Pursuit - The Journal of Undergraduate Research at the University of Tennessee

Volume 6 | Issue 1 Article 5

April 2015

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PURSUIT

Herd Immunity: Does Social Media Affect Adherence to the CDC Childhood Vaccination Schedule?

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Social Media can alter herd immunity by having a subtle yet pervasive impact on the adherence to the Childhood Vaccination Schedule recommended by the Center for Disease Control (CDC). Parents of children (newborn to young adults) utilize social media to acquire medical information such as the CDC's Recommended Childhood Vaccination Schedule. Complying with anti-vaccination messages can result in parents not vaccinating their children, leading to a decline in the public's herd immunity against known pathogens. However, there is a dearth of information about the possible impact of social media on herd immunity from childhood vaccination. Thus, this literature review will discuss the emerging themes from the current science in an effort to provide an initial understanding. In addition, the authors will provide a framework by which these themes demonstrate the 'pitfalls' of social media.

1. Introduction

"We were not concerned that she was at risk of contracting any serious childhood illnesses. We were wrong….a week before our baby girl's first birthday…she was hurriedly admitted to intensive care with the diagnosis of spinal meningitis caused by *Haemophilus influenzae*, type B, which is a vaccine preventable disease" (Walther, 2011, p. S7). Unfortunately, this scenario may become the reality for an increasing number of parents due to a lack of adherence to the Center for Disease Control (CDC) and Prevention's recommended childhood vaccination schedule. With growing outlets for personal opinion via social media such as Facebook, personal blogs, Twitter, and activist sites, parents seeking information on childhood vaccinations are often exposed to a barrage of information heavily laden with medical jargon and anecdotal data. Unfortunately, a portion of this information has not been scientifically validated and has the potential to be both misleading and frightening. While an overwhelming majority of American parents adhere to the CDC's recommended childhood vaccination schedule, there is an expanding population that chooses to delay, alter, or decline these vaccinations. This incidence of non-adherence is significant because, in geographic pockets of the United States, herd immunity is being compromised. Herd immunity occurs once 75% of the herd or populace of a geographic area is vaccinated against a particular pathogen. It also means that the entire populace is considered immune because when 75% is immune, it creates an immunity majority threshold that provides protection for all, including the non-immune remaining 25%. As a result, the herd immunity is not weakened by this small percentage of non-immune populace, which may be due to immunosuppression or other factors. This lack of immunity is evident as recent as April 3, 2012, when the "Washington State Secretary of Health declared a pertussis epidemic [due to a] 1300% increase in pertussis when compared with the same period in 2011, having the highest number of cases reported in any year since 1942" (Center for Disease Control and Prevention [CDC], 2012, p. 517). Every effort has been activated to contain epidemics like pertussis by regaining herd immunity. In general, herd immunity is currently being maintained. This effort has diminished potential given the emerging and growing vaccination resistant movement.

Using social media, the vaccination resistant movement is promoting an anti-vaccination doctrine that is accessible in any household with a viable Internet connection. Social media becomes the conduit between an anti-vaccination doctrine and concerned parents and/or children's caregivers. These parents are exposed to anti-vaccination messages that may not be scientifically validated with epidemiological studies. With this heightened level of accessibility, anti-vaccination messages can influence parents' opinions and decisions about childhood vaccination. Their decision to forego childhood vaccinations has enhanced potential to alter the utilization of the CDC recommended vaccination schedule for children (from birth to age 18). The anti-vaccination doctrine corrodes our country's herd immunity by infecting singular decisions related to childhood vaccinations. Consequently, herd immunity declines, increasing the potentiality for epidemic exposure. Understanding the infiltration of the anti-vaccination doctrine would significantly provide insight into pockets of the United States experiencing vaccine-preventable disease epidemics due to the decline of herd immunity and the effect anti-vaccination decisions pose for the future health of the population.

However, there is limited, if any, literature about the effect of the vaccination resistant movement on herd immunity. Therefore, the purpose of this analytical literature review is to discuss the emerging themes from the current studies in order to characterize and examine their patterns and relationships. Additionally, this literature review will discuss how they collectively provide a foundational understanding of how social media can contribute to the relationship between the vaccination resistance movement and herd immunity.

2. Search History

Searching in Cumulative Index of Nursing and Allied Health Literature (CINAHL), Public Medline (PUBMED), and Elsevier databases were performed with limiting factors, including: written in English language, geographic subset of the United States, and published from 2003-2013. Search terms included herd immunity, social media, vaccinations, immunizations, parental attitudes, and physician's attitudes. All types of vaccinations and immunizations were included. From this search, 1,464 articles were identified in CINAHL, 224,910 articles in PUBMED, and 1,358 articles in Elsevier. Abstracts were reviewed to determine if the articles focused on the key search terms—herd immunity, social media, and vaccinations. Combining the key search terms into 2-term combinations and 3-term combinations further eliminated articles from the 225,000+ selections. This process resulted in 2,567 2-term articles and 125 3-term articles (using filters including clinical trial, English, 01/01/2003-01/01/2013, and humans). Including both quantitative and qualitative, 19 articles published from 2005-2013 were chosen for understanding the factors characterizing the impact of social media on herd immunity.

