

Recommendations to Health Care Providers for Responding to  
Parents' Vaccine Safety Concerns in the Clinical Context

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## Introduction

According to experts, public confidence in vaccines has waned.<sup>1</sup> In a 2009 National Immunization Survey of 11,206 parents, 25.8% of respondents reported to have delayed their children's vaccines and 8.2% to have refused them.<sup>2</sup> A 2015 Gallup poll of 1,015 U.S. adults reported that 9% believed vaccines are more dangerous than the diseases they prevent compared to 6% in 2001. Moreover, 6% believed vaccines cause autism while less than half believed they do not.<sup>3</sup> Meanwhile, the public health consequences of declining vaccine confidence are clear. In 2011, the United States experienced 17 outbreaks and 112 outbreak-associated cases of measles, a vaccine-preventable disease. Forty-four percent of these cases concerned unvaccinated individuals with philosophical exemptions.<sup>4</sup> Additionally, the Centers for Disease Control and Prevention reported 667 cases of measles in 2014, the largest number of cases since 2000 when measles was declared to have been eliminated from the country.<sup>5</sup>

Much work has been done to understand the origins and causes of ‘vaccine hesitancy’—a term used by public health experts to denote the delay or refusal of vaccine administration despite availability of services. Despite the volume of research, however, it is apparent that the field remains disorganized, a consequence of the ambiguity of ‘vaccine hesitancy’ and its use as a catchall category. The notion has been broadly applied to a range of persons and situations, and invoked in reference to historical, political, and socio-cultural explanatory factors for vaccine delay and refusal.<sup>6</sup> Furthermore, study methods are heterogeneous and lack an established metric for identifying and evaluating vaccine hesitancy.<sup>7</sup> Unsurprisingly, inconsistent results abound, particularly in studies on the effects of socioeconomic status and education levels on vaccine hesitancy.<sup>6,7</sup>

Nevertheless, there has been progress in our understanding of factors influencing rates of vaccine uptake. On the one hand, it has been found that encouragement from social and professional contacts, perceived value of vaccinating, and perceived severity of vaccine preventable diseases (VPDs) among health care providers, are involved in improving uptake. On the other hand, it has been shown that exposure to negative news stories about vaccination discourages uptake.<sup>7</sup> This latter finding is concerning given that, of 1147 print articles published between 1995 and mid-2005, 45% were unfavorable towards vaccines.<sup>8</sup> Moreover, research has indicated that the Internet is a leading source of health information—troubling in light of the fact that in a 2002 study, 43% of the first 10 hits produced by the seven leading search engines upon entering “vaccination” and “immunization” were anti-vaccine.<sup>9,10</sup>

These websites and articles share features that help to propagate vaccine hesitancy. According to a 2005 paper, vaccine-critical websites commonly include statements that vaccines are linked to idiopathic chronic diseases, such as autism.<sup>11</sup> In addition, they tend to endorse poorly-conducted studies promoting anti-vaccine agendas, attack critics with personal insults, promote conspiracy theories, argue that anti-vaccine claims are true because many believe them, and endorse ‘natural’ options.<sup>9</sup> According to a content analysis of 480 anti-vaccine websites, 62.2% of these websites claim that vaccines cause autism, 30% use anecdotes to support their claims, 41% emphasize choice, and 18.8% promote the use of alternative medicines.<sup>12</sup> Meanwhile, attempts to leverage similar rhetorical tactics in favor of vaccination have not proven as effective. In a 2014 randomized trial of 1759 parents with children ages 17 years or younger, it was shown that invoking images of children with vaccine-preventable diseases or providing an anecdote about an

infant who almost died of measles were as ineffective at increasing intent to vaccinate a future child among parents with unfavorable attitudes towards vaccines, as supplying information debunking the vaccine-autism hypothesis and describing the dangers of vaccine-preventable diseases.<sup>13</sup>

Health care providers (HCPs) remain one of the largest influences on a parent's decision to vaccinate his or her child.<sup>2,14,15</sup> However, physicians and nurses are not adequately prepared to answer vaccine-related questions from patients.<sup>15,16</sup> Questionnaires administered to 184 students from six countries reported that only 44% had received training on how to communicate with patients and parents about vaccination.<sup>15</sup> This study therefore aims to identify recommendations to HCPs for responding to parents' vaccine safety concerns through a review of the published literature. By characterizing recommendations to HCPs for navigating vaccine hesitancy, this study can help to improve the training of HCPs, who are in an essential position to foster public confidence in vaccines and increase vaccine uptake in the United States.

