this study they concluded that since 1979 to when the MMR vaccine was made available to the public in 1988 and four years after, there was no significant spike in diagnosis of autism in the patients within the months after the vaccine was administered [5].

### Vaccination industry

Another belief is that pharmaceutical companies receive shocking profits from mass immunization [1]. It is true the North American vaccine market was worth approximately \$24 billion in 2016 and are projected to grow to be worth \$61 billion by the year 2020 [7]. This seems deterring but the more important question to ask is not are vaccination companies motivated by money. It is, are the products they produce still safe and effective even if they are motivated by money? And the answer is an overwhelming yes. Vaccines save countless lives every year. In Canada alone mortality rate from measles reduced from 535,300 deaths in 2000 to 139,300 deaths in 2010 [6]. Low vaccination rates lead to increase costs on the health care system [3,6,8]. Vaccines cost-effectively increases longevity, as well as saves lives while decreasing hospitalizations, length of hospital stays, use of antibiotics and long term disabilities [6]. Besides the aforementioned benefits, it can help in other areas of society as well, for example: education and labour [6]. Children that are healthy and not missing school due to illness perform better and working adults can prevent loss of income and increase efficiency in the workplace [6]. Immunization programs compare positively to other public health initiatives by decreasing cost per life year saved [6]. It is an easy decision to include inexpensive vaccines to prevent common diseases such as MMR in publicly funded immunization programs [6]. Nevertheless, some newer and more expensive vaccines such as meningococcal vaccine, the results of this is that there is benefit to the vaccine because of the prevention of meningococcal but not in savings per case prevented [6]. To include the more expensive vaccines in publically funded programs is contingent on if the public will accept or reject the responsibility to pay for the associated health benefits [6].

### Herd immunity

Herd immunity is when the majority of the population gets vaccinated, which then decreases the spread of the disease altogether [9-11]. Herd immunity is different with each disease and its ability to transmit [6]. The highest rate of immunization coverage in preventable diseases is ideal [1,6,9,11]. It is suggested that 95% of children should receive the MMR vaccine for herd immunity to occur [1,9,11]. When there is herd immunity it protects those who are not vaccinated or who are unable to be vaccinated, such as children that have allergic reactions, young infants, the immunocompromised and patients undergoing chemotherapy [9-11]. Proponents of vaccinations see vaccinations as a collective benefit and therefore to them it is morally imperative that the public gets immunized [10].

One reason why herd immunity is not always reached can be accredited to the possibility for people to exempt themselves or their children from receiving vaccines based on religious or philosophical beliefs [9,11]. Although there are policies in place for those who are not vaccinated, such as not being allowed to attend school or work in specific areas, it is ultimately up to the individual to make their own decision [9,11]. It is important to consider that attitude and behaviours play a role in vaccination [11]. For example, a mother may choose to vaccinate herself and her family not because she believes it is the right thing to do but because the policies at her child's school and

her workplace require them to be vaccinated. This means that the mother is behaviourally compliant but her attitude may differ based on religious viewpoints or differing perspective on risks versus benefits [9,11]. Other patients may hold pro vaccination attitudes but may not be able to vaccinate due to barriers such as remote location or financial difficulties [11]. Furthermore, some parents may refuse particular vaccinations but allow others based on beliefs about the necessity of said vaccine [11]. The exemption policies have been long debated. The two sides are: people should have freedom of choice and vaccinations promote the wellbeing of the group [11]. From a vaccine advocate's perspective, it is for the health of the group that all that can be vaccinated should be vaccinated [9,11]. It takes very few unvaccinated people for highly infectious diseases such as measles to spread [11]. In 1998, Canada had declared that measles had been eliminated, however in 2015 there was a reported 196 cases of the measles [8]. Out of the 196 cases reported in 2015, 171 of the people were unvaccinated [8]. Of the 171 unvaccinated cases, the largest group that were affected were in the age range 10 - 14. This was largely due to a sizable epidemic in a non-vaccinated religious community [8]. Despite the constant campaign to immunize, Canada is unceasingly challenged by resistance from the anti-immunization community [8].

