



## Association of vaccine-related attitudes and beliefs between parents and health care providers



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### ABSTRACT

**Objectives:** Health care providers influence parental vaccination decisions. Over 90% of parents report receiving vaccine information from their child's health care provider. The majority of parents of vaccinated children and children exempt from school immunization requirements report their child's primary provider is a good source for vaccine information. The role of health care providers in influencing parents who refuse vaccines has not been fully explored. The objective of the study was to determine the association between vaccine-related attitudes and beliefs of health care providers and parents.

**Methods:** We surveyed parents and primary care providers of vaccinated and unvaccinated school age children in four states in 2002–2003 and 2005. We measured key immunization beliefs including perceived risks and benefits of vaccination. Odds ratios for associations between parental and provider responses were calculated using logistic regression.

**Results:** Surveys were completed by 1367 parents (56.1% response rate) and 551 providers (84.3% response rate). Parents with high confidence in vaccine safety were more likely to have providers with similar beliefs, however viewpoints regarding disease susceptibility and severity and vaccine efficacy were not associated. Parents whose providers believed that children get more immunizations than are good for them had 4.6 higher odds of holding that same belief compared to parents whose providers did not have that belief.

**Conclusions:** The beliefs of children's health care providers and parents, including those regarding vaccine safety, are similar. Provider beliefs may contribute to parental decisions to accept, delay or forgo vaccinations. Parents may selectively choose providers who have similar beliefs to their own.

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### 1. Introduction

Vaccines were one of the greatest public health achievements of the 20th century, dramatically reducing morbidity and mortality from many infectious diseases [1]. As a result of this success, the majority of health care providers and parents have no or minimal experience with many vaccine-preventable diseases. Meanwhile, concern over potential adverse reactions from immunizations has contributed to an increase in parents seeking non-medical exemptions from school immunization requirements for their children [2,3]. Pockets of unimmunized and underimmunized children have

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been associated with disease outbreaks in recent years [4–9]. Freed et al. surveyed parents on their vaccine-related attitudes and beliefs and found that over 11% of parents refused at least one vaccine for their child and half were concerned about serious adverse effects of vaccines [10].

This study builds on previously published research, which demonstrated that parents of children with an exemption to school immunization requirements and parents of non-exempt children have different vaccine knowledge, attitudes, and beliefs [2]. Parents of fully vaccinated children were more likely to report that children benefit moderately or a great deal from vaccination than parents of exempt children, and held higher overall perceptions of disease severity, disease susceptibility, vaccine efficacy, and vaccine safety. Vaccine safety was the most common factor in parents' self-reported reasons for not vaccinating their child. The majority of all parents trusted their health care provider and over 90% identified their health care provider as the most frequently used source for vaccine information.

A follow-up survey was conducted to evaluate the vaccine related attitudes and beliefs of providers of these exempt and non-exempt children [11]. While providers of exempt and non-exempt children shared mostly similar beliefs, providers of children with exemptions were more likely to report concerns about vaccine safety and decreased perceived benefit of immunization compared to providers of vaccinated children. The majority of both exempt and non-exempt parents trusted their child's health care provider, used them for information, and thought that they are a good source for vaccine-related information. Other literature has shown that providers are one of the best sources of information for parents [12–14]. The health care provider could be an important influence on parents' beliefs about the benefit and safety of vaccines [14]. This study aims to investigate the association between parental and provider vaccine attitudes and beliefs.

## 2. Methods

### 2.1. Design

This study investigated associations between parental and provider vaccine-related attitudes and beliefs using the same parents surveyed in the study noted above [2,11]. Parents of 815 elementary school children who were exempt from at least one school immunization requirement and 1630 randomly selected, fully vaccinated children in Colorado, Massachusetts, Missouri, and Washington were mailed a survey between 2002 and 2003 that examined factors associated with parental vaccination refusal [2]. Parents were asked to identify their child's primary health care provider(s) when the child was 2 and 5–6 years of age as these are two age windows typically marked by increased vaccination of children (age 2) and when school entry requirements apply (ages 5–6). Parents identified 806 unique providers. Surveys were mailed in 2005 to 712 of these parent-identified providers for whom contact information could be found [11]. One hundred fifty-eight parents identified multiple providers and 159 providers were identified by multiple parents. The data analyzed here are linked responses from parents and providers to examine their associations. The Committee on Human Research at Johns Hopkins University approved this study.