## **Methods**

For the purpose of this review, the following definitions are used.

Health care provider (HCP): This term refers to practitioners involved in primary, secondary, or tertiary care, such as medical doctors, nurse practitioners, physician assistants, registered nurses, and midwives. In addition, it is used to reference pharmacists and doctors of osteopathic medicine. Excluded from this definition are public health officers, public health advocates, public health organizations, and scientific researchers.

Vaccine safety concern: This term encompasses a range of different objections to the administration of prophylactic immunizations, including but not limited to the vaccine schedule, vaccine ingredients, putative connection between vaccines and autism, and risk-benefit ratio of vaccines. It excludes safety concerns about therapeutic vaccines.

Clinical context: This term refers to the private interactions between a health care provider and individual patient in a medical institution, such as a hospital, clinic, or primary care office. Its main referents are primary care visits. Virtual HCP-patient interactions are not included in the study in virtue of lacking mention in the reviewed literature.

Recommendation: This term is used to indicate calls to action made by articles to HCPs. To count as recommendations, calls to action had to be expressed in normative language ("should", "must", "it is important that") or imperative language ("print these handouts", "use examples", "avoid jargon"). In addition, it was required that they be specific. Vaguely general prescriptions such as "educate the public" were excluded from the study.

### *Search Strategy*

A systematic literature search was conducted between June and August 2015 using PubMed/Medline and Embase (Figure 1). Search terms were chosen to represent the following: 1) "Vaccine" and "Immunization" to identify articles focused on vaccines and vaccine administration; 2) "Autism" and "Child Pervasive Developmental Disorders" to identify articles

focused on scientifically unfounded concerns about vaccine safety, of which autism is one; and 3) “Anti-vaccine” to identify attitudes, behaviors, and groups exhibiting entrenched opposition to vaccine administration.

The goal was to perform a broad search of articles describing and responding to vaccine safety concerns. Articles written in English were identified and de-duplicated. A single investigator screened articles for relevance based on the title and abstract. Articles unrelated to unfounded vaccine safety concerns such as the putative link between vaccines and autism, sympathetic to unfounded safety concerns, absent of specific recommendations to HCPs in the clinical context, or published before 1998, were eliminated. This resulted in 1122 articles that were read in their entirety by one investigator; full-texts making specific recommendations to HCPs were identified. One hundred and fifty articles accepted by title or abstract during the search could not be found. Therefore, a total of 52 articles were included in the final analysis.

### *Study Quality*

No articles were excluded based on quality concerns. Characteristics of the analyzed articles are presented to allow readers to judge the quality and representativeness of each article given the aim of the study.

## **Results**

The initial search yielded 2613 titles. Screening by title/abstract resulted in 1122 sources, of which 52 were used in the analysis. At least one article from every year between 2001 and 2015 was analyzed. Seven were commentaries, 2 were conference summary reports, 2 were content analysis studies, 2 were cross-sectional studies, 9 were editorials, 4 were letters to the editor, 1 was a focus group study, 1 was a policy statement, 21 were reviews, 1 was a semi-structured interview, 1 was a survey, and 1 was a testimonial (Figure 2). Identified recommendations were categorized into three main themes: explanations and arguments for vaccine safety (n = 40), manner of communication (n = 34), and responses to vaccine refusal (n = 13) (Figure 3).

### *Explanations and Arguments for Vaccine Safety*

Of the 52 sources included in the final analysis, 40 made recommendations to HCPs pertaining to explanations and arguments for vaccine safety. Thirty-three recommended that HCPs appeal to facts and science-based arguments to persuade parents to vaccinate their children. Of these articles, 10 encouraged HCPs to discuss the dangers of non-vaccination with vaccine hesitant parents. It was suggested that HCPs mention the communicable nature and serious complications of VPDs, such as measles.<sup>11,17,18</sup> Moreover, it was recommended that HCPs emphasize both the effectiveness of vaccines on decreasing the incidence of VPDs and the likelihood of their recurrence if vaccine uptake rates decline.<sup>19,20</sup> Other sources urged HCPs to inform parents that non-vaccination puts other vaccinated children at risk.<sup>21,22</sup> Meanwhile, three articles recommended that HCPs present parents with the dangers of delaying vaccination, but did not specify which risks to emphasize.<sup>14,23,24</sup>

