



Immune overload: Parental attitudes toward combination and single antigen vaccines



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ARTICLE INFO

Article history:

Received 6 January 2015

Received in revised form 30 March 2015

Accepted 7 April 2015

Available online 17 April 2015

Keywords:

Parental attitude

Combination vaccine

Single antigen vaccine

Immune overload

Alternative vaccine schedule

Vaccine refusal

ABSTRACT

Parental concerns have led to a recent decline in immunization coverage, resulting in outbreaks of diseases that were once under control in the US. As the CDC vaccination schedule continues to increase in complexity, the number of required injections per office visit increases as well. Some parents perceive that there is trauma associated with the administration of multiple injections, and research shows that having multiple vaccines due in a single visit is associated with delays and lower immunization rates. Combination vaccines make vaccination more efficient by incorporating the antigens of several different diseases into a single injection, but many parents worry that they may overload the child's developing immune system and leave him or her susceptible to secondary infections. This literature review synthesizes current evidence regarding the parental fear of vaccine-induced immune system overload and the fear of vaccine-associated trauma, in an attempt to understand the scope and nature of these fears. Despite the wealth of knowledge about each of these fears individually, it is still unknown which is of greater concern and how this affects parental decision-making.

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1. Introduction

Vaccines are considered the greatest public health achievement of the 20th century by the Centers for Disease Control and Prevention [4]. Even so, they have recently come under scrutiny by the media and a vocal minority of concerned parents. A large number of parents are wary of combination vaccines because of negative publicity focusing on possible side effects, including autism. Although many of these reports lack scientific evidence or describe rare occurrences, they are nonetheless influential in parents' decision-making processes. A common charge is that combination vaccines overload the young child's immune system, leaving him or her more susceptible to other infections [31]. Some parents see this as a case for single-antigen vaccines. However, parents also worry about the pain their children experience when receiving multiple injections at a single office visit. This can lead them to delay or refuse vaccinations, leaving their children and other children who are medically unable to receive vaccines unprotected. With new vaccines continually being developed, it is important to understand and attempt to allay parents' fears so that their children can be protected from potentially deadly diseases. Although many other factors influence

parental attitudes toward vaccines, this literature review synthesizes research on these two specific fears to determine how parents choose between combination and single antigen vaccines.

As more parents refuse or delay immunizations for their children, the herd immunity protecting vaccine non-responders and the unimmunized, including those who are immunocompromised or too young to be vaccinated, decreases. Besides the risk to the children, the decision not to vaccinate also places stress upon pediatric practices. They must balance the liability of an unvaccinated child – the possibility of infecting others in the waiting room or other setting, injury resulting from vaccine-preventable disease, or allegations of failure to adequately educate caregivers about the risks of vaccine-preventable disease – with the similarly undesirable option of dismissing the family from the practice [28].

Many parents today have never experienced deadly vaccine-preventable diseases and may underestimate the diseases' severity [9]. The United States has seen several recent outbreaks of diseases that were once under control in this country, like pertussis and measles [1,18], and the increase in global travel places everyone at risk.

An increase in the number of vaccines on the CDC immunization schedule over recent years has resulted in five or more separate injections being given during a single office visit [5]. In an attempt to simplify the schedule, a diphtheria–tetanus–whole-cell pertussis vaccine came into use in the 1940s and now more than

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20 combination vaccines are in use or under development [16]. While combination vaccines have numerous benefits, in a 1998 article the MMR (measles–mumps–rubella) vaccine was reported to have been linked to autism and inflammatory bowel disorders [35]. Although the study was later found to be fraudulent and the author's medical license was revoked due to multiple breaches of ethical principles [12], people continue to fear the side effects of combination vaccines.

2. Search history

The authors searched CINAHL, MEDLINE, and Web of Knowledge databases using key terms such as: immunization, parents, parental attitudes, immunization schedule, combined vaccines, immunization/psychology, and immunization/adverse effects. Results were limited to English, and abstracts were read to determine the most relevant articles. Reference lists of retrieved studies were searched to identify further articles related to parental concerns of immune system overload and multiple injections. Twenty-seven articles were chosen, with publication dates ranging from 2000 to 2014. They include both qualitative and quantitative studies, as well as reviews.

3. Combination versus single antigen vaccines

Combination vaccines contain the antigens of multiple diseases and are used in place of single antigen vaccines to decrease the number of injections a child must receive. Other benefits of combination vaccines include less paperwork, less time spent in the healthcare facility, fewer office visits, higher coverage rates, reduced vaccine administration costs for the family, and increased safety for both the child receiving the injection and the nurse administering it [8]. They also decrease the risk for medical errors and errors in recordkeeping, and save money because the healthcare practice does not need to stock as many vials [17]. However, combination vaccines pose unique challenges as well, mainly in the areas of research and development. Pharmaceutical companies must ensure that each component vaccine is compatible and will not decrease the effectiveness of the others, and costly drug trials must be performed even if the component vaccines have already been proven safe and effective [10,21].