3. Literature Reviewed

3.1 Social Media and Its Impact on Health

Social media conceptually is an open electronic forum with public accessibility where user-generated information such as knowledge, thoughts, beliefs, and opinions are shared. This understanding of social media is manifested in the forms of websites, Twitter, Facebook, blogs, and activist sites. Social media has revolutionized public communication. It seems that "the more positive the Facebook Groups members' attitude toward knowledge sharing is, the greater the intention to share knowledge will be" (Pi, Chou, & Liao, 2013, p. 1972). This hypothesis was examined with an online survey, completed by 271 participants with 64% having at least a high school education (Pi, et al., 2013). Regarding attitudes toward "knowledge sharing" and "openness", the participants reported that Facebook users were more willing to share information if they found it was beneficial to others (Pi, et al., 2013, p. 1973). The social medium, Facebook, provided these users a known way for sharing information or knowledge.

This finding is expounded on when Schwartz (2012) reported that social media uses the sharing of knowledge to bring individuals and groups together who share a similar view on a topic such as vaccination. Social media enables parents to compare their experiences and gather support for their activism efforts (Schwartz, 2012, p. 52-3) related to their emotional investment in the topics or issues they experienced. For parents who might have had negative experiences with vaccinations, social media provides a public outlet where they can share their experiences with other users, especially those with concerns for their child's health. Those who are critical of vaccines can use social media to actively express thoughts of anti-vaccination. It is important to note that these parents who publicize anti-vaccination messages on their profiles are simply sharing what they have found to be helpful in their decision making process. Many of these parents are passionate about sharing the risks they perceive regarding vaccinations; furthermore, they believe these risks outweigh the risk of the diseases they prevent (Schwartz, 2012, p. 50).

Importantly, these findings indicate that parents are turning to social media for a better understanding of the medical information and to solicit peer perceptions of the information's utility in caring for their children (Schwartz, 2012). The increased use of social media for childhood vaccination information demonstrates social media's impact on health care as parents are turning to Facebook to secure information (Pi, et al., 2013). Parents feel that they are inadequately informed by healthcare providers. As a result, parents use social media for peer support and insight as well as a sense of acceptance by those who share their perception (Bean,

2011, p. 1879, Pi, et al., 2013). Therefore, parents have a new outlet for credible and experiential information (Schwartz, 2012; Pi, et al., 2013). Clearly, information, peer support, and what is perceived as credible information are attainable through social media. However, there is still an absence of information about what happens when these influences come into play (Schwartz, 2012). Specifically, the impact on herd immunity is infrequently discussed when social media users advocate for non-adherence to the CDC Vaccination Schedule.

3.2 CDC Vaccination Schedule Non-Adherence

CDC Vaccination Schedule Non-Adherence is any altering, delaying, or complete declination of the recommended vaccination schedule for children from birth upward to 18 years old as set forth by the CDC (*see* Appendix A). With a random sampling (n = 2,921 households), parents of children aged 19-35 months participated in a telephone survey study to determine associations between timely vaccination uptake and intentional delay of vaccinations (Smith, Humiston, Parnell, Vannice, & Salmon, 2010). Results demonstrated that parents who intentionally delayed their child's vaccinations were significantly more likely to support their decision with information from the Internet. A group of parents chose to delay their child's vaccinations based on personal research, i.e. social media, leading 73.9% of those parents to intentionally delay their child's vaccination schedule without doctor consultation. On the other hand, 93.9% of another group of parents were advised by their doctor to delay one vaccination due to a current illness that would alter efficacy of the immune response desired by the scheduled vaccination. Clearly, both group of parents are seeking what they feel is the best for their child. Yet, securing a "timely vaccination" (where their child receives all recommended vaccines by 19 months of age) is a significant milestone in developing a child's resistance to infection and to the concept of herd immunity. Reaching this milestone demonstrates that the parents are adhering to the CDC recommended childhood vaccination schedule (Smith, et al., 2010, p. 534-6).