Nine out of the 33 articles recommended that HCPs acknowledge the risks of vaccines. It was suggested that including mention of vaccine-related risks would improve a parent's intent to vaccinate his or her children by establishing credibility and trust.<sup>2,19</sup> Consequently, it was recommended that providers learn the risks of immunization before a consultation in order to provide reliable and truthful information about the risks to patients.<sup>17,25</sup> Three articles recommended that HCPs include during patient consultations discussions of the fact that no vaccine is 100% safe.<sup>2,26,27</sup> However, others also argued that HCPs should be careful to convey the impression that vaccines are safe despite their non-zero risks.<sup>18,20</sup> According to Lyren et al. HCPs should emphasize the benefits and only mention the risks, rather than emphasize the risks, so that parents feel more at ease.<sup>28</sup>

The importance of explaining the evidence and research on vaccine safety was emphasized in 12 out of the 33 sources. Three generally recommended that HCPs present evidence for vaccine safety.<sup>23,24,29</sup> One article specified that providers should emphasize that evidence linking the MMR vaccine to autism is lacking.<sup>17</sup> Elsewhere, it was suggested that HCPs help parents to understand the methods by which vaccine safety evidence is obtained, either by reviewing the rigor and objectivity of the vaccine safety system, explaining how healthcare professionals test hypotheses, or by providing information on the development of vaccine schedules.<sup>18,19,30,31</sup> Interestingly, 3 articles further recommended that HCPs improve the quality of parents' reasoning by encouraging them to base their decisions less on emotional variables, teaching them probabilistic reasoning to "immunize" them against anecdotal thinking, and reminding them of logical fallacies such as 'post hoc, ergo propter hoc'.<sup>20,32,33</sup> In addition, Mormann et al. recommended that HCPs discourage parents from solely relying on the media for health care information.<sup>34</sup>

Five out of the 33 articles recommended that providers mention the scientific theories behind vaccine safety. One letter to the editor invoked Thomas Jefferson's appreciation for science education in order to highlight the importance of educating people on the science of vaccination.<sup>35</sup> Kimmel et al. claimed that HCPs should inform patients that vaccines are biologic agents intended to stimulate immunity.<sup>21</sup> In response to concerns that vaccines cause antigenic overload, two articles recommended that HCPs explain the fact that immune systems face numerous natural challenges from foods and the environment every day, rendering the number of antigens introduced by a vaccine negligible.<sup>14,25</sup> Moreover, a 2014 commentary proposed that providers, in lieu of enumerating vaccine risk statistics, educate vaccine deniers on the molecular nature of vaccines to illustrate how they function in tandem with the immune system.<sup>36</sup>

A total of 19 articles out of 33 recommended that HCPs provide patients with references to the scientific and medical literature. Five suggested making printed resources available in the form of information leaflets, question-and-answer pages printed from the Internet, and Vaccine Information Statements.<sup>21,37-40</sup> Meanwhile, 5 of the 19 emphasized the provision of reliable and accurate web sites.<sup>25,28,41-43</sup> Eight articles provided the names of reputable sources, such as the Vaccine Education Center website, the Canadian Coalition for Immunization Awareness and Promotion, England's Department of Health 'information prescriptions', Centers for Disease Control and Prevention, and American Academy of Pediatrics.<sup>11,20,23,27,32,34,44,45</sup> One source, however, only offered a nonspecific recommendation to supply patients with references to the medical literature.<sup>46</sup>

Finally, of the 40 articles discussing recommendations to explanations and arguments for vaccine safety, 15 recommended that HCPs tailor their arguments to make use of parents' emotions and decision heuristics. Six out of the 15 articles clearly expressed reservations about the efficacy of reason, evidence, and education in persuading parents to vaccinate their children.<sup>47-52</sup> According to Cunningham et al. there is evidence to suggest that many people misunderstand quantitative information about risk, such as probabilities, percentages, and prevalence. As a result, they recommended that HCPs use anecdotal information—storytelling—to convey the importance of vaccination to parents.<sup>49</sup> Three articles also noted that the 'non-rational' rhetorical strategies of anti-vaccine communities may be more persuasive than fact or science-based arguments traditionally employed by scientific and medical experts.<sup>50-52</sup>