Before being licensed it must be shown that a new combination vaccine does not increase the risk of adverse effects above that of the component vaccines [17]. Vaccines are tested in larger numbers of children and for longer amounts of time than are other drugs [24]. However, parents are wary of pharmaceutical companies and 19% disagreed with the statement that “immunizations are always proven safe before they are approved for use” ([11], p. 1099). Perceptions of combination vaccines are significant because a systematic review conducted in 2010 found that negative views about combination vaccines tended to correlate with lower vaccine uptake [3].

Parents in one qualitative study on the “5-in-one”, DTaP/IPV/Hib vaccine expressed an appreciation for the convenience of combination vaccines. As one mother puts it, “Well it's all over and done with then isn't it. It's all out the way, so you haven't got to think I've got an injection this week and another one next week,” ([34], p. 7402). On the other hand, 8 of the 22 parents interviewed for the same study said they would rather have single antigen vaccines whenever possible. A survey was sent out to 2253 parents in East Berkshire, England to gauge their attitudes about the introduction of new vaccines. Of the 859 respondents, 612 expressed a preference to the question of whether they would rather new vaccines be given separately or in combination with other immunizations. Seventy-one percent ($n=434$) of them said they would

prefer the single vaccine [2]. The primary reasons they gave were fear of immune overload (44%) and belief that the combination vaccine would cause more side effects (29%). On the other hand, 98 of the 105 parents who would choose the combination vaccination for their child would do so to decrease the number of injections and make the experience less distressing for their child. The findings are limited by a relatively small sample size, but this study does provide useful insight into parents' motivations.

4. Immune system overload

Several investigators have produced both qualitative and quantitative data which indicate that parents are concerned about vaccines overwhelming their children's immune system [3,20,34]. Parents fear that the vaccine will initially cause immunosuppression, leaving their child vulnerable to secondary infections [13]. In a nationwide telephone survey of 1600 parents, 25% agreed with the statement “I am concerned that my child's immune system could be weakened by too many immunizations,” and 23% thought that “children get more immunizations than are good for them” ([11], p. 1099). Since the time of the study several new vaccines have been added to the CDC schedule, and a more recent survey of 376 parents found that 34% believe children get too many vaccines during their first two years of life [15]. A common belief is that babies' immune systems are still immature, so they are not ready to handle the stress of immunizations. One Utah parent recommends, “Do not start until they are two and then go slowly,” ([20], p. 29).

When directly asked during a focus group session what they meant by ‘overloading’ of the child's immune system, many parents were unable to clarify. One mother explained her understanding of the topic by saying, “Well, from what I've heard, combined vaccines are like a sudden onslaught to the body's immune system, normally you would catch it through the mouth and there are so many defenses that it goes past before it gets there. But when they inject them, it goes straight into the bloodstream and it doesn't pass all those defenses and the body just gets a shock, where did this come from?” ([13], p. 4324). With the constantly increasing number of immunizations, parents perceive that the number of antigens is increasing as well. However, thanks to the swapping of the whole cell pertussis vaccine for acellular pertussis, the opposite is actually true. In 1960 the five routinely recommended vaccines contained 3217 proteins and polysaccharides (antigens), in 1980 the seven recommended vaccines contained 3041, and in 2000 the total was only 123–126 for 11 vaccines [25].

Looking at the clinical effects of vaccination, a 2009 study found no increase in hospital admissions for severe bacterial or viral infections among people who were vaccinated for MMR in the previous 90 days [31]. There may be an added benefit of protection against unrelated infections in the immediate post-vaccination period [14].

5. Parental fear of combination vaccine side effects

Many parental concerns about the safety of vaccines are related to side effects, with the MMR being the most commonly refused [3,13]. One analysis used Millennium Cohort Study data, collected from children born in the UK between September 2000 and January 2002, to determine parental reasons for either refusing the MMR vaccine altogether or electing to receive single antigen vaccines instead [26]. They found that 67% ($n=588$) of parents whose children failed to receive immunizations against any of the three diseases made a conscious decision to refuse them. Additionally, the decision to forgo the MMR vaccine and opt for at least one measles, mumps, or rubella single antigen vaccine was made deliberately by 82% of parents ($n=522$). If the study were repeated now, the results might be more skewed toward practical and medical

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