### 2.2. Survey

Both parents and providers responded to questions on a 5-point Likert scale concerning their attitudes and beliefs regarding immunization. For each of the vaccine-preventable diseases studied, parents and providers were asked questions about their beliefs

on disease susceptibility, disease severity, vaccine safety, and vaccine efficacy. These four constructs are predictors of vaccination according to the Health Belief Model [15,16]. The provider questions included “How likely do you think an unimmunized child in the United States is to get the following diseases during the next ten years?”, “If an 8-year old got these diseases, how likely is the child to be seriously ill?”, “How well do you think each of these vaccines prevents disease?”, and “How safe do you think these vaccines are?”. Vaccines and diseases studied in both parents and providers included diphtheria, pertussis, tetanus, measles, mumps, rubella, polio, *Haemophilus influenzae type b (Hib)*, varicella, and hepatitis B. Providers, but not parents, were questioned about invasive pneumococcal and influenza due to the addition of these diseases and vaccines on only the provider survey. Responses were averaged across vaccine or disease to create four overall constructs (disease susceptibility, disease severity, vaccine efficacy, and vaccine safety) on a 5-point Likert-scale.

Other questions examined key immunization beliefs, such as “vaccines strengthen the immune system.” Providers were asked to specify: their most advanced clinical degree, their type of clinical practice (pediatric, family medicine, internal medicine), and practice setting (urban, rural, suburban).

### 2.3. Data analysis

Constructs, previously described, were created for beliefs on disease susceptibility, disease severity, vaccine safety, and vaccine efficacy [2,11,17]. Responses for each set of questions were averaged across diseases and vaccines and the resulting score was dichotomized by 1 to <4 vs.  $\geq 4$ , consistent with previous studies [2,11,17]. Responses for “who benefits when a child is fully vaccinated” and “key immunization beliefs” were dichotomized by 1–3 (strongly disagree, disagree, and neither agree nor disagree) vs. 4 and 5 (agree and strongly agree). Responses of “don't know” were counted as missing data and excluded from the analysis.

Associations between provider and parental responses were explored using logistic regression and estimated using Generalized Estimating Equations (GEE) to control for clustering of parents within providers [18]. For this analysis, parental responses were set as the dependent variables and provider responses as the independent variables to test for association between provider and parental responses. Results are interpreted as the odds that a parent and a provider share a particular belief compared to the odds that a provider and parent do not share that belief. Secondary analyses tested differences in provider characteristics by a parent's dichotomized belief in vaccine safety. Results were considered to be statistically significant if the *P*-values were  $\leq 0.05$ . All analyses were conducted using the Stata v.10.1 (Stata Corp, College Station, TX).

## 3. Results

For the parental survey, 1367 of 2435 surveys were completed for a response rate of 56.1% (48.6% rate for parents of exempt children vs. 59.9% rate for parents of non-exempt children). Of the 712 provider surveys sent, 44 did not reach the provider due to death, retirement, or a closed practice and 14 were sent to a non-health care provider. Of the remaining 654 providers, 103 declined to participate. Surveys were returned by 551 providers (84.3% response rate). The dataset consists of 705 unique parents linked to 551 unique providers.

Parental and provider perceived benefits to a fully vaccinated child were highly associated (Table 1). For example, parents had 45 times higher odds of agreeing that the community benefits from having children fully vaccinated if their provider agreed, compared

**Table 1**  
Associations between provider and parental responses on moderate amount or high benefit when a child is fully vaccinated.<sup>a</sup>

Who benefits when children receive all of the recommended vaccines	Belief of moderate or high <sup>a</sup> benefit		Parents reporting moderate or great deal of benefit	Parents reporting low benefit	Odds ratio	95% Confidence interval
	% Parents	% Providers				
Child	90.4	97.8	99.9	11.1	108.9*	12.3–966.7
Community	86.5	98.4	99.9	5.4	45.0 <sup>b,c</sup>	5.0–407.0
Primary care practitioner	58.7	65.9	67.8	39.9	1.4*	1.1–1.9
State and federal government	58.7	83.6	83.4	19.4	1.2	0.8–1.9
Vaccine companies	90.6	88.5	87.4	16.3	1.3	0.7–2.7

<sup>a</sup> Belief that the indicated entity/person has either a moderate amount or great deal of benefit when a child is fully vaccinated.

<sup>b</sup> Raw, unadjusted percentages that include providers multiple times if identified more than once.

<sup>c</sup> Parents who believe the community benefits when children are fully vaccinated have 45 times higher odds of having a provider who also believes the community benefits when children are fully vaccinated compared to parents whose providers do not believe the community benefits when children are fully vaccinated.

\* *P*-value ≤ 0.05.

to parents whose providers did not agree. In addition, parents had statistically significant higher odds of agreeing that the child and primary care provider benefit from vaccination if their providers reported agreement, compared to parents whose providers did not agree. Parents' and providers' beliefs about benefit to state and federal government and vaccine companies were not statistically significantly associated.

Parental and corresponding provider likelihood of each reporting high confidence in vaccine safety was associated as was the likelihood of each reporting high perception of disease severity (Table 2). Parental and provider reporting of disease susceptibility and vaccine efficacy were not associated. Parents had 3.1 greater odds of believing vaccines were safe or very safe if they had a provider who also believed highly in vaccine safety as compared to parents whose providers did not have a high belief in the safety of vaccines.