### Information available to the public via the media

According to the International Telecommunications Union, 40% of the global inhabitants and 78% of the first world's population is connected to the internet [2]. The internet is so accessible that it is more likely for parents facing the decision to vaccinate their children to seek information from the internet rather than their doctor [1,2]. A massive concern with having information readily available via search engines is the quality of medical information [2]. In the analysis done by Sak., *et al.* they discovered that pro-vaccine website held better quality information when comparing 1093 webpages with almost equal parts pro and anti-vaccination webpages (47% pro-vaccination, 43% anti-vaccination and a small sample group of neutral or undeclared 10%) [2]. The results of this study showed that pro-immunizing sites which have better quality information can be credited to the fact that they are owned by well-known medical institutions such as World Health Organization (WHO) and the Center for Disease Control and Prevention (CDC) [2]. Anti-immunizing sites are regularly owned by activists of the anti-immunizing movement [2]. These activists are citizens that are expressing their views publically and are less likely to have professionally designed websites and many are unable to keep the information current and up to date with advancing standards [2]. However, 87 of the anti-vaccine websites were found to be credible sources of information by Sak., *et al.* [2]. So it is not to say that anti-immunizers have no source of quality information [2]. Facebook is currently the largest social media platform [12]. In 2012, Facebook collected data showing that 901 million users are using Facebook at least once a month [12]. It has been found that there are 3.2 billion comments and 'Likes' per day on Facebook, demonstrating that users interact constantly [12]. Buchanan., *et al.* assessed 520 Facebook pages for interest level, validity and purpose of information regarding vaccinations available on Facebook [12]. The result of the study found that pro vaccination sites were less active than anti-vaccination sites [12]. Information found on anti-vaccination sites was not in accordance with information endorsed by the CDC or Food and Drug Administration (FDA) [12]. These two results show that with the high rate of activity and interest in anti-vaccination sites, false information can be easily spread through anti-immunization Facebook pages [12]. Nowadays, it is more common for parents to refuse vaccinations for their children or themselves, because they were not alive in the era when deadly infectious diseases such as polio and measles were prevalent [12]. Therefore, they do not understand the consequences of these diseases, they believe that the vaccine is of higher risk than the disease [12]. Two reasons for pro-vaccination sites being less active than anti-immunization sites are that material found on medically researched sites may be less probable to provoke emotional responses. And secondly those people who endorse immunization are inadvertently less engaged in the vaccination deliberation online [12].

### Vaccinations and their relation to asthma

There has been debate that vaccinations in the early years of life can increase the risk for developing asthma and allergic diseases [13]. This section will discuss common vaccines such as MMR, influenza and DTaP, and how they interact with asthma in the adult and pediatric population.

#### Influenza

Influenza vaccines are recommended for patients with asthma of all ages [14]. Concerns have been raised that the administration of the influenza vaccine can cause an increase in asthma exacerbations [13,14]. Due to these apprehensions, numerous studies have been

conducted to test the safety of patients with asthma receiving the influenza vaccination [14]. Those at greater risk for influenza are the young and the elderly, along with those with chronic respiratory conditions such as asthma [6,13,15]. In Canada, influenza causes approximately 12,000 hospitalizations and 3,500 deaths yearly [15]. It has been recommended that asthma patients receive the vaccine annually to decrease the amount of hospitalization [13,15]. Approximately 2.2 million Canadian adults have asthma [15]. Unfortunately, this portion of the population has less vaccination uptake than ideal [15]. Roughly 30 - 50% of the Canadian population receives their influenza vaccination; this number is much less in those with chronic conditions [6,15]. It has been reported that those who believe that they are in good health are less likely to vaccinate against influenza [6,15]. This statement is true for individuals with well controlled asthma, despite their respiratory disease, patients view the influenza vaccine as unnecessary because they are in good health [6,15].

### MMR

The MMR vaccine is associated with autism but there has also been association between the MMR vaccine and asthma [16]. The association with MMR immunization and asthma in this case is positive. The MMR vaccine was proven to decrease the odds of asthma by two thirds in a study conducted by Timermann, *et al.* It found that there was a reduction in IgE level production. This is because the MMR vaccine promotes the T helper type 1 immune response which suppresses T helper type 2 cells that facilitates the production of IgE [16]. Increasing the T helper type 1 cells decreases the likelihood of developing asthma later in life [16]. It therefore seems that early MMR vaccination lowers the risk of a child developing asthma later in life [16].

### Pertussis

The pertussis vaccination was widely tested through the 1930s and 1940s trying to find the most effective formula to fight a disease that killed 19,878 between the years 1938-1942 in Canada [6,18]. By the end of the 1940s, a whole cell vaccine was proving effective and by 1980 had decreased pertussis cases by 99% in the USA [15]. In the United States in 2012 there was a spike of 41,000 cases of whooping cough recorded by CDC, this made 2012 the year with the most cases in the United States [9]. This can be linked to the fact that the DTaP vaccine has been falsely associated with undesirable effects, such as sudden infant death syndrome (SIDS), asthma and seizures or encephalopathy [15]. In 1994, a study was conducted by Odent, *et al.* This study compared three groups of patients with asthma receiving either the acellular vaccine, whole-cell vaccine or one group receiving a placebo [15]. It was found that there was no significant differing evidence within the three groups and therefore there is no reason to withhold the vaccine from patients with asthma [15]. Patients with asthma are however at more risk of contracting pertussis, therefore it is highly important for asthma patients to receive proper vaccination early in life [15,17].

### Conclusion

Although the scientific evidence is on the side of the pro immunizers, it is important that all sides be heard so that open discussion can be had and any conspiracy theories can be addressed. It is imperative for health care workers to be informed of the circulating information so that when questioned, they feel confident in their answers and can appease questioning patients and parents. The findings of this paper can be useful in understanding how and why the public forms these opinions and how vaccination rates have and will continue to affect our health care system. It can be said that perception of vaccinations is multifactorial and that the decline in vaccinations has increased the burden on the health care system [1,3,9]. Asthma patients are at high risk for contracting infectious diseases such as influenza, pertussis and MMR, and therefore to be a targeted audience for receiving vaccinations when recommended.

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