However, some parents may decide to not be guided by the CDC recommendations for their child's vaccinations. Ninety percent of the parents in a study utilizing telephone surveys to quantify the knowledge, attitudes, and beliefs of parents regarding vaccination reported the decision of delaying their child's vaccinations until after two years of age. (McCauley, Kennedy, Basket, & Sheedy, 2012). The most common concern shared by 34.1% of respondents related to "vaccine side effects". The CDC provides information regarding recommended vaccinations, including side effects and potential reactions (*see* Appendix B). This concern was evident in most parents' questions and concerns regarding vaccinations, whether they chose to adhere to the recommended schedule or not (McCauley, et al., 2012, pp. 375-7, 382). The impact of this decision materializes when exploring doctors' perspectives about communicating with parents who wanted to either alter or not follow the recommended vaccination schedule (Leib, Liberatos, & Edwards, 2011). Some doctors refuse to treat the children of parents who altered the vaccination schedule. Distrust of that doctor is only one of the outcomes from a doctor's dismissal. Another, critical outcome is the parents' distrust of all medical professionals in regards to their child's vaccination, which could strengthen their resolve to avoid vaccinating their children in the future (Leib, et al., 2011). As a result, parental attitudes about childhood vaccinations can be significantly impacted by the fear of vaccination side effects and negative response by the medical profession for not wanting to comply with CDC.

3.3 Parental Attitudes

Parental attitudes relate to the parents' opinions, views, and beliefs about childhood vaccinations for children (birth to 18 years old), where these attitudes are manifested in the parents' actions and/or behaviors. Parental attitudes can significantly influence the trust in vaccinations and the sources (e.g., social media) from which the vaccine information comes.

By examining the vaccine information from a variety of different venues (i.e., public safety announcements or patient-doctor discussions), it was possible to recognize the varying degree of credibility each social media as determined by specific segments of the population focused (Freed, Clark, Butchart, Singer, & Davis, 2011). After an aggressive nation-wide recruitment effort using the telephone and Internet, 1,552 individuals completed a survey that included items related to parental trust in various information sources about childhood vaccinations. The sample consisted of both parents and nonparents. Analysis was conducted to match the national (US) population distribution regarding gender, race, education, income, etc. The majority of parents (76%, n = 1916) reported trusting their child's doctor "a lot". However, only 26% (n = 655) of parents reported trusting other healthcare providers, and only 23% (n= 580) reported trusting government vaccine experts/officials. Furthermore, 65% (n= 1639) of parents report some trust in other parents who believe their child was harmed by a vaccine (Freed, et al., 2011). While there is significant trust in a child's doctor, there are still a number of parents feel that these doctors do not provide them with enough information regarding vaccine. There seems to be even less trust in healthcare providers and governmental public health officials in regards to childhood vaccinations (Gust, et al., 2005; Gust, et al., 2008; Salmon, et al. 2005). Another way that parental attitudes are manifested in regards to childhood vaccination is their trust in certain sources. Parents (27%, n = 419) report "a lot" of trust in Internet websites for doctor groups (i.e., the American Academy of Pediatrics, whereas only another 10% (n = 155) report "a lot" of trust in other sources (i.e., government websites, magazines and news articles, and vaccine company websites). Interestingly 30-48% (n = 466-745) of parents' place "some" trust in these other sources. Evidently, "parents have reported difficulty in determining who to trust when safety information among sources is contradictory" (Freed, et al., 2011, p. S110).

In another study (n = 475) examining the degree of credibility parents place on patient-doctor interactions, 84% (n= 399) strongly or somewhat agree that they trust the advice from their primary care provider. (Kennedy, Basket, & Sheedy, 2011). Most parents felt vaccines were important to their child's health, and the most common concern regarding vaccines was the pain their children would experience as a result of the number of immunizations being given during a particular appointment. In addition, many parents found the number of vaccines administered was concerning. One study identified that 20% (n= 95) of parents were not fully confident in the safety or importance of vaccines (Kennedy, et al., 2011). This highlights the need for education regarding the benefits of vaccines and the potential dangers of the diseases they prevent (Kennedy, et al., 2011, p. S92-8). Perhaps education could be satisfied by increased responsibility taken by healthcare providers to provide parents with comprehensive information regarding vaccination, allowing adequate time for questions to be addressed.

The importance of parental attitudes about vaccine information is further illustrated in an evaluation of the knowledge, attitudes, and beliefs guiding parents in their decision about vaccination (McCauley, et al., 2012). With a predominantly female sample (n = 1503; mean age of 32), the most common reason reported for children not receiving vaccines was the fear of serious side effects. Although over 96% of parents (n = 1443) made sure that their child received at least one vaccine, only 80.6% (n = 1211) complied with the CDC recommendation for all childhood vaccinations. Clearly, many parents share the same questions and concerns about childhood vaccination as the fear of vaccine side effects is a prevailing concern (McCauley, et al., 2012, p. 375-82).