Nine out of the 15 articles recommended that HCPs use stories to respond to the concerns of vaccine-hesitant parents. Five articles generally emphasized their importance by asserting either that the best health communicators are storytellers, that stories are universal and transcend educational levels, or that stories from other parents are more trustworthy.<sup>22,29,33,48,49</sup> Two articles related their efficacy to their appeal to parents' emotions, specifically their ability to bridge the gap between logic and emotion.<sup>31,49</sup> Another two recommended that HCPs include visual imagery of children suffering from VPDs, while one article further recommended that HCPs direct parents to pro-vaccine blogs and Facebook pages where such images and stories are prevalent.<sup>2,11,50</sup> Shelby et al. acknowledged that anecdotes are anathema to medical professionals because they are unreliable sources of evidence; for one, they cannot be replicated. Nevertheless, they argued that HCPs should use stories anyway in order to be more effective health communicators.<sup>50</sup>

Six out of 15 recommended that HCPs make arguments exploiting decision heuristics. For instance, Zimmerman et al. suggested that HCPs raise the possibility that vaccine-critical websites have conflicts of interest because they sell products.<sup>11</sup> Kimmel et al. also recommended that HCPs use the 'bandwagon' appeal: 'vaccinate because everyone else is'.<sup>21</sup> It was proposed that HCPs inform parents that his or her own children are vaccinated, present information in terms of gains rather than losses, use a 'presumptive' approach that presumes parental compliance with vaccination, and exploit 'anchoring' and 'availability' heuristics by informing parents of VPD outbreaks in graphic detail.<sup>20,22,50,53</sup>

### *Manner of Communication*

Of the 52 analyzed articles, 35 made recommendations to HCPs pertaining to their manner of communication. Ten out of 35 emphasized the importance of fostering trusting relationships with parents. Suggested strategies for cultivating trust included reassuring parents that vaccination decisions would not affect their future medical care, honestly addressing uncertainties and risks of vaccinations, and encouraging parents to bring their concerns and questions to the clinic.<sup>17,43,54-56</sup> Four articles noted the importance of trust in effective vaccine risk-benefit communication and persuading parents to vaccinate their children.<sup>33,42,52,57</sup> Kushner emphasized that people prefer friendly physicians offering bad advice to cold and knowledgeable physicians. A warm and caring demeanor was therefore recommended for creating an environment in which parents feel comfortable expressing their concerns.<sup>58</sup>

Seven out of 35 articles explicitly recommended engaging patients in two-way discussion or dialogue about their vaccine safety concerns. For instance, Leask argued that risk communication in the clinical encounter involves more than a unidirectional supply of information from the HCP to patient.<sup>52</sup> Others concurred that HCPs must establish a two-way exchange of information and opinions, non-confrontational dialogue, and a forum where they can voice their worries and engage in a full discussion about vaccine risks and benefits.<sup>2,18,40</sup> According to Kimmel et al. allowing parents to express their concerns would increase their willingness to listen to the physician.<sup>21</sup> Furthermore, MacDonald et al. and the Canadian Paediatric Society recommended that HCPs employ motivational interviewing techniques during dialogue—semidirective questions aimed at changing the parents’ views, such as ‘what are the good things about vaccinating?’<sup>22,30</sup>

Moreover, 8 out of 35 articles recommended that HCPs listen carefully, respectfully, and empathetically to parents. It was suggested that HCPs explore parents’ views that vaccines cause autism through listening.<sup>17</sup> In addition, a prototype for the pre-service vaccinology curriculum of future health care workers developed by a 14-country collaborative project emphasized respecting different views through listening and listening non-judgmentally to beliefs about vaccine safety.<sup>15</sup> Two articles implicitly distinguished listening from empathy.<sup>27,47</sup> However, one conflated the activity of listening with the activity of empathizing, asserting that a good physician sits in silence with parents to ‘let parents know that it is okay if they are afraid’.<sup>29</sup> On the other hand, 3 out of the 8 articles made no simultaneous mention of empathy.<sup>24,55,56</sup>