There were strong associations between many key immunization beliefs between parents and providers (Table 3). For example, parents who agreed or strongly agreed that a child's immune system could be weakened by too many immunizations had 4.6 higher odds of having a provider who shared this belief compared to parents whose providers did not agree or strongly agree with this belief. One of the strongest associations was for the belief that healthy children do not need immunizations with parents having approximately 12 times greater odds of having this belief if their provider also held this belief compared to parents whose providers did not believe that healthy children do not need immunizations. While there were no statistically significant associations for some of the immunization beliefs examined, the direction of association for all beliefs was positively correlated.

Pediatricians had 1.9 increased odds of having parents in their practice that believed that vaccines are safe compared to family medicine providers (Table 4). There were strong associations between provider degree and parents' belief in vaccine safety. Medical doctors had 2.8 higher odds of having parents who believed vaccines were safe compared to other types of health care providers (Osteopathic Doctors, Naturopathic Doctors, Chiropractic Doctors, Nurse Practitioners and Registered Nurses). Examining the associations of parental beliefs in vaccine safety yielded no statistically significant differences for urban, rural, and suburban settings.

#### 4. Discussion

The results presented here add to the literature by demonstrating a strong association between parental and provider vaccine-related attitudes and beliefs. Providers likely influence parents' attitudes and beliefs about immunization, given how widely

providers are used as a source for vaccine information and their credibility for such information [2]. This is consistent with previous research showing that providers play a critical role in influencing a parent's decision to vaccinate their child [19]. If providers are influencing parents it will be important to educate providers and to help providers educate parents on the intended benefits of vaccination to the child and the community, as well as the safety of vaccination as these were the most highly correlated beliefs between parents and providers. However, it is also likely that parents may be more likely to choose providers who have similar vaccine beliefs as their own or that providers are more likely to attract and retain parents who have similar vaccine attitudes and beliefs as their own. The prevalence of family dismissal from a practice for vaccine refusal may be high at 39% for refusal of all vaccines and 28% for refusal of specific vaccines [20]. Freed and colleagues found that pediatricians were more likely than family medicine providers to ask parents refusing vaccines to seek another practitioner, possibly explaining why parents with pediatrician providers in our study are more likely to believe vaccines are safe or very safe compared to parents with family medicine providers [14]. The association may also be the result of a combination of the above scenarios; however, causality cannot be assessed from this study. Although establishing causality would be challenging, qualitative studies could provide insight on parental and provider dynamics in the immunization context.

Although only disease severity and vaccine safety were statistically significant in our study, there was a positive association between parents and providers for all four constructs. Parental concern about the safety of routine childhood recommendations has grown in recent years and is today cited as one of the main reasons for delaying or refusing vaccination [2,10,11,14]. As vaccine safety was the most highly associated construct between parents and providers it supports a potentially critical role that providers play in influencing parental belief.

As vaccine safety has been cited as a key reason for non-vaccination, we further investigated associations between beliefs in vaccine safety with other provider variables. Medical providers had a higher belief in the safety of vaccines compared to non-medical providers, similar to findings from a cross-section study of Canadian naturopathic and chiropractic students where the further along a student was in their studies, the more likely he or she was to have negative views of vaccines [21]. We found no association between provider's community size and parental belief in vaccine safety in contrast to an earlier study [22]. However, this lack of association in our study may be the result of factors other than parental attitudes impacting vaccine uptake or inadequate power in this study due to sample size limitations.

**Table 2**  
Associations between provider and parental responses for high perceived susceptibility and severity of disease and efficacy and safety of vaccines.<sup>a</sup>

Constructs	High belief <sup>a</sup> in vaccine/disease construct		Parents in high category % Providers agree with parents <sup>b</sup>	Parents in low category % Providers agree with parents	Odds ratio	95% Confidence interval
	% Parents	% Providers				
Disease susceptibility	23.8	6.2	5.7	95.3	1.2	0.6–2.5
Disease severity	42.0	28.9	30.4	75.8	1.4*	1.0–1.9
Vaccine efficacy	72.7	89.6	91.4	10.2	1.2	0.7–2.1
Vaccine safety	62.3	92.6	95.6	13.3	3.1 <sup>†,c</sup>	1.8–5.3

<sup>a</sup> “High Belief” represents believing (1) an unimmunized child is susceptible or very susceptible to disease (2) it would be serious or very serious if an 8-year old had the disease (3) vaccines are protective or very protective (4) vaccines are safe or very safe, respectively.

<sup>b</sup> Raw, unadjusted percentages that include providers multiple times if identified more than once.

<sup>c</sup> Parents who believe that vaccines are safe have 3.1 times higher odds of having a provider who also believes that vaccines are safe compared to parents whose providers do not think vaccines are safe.