Parents appear to understand that you cannot trust everything you read, as demonstrated in their response of "some trust" to certain questions since only part of what they are reading maybe factual. If parents are mistrusting of medical providers, education regarding the importance of vaccinations is less effective. Knowing this, it is useful to know how parents are evaluating what is factual and should be trusted. Often this evaluation is guided by doctors, in whom a majority of parents trust. However, the changing medical profession may present a barrier to parents acquiring or even trusting this guidance. A doctor's unexplained or

undiscussed reason for not treating a child of a parent who fears the vaccine side effects can result in parents turning to social media generated by other concerned parents for guidance in determining what is factual and who or what to trust. Yet, this is user-generated information and can leave an inquiring parent with unverifiable facts and possibly more questions and concerns. The committed and concerned parents will seek out guidance through social groups utilizing social media to disseminate their message and doctrine. As a result, parents concerned about childhood vaccinations side effects become willing listeners to the vaccine resistance movement.

3.4 Vaccine Resistance Movement

"At first glance, childhood immunizations are no-brainers for good parents…We Web-search 'immunization vaccine adverse reaction' and find horror stories of children damaged by vaccines" (Walther, 2011, p. S6). This illustrates the expansion of the vaccine resistance movement or any group of people who believe that the risk of the CDC recommended vaccination schedule outweighs the benefits and therefore advocate against their use.

In a content analysis study, 25 user-generated Internet websites were reviewed to assess the dynamics of content, design, and credibility that they employed to convey their messages for anti-vaccination (Bean, 2011). An overwhelming 76% (n = 19) of the websites inferred that vaccines caused illness, damage, and death by challenging their safety and efficacy. Forty-four percent (n = 11) cited vaccination mandates as a violation of civil liberties. Eighty percent (n = 20) indicated the use of poison and additives in vaccines with both mercury and aluminum viewed as particular suspects. In addition, 52% (n = 13) alleged that vaccines were promoted with ulterior financial motives with claims against pharmaceutical companies and those promoting vaccines. These findings indicated the existence of a vaccination resistance movement (Bean, 2011, p. 1877). Even though only 25 Internet websites were included in the study, the identified themes parallel the concerns reported by parents in other studies and these themes occurred greatly in the 25 websites (Leib, et al., 2011; Kennedy, et al., 2011; Smith, et al., 2010).

Moreover, websites have been reviewed to examine the tactics found in user-generated content utilized by the vaccination resistance movement. The tactics consisted of but not limited to logical fallacies, emotionally charged anecdotal data, shifting hypothesis, attack on the websites' critics, and censorship of scientific data. With this tactic, the vaccination resistance movement advantageously utilizes the evolving medical paradigm created by the birth of the informed patient (Kata, 2012, p.3778-9). In other words, for the first time patients are actively seeking out information so that they can become informed users of the health system. Even though this study clearly expressed a personal bias by the researcher, this is minimized by examining the information presented in the websites and not the responses from participants—low response bias to trigger any personal bias expressed (Kata, 2012).

These findings are substantiated in a case study about the odyssey that a well-meaning mother undertook to ensure that vaccination was the right choice for her third child (Walther, 2011). When faced with these anti-vaccination tropes, the mother questioned her ability to make an informed decision. She gave herself a year to ascertain information that she could be confident in before making her final decision. Unfortunately, before that year was up, her child was stricken with a potentially fatal diagnosis caused by a vaccine preventable disease (VPD). Her family endured the hardships of a disease that has virtually been eradicated through childhood vaccination for decades (Walther, 2011, p.S6-7). This case study demonstrates the devastating impact from the use of anti-vaccination tropes; moreover, it crystallizes how communication via social media in support of the vaccine resistance movement can ultimately decimate the herd immunity with one family at a time.

3.5 Herd Immunity

Herd immunity means that once 75% of the herd or population is vaccinated against a particular pathogen, then the herd or society has immunity against the pathogen. A majority threshold is created from the immune 75% must be maintained in order to keep both the vaccinated and unvaccinated populations protected from the pathogen (Bauch, 2005). A 75% majority threshold level is ideal because from a social perspective, it creates an allowance for those children who cannot be vaccinated due to medical concerns (e.g. those with immunosuppressive diseases such as cystic fibrosis, allergies, recipients of organ transplant, etc.). As an increasing number of people are vaccinated, the unvaccinated have a decreased chance of becoming infected due to herd immunity. A population with a high enough vaccination level can virtually eradicate the social effect or social presence of a disease without vaccinating everyone in the given population (Bauch, 2005). In addition, the 75% majority threshold guarantees that the majority of the population will be accessible to contain any possible outbreak from those without immunity. In other words, persons who are not recommended to receive certain childhood vaccines, due to the risk profile associated with their specific illness, are still protected from vaccine-preventable diseases (Bauch, 2005).

Currently, only a small percentage of parents are selecting non-adherence, although there seems to be a "greater individual incentive not to vaccinate." As a result, herd immunity is still being reached because, on a social level, parents do not have to choose to expose their child to possible risks of vaccines or of the diseases. This could be considered a "free ride" for parents who are unsure of the choice between adherence and non-adherence to the CDC recommended vaccination schedule (Bauch, 2005, p. 1669-70).