Seven out of 35 explicitly recommended that HCPs avoid defensive or judgmental behavior when interacting with vaccine-hesitant or anti-vaccine parents. HCPs were urged to agree to disagree in a respectful manner, tell parents it is their decision to do what they feel is best, change the topic if the discussion devolves into an argument, and counter conspiracy theories with rational arguments instead of dismissiveness.<sup>17,25,59,60</sup> Disparaging questions, ridiculing sources of misinformation, and negative judgment of parents were denounced.<sup>42,54,61</sup> Meanwhile, 2 articles recommended that HCPs emphasize the values they share with parents, such as the children’s best interests and the public good.<sup>60,62</sup>

Eighteen of the 35 articles recommended that HCPs tailor the content and style of their responses to the individual families. According to Smith et al. a ‘one size fits all’ approach to responding to parents is ineffective given the complexity of vaccine confidence.<sup>53</sup> Thus, it was recommended that HCPs consider the specific concerns of the parent, the philosophical frameworks engendering the parents’ concerns, the experience and context of individual families, their educational backgrounds, and their needs for detailed information.<sup>2,19,20,27,28,30,51,55</sup> In addition, several articles proposed that HCPs distinguish vaccine-hesitant parents from those unlikely to revise their views under any circumstance.<sup>14,58,60,63</sup> Gowda et al. suggested that HCPs ‘screen’ parents prior to risk communication in order to categorize their degree of vaccine hesitancy and adjust their messages accordingly.<sup>19</sup> Chen et al. suggested that HCPs learn to distinguish ‘inquiry statements’ from ‘decision statements’, that is, statements expressing uncertainty and a need for information, from statements expressing the prepared decision to refuse vaccination.<sup>59</sup>

Additionally, eight of these 18 articles recommended that HCPs focus their efforts on persuading vaccine-hesitant parents and avoid engaging those with resolute objections to vaccination. Two suggested that the latter do not respond to scientific explanation.<sup>31,58</sup> Others took the lack of openness to factual information to explain the latter's unresolvable objections.<sup>2,36,54,55</sup> Wolfe proposed that 'hard-core' vaccine opposition arises from emotion and alternative philosophical views of medicine and healing; consequently, they argued that HCPs should give up the project of educating parents staunchly opposed to vaccines.<sup>64</sup> Likewise, McIntyre et al. asserted that 'radicals' who have adopted an alternative notion of health are unlikely to be convinced to vaccinate by HCPs.<sup>63</sup> Meanwhile, several articles recommended that HCPs continue efforts to educate parents who do not harbor 'hard-core' opposition to vaccines with scientific explanations and evidence; this is because, for these parents, the disagreement arises from a lack of information, not from conflicting ideologies or closed-mindedness.<sup>2,31,36,58,64</sup>

Finally, in 7 of the 35 articles, HCPs were urged to avoid technical or scientific language. According to Kushner, using 'there is no evidence that' to discount the vaccine-autism link may mislead a parent who takes it to imply that the hypothesis has not been tested or that there is a dearth of evidence to confirm or falsify the hypothesis.<sup>58</sup> In addition, 5 articles of the 7 emphasized the importance of clear, direct language unencumbered by scientific jargon.<sup>2,22,25,30,42</sup> Kushner argued that the language of science would be unconvincing to a parent already skeptical of science.<sup>58</sup> Likewise, Roberts et al. cautioned HCPs against using medically valid statements such as 'you must immunize!' that nonetheless might alienate a vaccine-hesitant parent.<sup>24</sup>

### *Responses to Vaccine Refusal*

Thirteen of the 52 articles included in the final analysis contained recommendations to HCPs for responding to parents' vaccine refusal on the basis of vaccine safety. Of the 13, 10 discussed whether to discontinue medical care as a consequence of a parent's vaccine refusal. Eight articles clearly discouraged HCPs from dismissing families from the practice. Three argued that discontinuing care would eliminate opportunities to continue discussion with parents, disabuse them of vaccine misconceptions, and improve their trust of the health-care system.<sup>14,28,45</sup> Others did not justify their recommendations, merely stating that HCPs should maintain their relationship with the parents and families who refuse vaccination.<sup>2,22,30,56,60</sup> Meanwhile, 2 of the 10 articles offered a balanced perspective of both discontinuing and continuing medical care. A policy statement issued by the American Academy of Pediatrics strongly discouraged discharging patients, but also acknowledged that substantial distrust, differences in philosophy of care, and persistently poor quality of communication were good reasons for pediatricians to encourage families to find other physicians.<sup>41</sup> In addition, Smith stated that permitting an unvaccinated child to sit in a waiting room put other patients at risk, which might justify discontinuing care for a family that refuses vaccines.<sup>20</sup>