<sup>†</sup> *P*-values ≤ 0.05.

There were several limitations to our study. First, as discussed, study design only shows an association between parental and provider beliefs and cannot assess the direction of the association. Second, the response rate of the parental survey was moderate and therefore there may be selection bias in our sample of parents. However, the response rate of the provider survey was high. Parents who trusted the health care system may have been more likely to fill out the survey and we may have missed parents with a relatively lower degree of trust. In addition, since parents of

exempt children were over sampled the overall proportions are not representative of the U.S. population. Finally, since the data were collected between 2002 and 2005 there may have been a change in vaccine-related attitudes, and beliefs of both providers and parents. While beliefs may have changed since this period the association between parental and provider beliefs may be more stable over time. We were unable however to find more recent or any other data that links the beliefs of parents to their child's health care provider.

**Table 3**  
Associations between provider and parental responses agreeing or strongly agreeing to key immunization beliefs.

	Agree or strongly agree with statement		Parents agreeing or strongly agreeing with statement % Providers agree with parents <sup>a</sup>	Parents disagreeing with statement % Providers agree with parents	Odds ratio	95% Confidence interval
	% Parents	% Providers				
Children should only be immunized against serious diseases	60.8	44.5	47.8	54.0	1.1	0.8–1.4
Children get more immunizations than are good for them	29.7	8.0	21.5	94.7	4.6 <sup>†,b</sup>	2.8–7.7
I am concerned a child's immune system could be weakened by too many immunizations	39.3	5.9	10.9	97.3	4.6*	2.2–9.3
I am more likely to trust immunizations that have been around for a while	81.4	69.4	74.2	31.9	1.4	0.9–2.0
Immunizations are one of the safest forms of medicine ever developed	40.3	81.0	85.2	20.4	1.5	1.0–2.2
Immunizations are getting better and safer all of the time as a result of medical research	64.6	89.0	94.4	12.9	2.5*	1.5–4.3
Vaccines strengthen the immune system	47.1	67.6	73.2	38.8	1.8*	1.3–2.5
For the overall health of a child, it is better for them to develop immunity by getting sick than to get a vaccine	16.5	5.2	16.3	96.8	5.5*	2.8–10.8
Healthy children do not need immunization	5.6	3.3	17.3	97.8	12.3*	5.0–30.3
Immunizations do more harm than good	6.7	3.7	8.2	97.8	4.5*	1.6–12.7
I am opposed to school immunization requirements because they go against freedom of choice	13.5	6.1	15.4	92.2	3.2*	1.6–6.3
I am opposed to school immunization requirements because parents know what is best for their children	6.1	2.4	8.8	94.9	2.8	1.0–7.9
School immunization requirements protect children against getting diseases from unimmunized children	76.5	88.0	91.4	13.7	1.7*	1.0–2.8

<sup>†</sup> *P*-values ≤ 0.05.

<sup>a</sup> Raw, unadjusted percentages that include providers multiple times if identified more than once.

<sup>b</sup> Parents who agreed that children get more immunizations than are good for them have 4.6 times higher odds of having a provider who also believes that children get more immunizations than are good for them compared to parents whose providers did not believe that children get more immunizations than are good for them.

**Table 4**  
Associations between parents' belief in vaccine safety and provider specialty, degree, and location.

	Parent believes vaccines are safe, % (No.)	Odds ratio	95% Confidence interval
Clinical specialty			
Family	52.0 (119)	1.0	1 [Reference]
Pediatric	66.8 (308)	1.9 <sup>a,b</sup>	1.4–2.6
Degree			
Non-medical			
Doctors/provider <sup>a</sup>	39.8 (37)	1.0	1 [Reference]
Medical doctor	64.6 (378)	2.8*	1.8–4.3
Location			
Suburban	62.0 (228)	1.0	1 [Reference]
Urban inner city	66.1 (37)	1.2	0.7–2.2
Rural	61.8 (176)	1.0	0.7–1.4

\*  $P$ -values  $\leq 0.05$ .

<sup>a</sup> Includes osteopathic doctor, naturopathic doctor, chiropractic doctor, nurse practitioner, and registered nurse.

<sup>b</sup> Parents whose providers are pediatricians have 1.9 increased odds of believing vaccines are safe compared to parents whose providers are family medicine doctors.

## 5. Conclusion

This study adds to our understanding of immunization decision-making by examining the association between parents and providers. The key finding of the study is that many of vaccine-related attitudes and beliefs are highly associated between parents and providers. Further study is needed however to investigate the directionality of the relationship. If there is directionality from providers to parents it will be important to understand and address the concerns of the group of providers who have low overall confidence in vaccine safety and benefit. Education of providers on tactics for effective communication with parents about immunizations may play an important role in improving parents' trust in the benefit and safety of vaccine.

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