This sensibility of herd immunity has been examined by several studies in an effort to understand the general population's knowledge of herd immunity. In a longitudinal case-control study, 439 participants were examined to see the risk of pertussis between children who received the pertussis vaccination as scheduled and those who did not due to parental refusal (Glanz, et al., 2009). Of the 156 children who had lab confirmed cases of pertussis, 89% (n = 139) partially received the vaccine with 11% (n = 17) not receiving it. "There is a strong association between parental vaccine refusal and the risk for pertussis infection in children. Vaccine refuters had a 23-fold increased risk for pertussis when compared with vaccine acceptors, and 11% of pertussis cases in the entire study population were attributed to vaccine refusal." (Glanz, et al., 2009, p.1449). Although 75% of the sample received the vaccine, this herd immunity did not provide absolute protection. In addition, children whose parents declined the vaccination had a 23-fold increased risk for pertussis (when compared to vaccinated individuals). This resulted in 11% of pertussis cases being an outcome from the vaccination declination (Glanz et al., 2009, p. 1146-50). Clearly, parents need to understand the potential outcome(s) of immunization refusal.

4. Summary and Implications

Social media is a new outlet for health information and can have an impact on the society's immunity against known and unknown pathogens. This information is easily accessible, which appeals to parents, but can lack peer reviews due to its user generated content. The vaccine resistance movement has found traction because, for the first time, social media provides members of the group an opportunity to share their convictions with others. Social media is causing a shift in the medical paradigm because people are becoming informed consumers of the healthcare system through information secured with social media. Specifically, it is having an influence on the parents seeking vaccination information. Even though the herd immunity is not currently compromised, this may change in the future. The presence of the vaccination resistance movement through social media will align with the growth of non-adherence to the CDC recommended childhood vaccination schedule. Due to social media, tropes used by the

vaccination resistance movement may influence parents' decisions regarding vaccinations in such a way that the decisions can change herd immunity (*see* Appendix C).

Parents need to understand the potential outcome(s) of immunization refusal. When "more than 1 of 10 parents of young children currently use[s] an alternative vaccine schedule," (Dempsey, et al., 2011, p. 848) the risk of not reaching this threshold increases and puts this specific population at risk, not just the unvaccinated child. Parents' decisions are not made in a vacuum; instead they are made as a cog that is necessary for the whole community to operate without incidence of vaccine preventable diseases.

Education strategies need to be developed to discuss risks and benefits with parents more effectively. Implementing in-services in hospitals regarding the risk/benefit ratio of childhood vaccines would increase the knowledge of nurses and better equip them to provide patient education. This increased confidence and education would improve outcomes of adherence to the CDC vaccination schedule.

The upsurge of the use of social media to promote anti-vaccination doctrine is beginning to present challenges related to the possible reality that, since the creation of vaccines, our country may face an inability to reach herd immunity. Therefore, a weakness we found in the literature is the small number of studies addressing the important concept of herd immunity and the possible resurgence of vaccine-preventable diseases if herd immunity is compromised.

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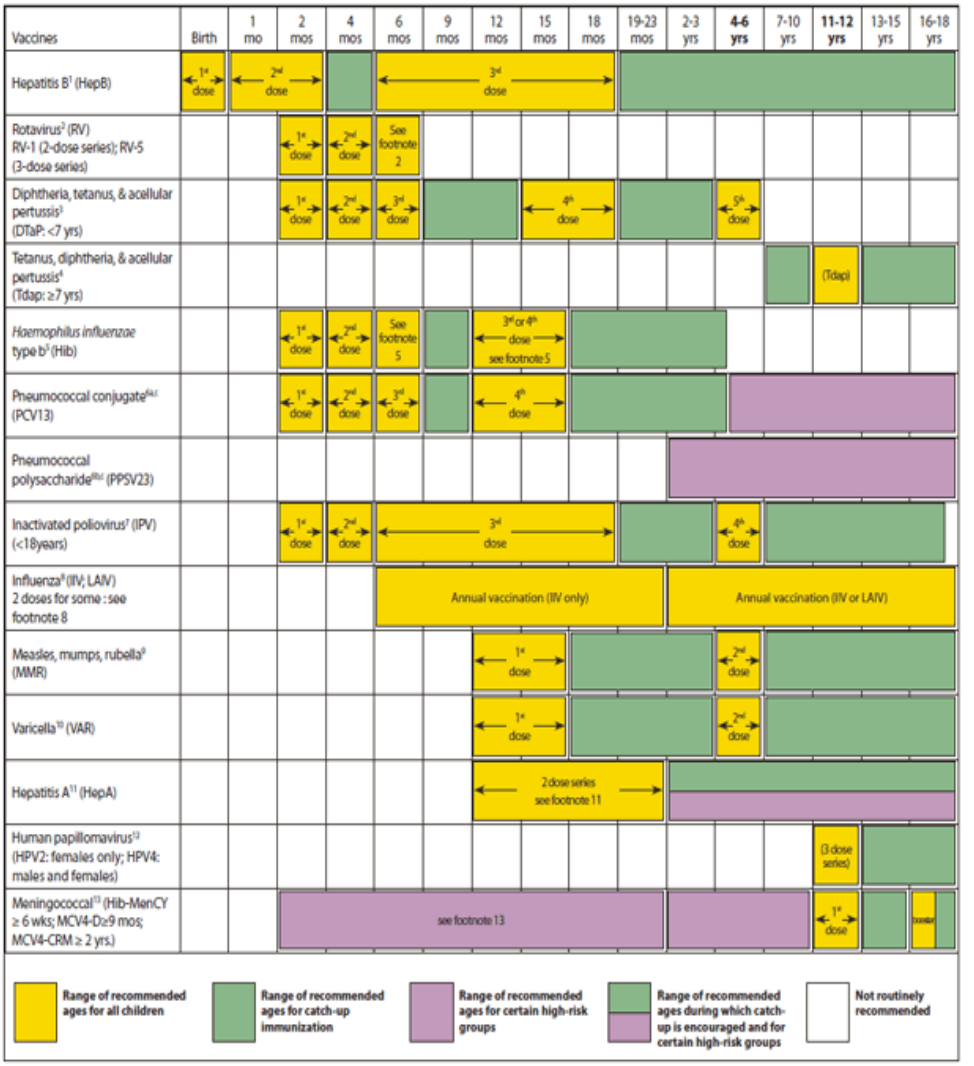
Appendix A

Table 1 (Center for Disease Control and Prevention [CDC], 2013, p. 1).

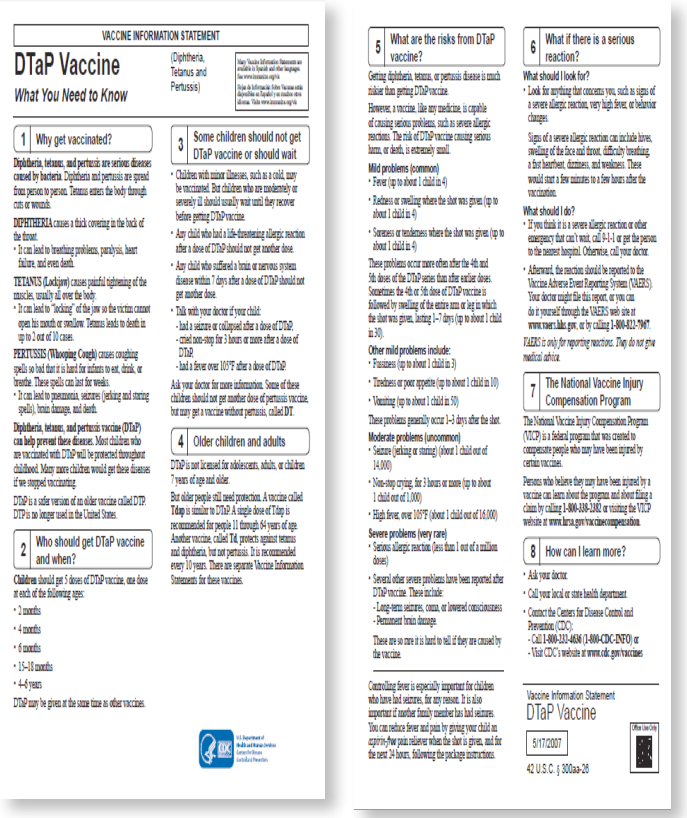
CDC recommended childhood vaccination schedule



Appendix B

Figure 1 (Center for Disease Control and Prevention [CDC], 2007, p. 1)

This is a sample of a CDC distributed information flyer about the risk/benefit profile regarding the DTaP Vaccine.



VACCINE INFORMATION STATEMENT

DTaP Vaccine (Diphtheria, Tetanus and Pertussis)

What You Need to Know

Many Vaccine Information Statements are available in Spanish and other languages. See www.immunize.org/vis

Hojas de Información Sobre Vacunas están disponibles en Español y en muchos otros idiomas. Visite www.immunize.org/vis

1 Why get vaccinated?

Diphtheria, tetanus, and pertussis are serious diseases caused by bacteria. Diphtheria and pertussis are spread from person to person. Tetanus enters the body through cuts or wounds.

DIPHTHERIA causes a thick covering in the back of the throat.
- It can lead to breathing problems, paralysis, heart failure, and even death.

TETANUS (Lockjaw) causes painful tightening of the muscles, usually all over the body.
- It can lead to "locking" of the jaw so the victim cannot open his mouth or swallow. Tetanus leads to death in up to 2 out of 10 cases.

PERTUSSIS (Whooping Cough) causes coughing spells so bad that it is hard for infants to eat, drink, or breathe. These spells can last for weeks.
- It can lead to pneumonia, seizures (jerking and staring spells), brain damage, and death.

Diphtheria, tetanus, and pertussis vaccine (DTaP) can help prevent these diseases. Most children who are vaccinated with DTaP will be protected throughout childhood. Many more children would get these diseases if we stopped vaccinating.

DTaP is a safer version of an older vaccine called DTP. DTP is no longer used in the United States.

2 Who should get DTaP vaccine and when?

Children should get 5 doses of DTaP vaccine, one dose at each of the following ages:
- 2 months
- 4 months
- 6 months
- 15–18 months
- 4–6 years

DTaP may be given at the same time as other vaccines.

3 Some children should not get DTaP vaccine or should wait

- Children with minor illnesses, such as a cold, may be vaccinated. But children who are moderately or severely ill should usually wait until they recover before getting DTaP vaccine.
- Any child who had a life-threatening allergic reaction after a dose of DTaP should not get another dose.
- Any child who suffered a brain or nervous system disease within 7 days after a dose of DTaP should not get another dose.
- Talk with your doctor if your child:
  - had a seizure or collapsed after a dose of DTaP,
  - cried non-stop for 3 hours or more after a dose of DTaP,
  - had a fever over 105°F after a dose of DTaP.

Ask your doctor for more information. Some of these children should not get another dose of pertussis vaccine, but may get a vaccine without pertussis, called DT.

4 Older children and adults

DTaP is not licensed for adolescents, adults, or children 7 years of age and older.

But older people still need protection. A vaccine called **Tdap** is similar to DTaP. A single dose of Tdap is recommended for people 11 through 64 years of age. Another vaccine, called Td, protects against tetanus and diphtheria, but not pertussis. It is recommended every 10 years. There are separate Vaccine Information Statements for these vaccines.

5 What are the risks from DTaP vaccine?

Getting diphtheria, tetanus, or pertussis disease is much riskier than getting DTaP vaccine.

However, a vaccine, like any medicine, is capable of causing serious problems, such as severe allergic reactions. The risk of DTaP vaccine causing serious harm, or death, is extremely small.

Mild problems (common)
- Fever (up to about 1 child in 4)
- Redness or swelling where the shot was given (up to about 1 child in 4)
- Soreness or tenderness where the shot was given (up to about 1 child in 4)

These problems occur more often after the 4th and 5th doses of the DTaP series than after earlier doses. Sometimes the 4th or 5th dose of DTaP vaccine is followed by swelling of the entire arm or leg in which the shot was given, lasting 1–7 days (up to about 1 child in 30).

Other mild problems include:
- Fussiness (up to about 1 child in 3)
- Tiredness or poor appetite (up to about 1 child in 10)
- Vomiting (up to about 1 child in 50)

These problems generally occur 1–3 days after the shot.

Moderate problems (uncommon)
- Seizure (jerking or staring) (about 1 child out of 14,000)
- Non-stop crying, for 3 hours or more (up to about 1 child out of 1,000)
- High fever, over 105°F (about 1 child out of 16,000)

Severe problems (very rare)
- Serious allergic reaction (less than 1 out of a million doses)
- Several other severe problems have been reported after DTaP vaccine. These include:
  - Long-term seizures, coma, or lowered consciousness
  - Permanent brain damage.

These are so rare it is hard to tell if they are caused by the vaccine.

Controlling fever is especially important for children who have had seizures, for any reason. It is also important if another family member has had seizures. You can reduce fever and pain by giving your child an aspirin-free pain reliever when the shot is given, and for the next 24 hours, following the package instructions.

6 What if there is a serious reaction?

What should I look for?
- Look for anything that concerns you, such as signs of a severe allergic reaction, very high fever, or behavior changes.

  Signs of a severe allergic reaction can include hives, swelling of the face and throat, difficulty breathing, a fast heartbeat, dizziness, and weakness. These would start a few minutes to a few hours after the vaccination.

What should I do?
- If you think it is a severe allergic reaction or other emergency that can't wait, call 9-1-1 or get the person to the nearest hospital. Otherwise, call your doctor.
- Afterward, the reaction should be reported to the Vaccine Adverse Event Reporting System (VAERS). Your doctor might file this report, or you can do it yourself through the VAERS web site at www.vaers.hhs.gov, or by calling 1-800-822-7967.

VAERS is only for reporting reactions. They do not give medical advice.

7 The National Vaccine Injury Compensation Program

The National Vaccine Injury Compensation Program (VICP) is a federal program that was created to compensate people who may have been injured by certain vaccines.

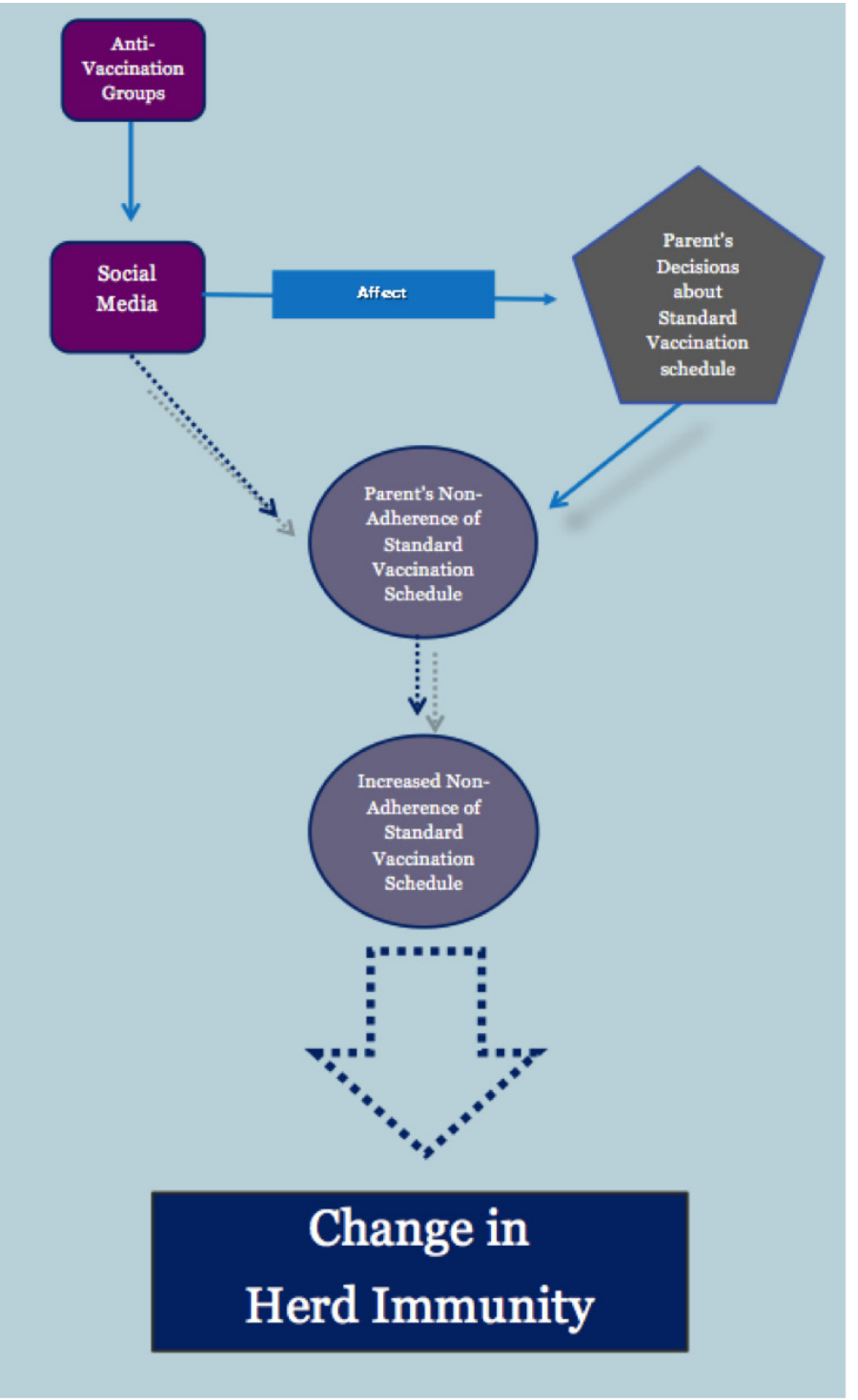
Persons who believe they may have been injured by a vaccine can learn about the program and about filing a claim by calling 1-800-338-2382 or visiting the VICP website at www.hrsa.gov/vaccinecompensation.

8 How can I learn more?
- Ask your doctor.
- Call your local or state health department.
- Contact the Centers for Disease Control and Prevention (CDC):
  - Call 1-800-232-4636 (1-800-CDC-INFO) or
  - Visit CDC's website at www.cdc.gov/vaccines

Vaccine Information Statement
DTaP Vaccine
5/17/2007
42 U.S.C. § 300aa-26

Office Use Only

Appendix C


Anti-Vaccination Groups
Social Media
Affect
Parent's Decisions about Standard Vaccination schedule
Parent's Non-Adherence of Standard Vaccination Schedule
Increased Non-Adherence of Standard Vaccination Schedule
Change in Herd Immunity