Three out of the 13 articles recommended that HCPs acquiesce to parents' requests for alternative vaccine schedules. It was argued that doing so would convince even very resistant parents to vaccinate.<sup>47</sup> In addition, by allowing parents to delay vaccine administration, it was suggested that more children would be vaccinated, a preferable outcome.<sup>61,64</sup>

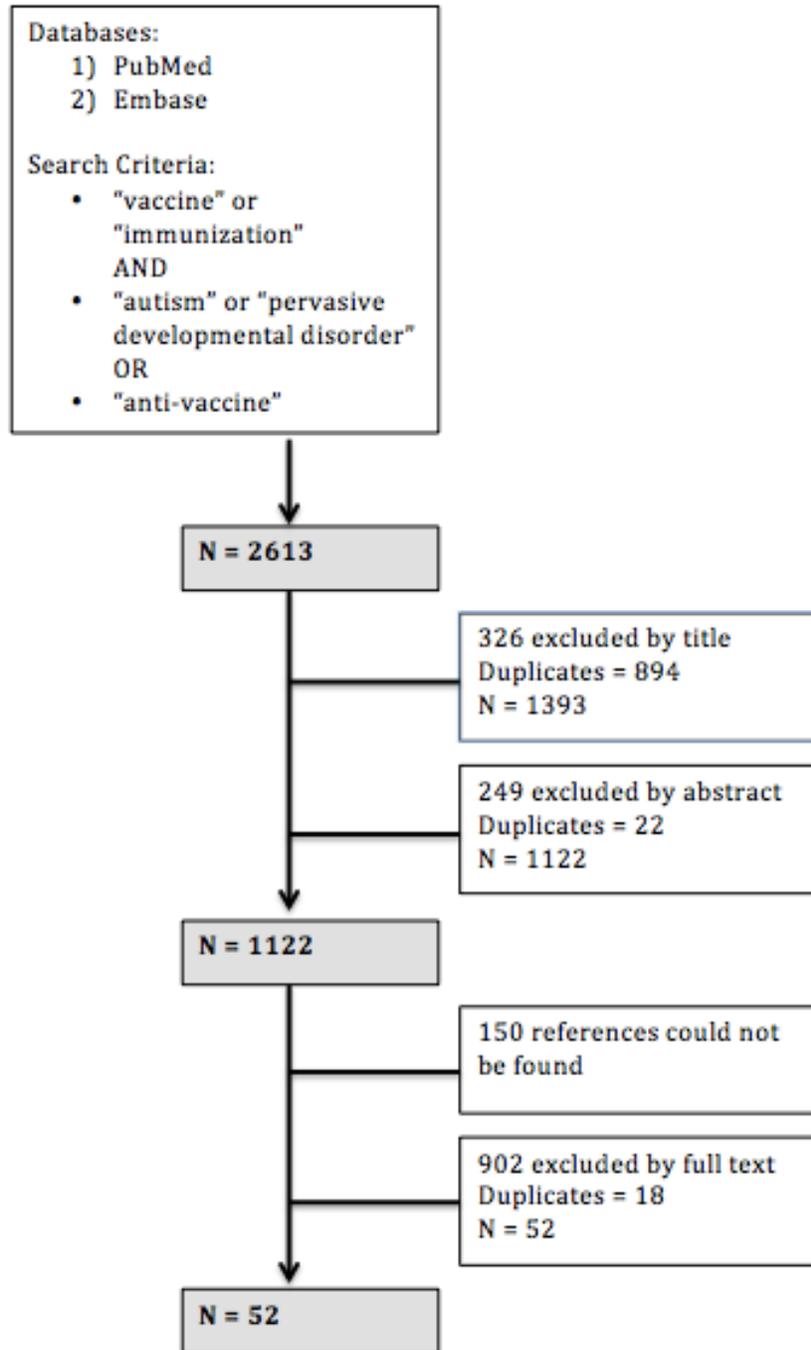
## Discussion

In this study, recommendations to HCPs for responding to parents' vaccine safety concerns in the clinical context were reviewed. Initially it was hypothesized that the frequencies of different types of recommendations would change from 2001 to 2015 as research on anti-vaccine and vaccine-hesitant communities accumulated. This was partially confirmed by the results (Figure 4). Appeals to facts or science exhibited a modest decrease in frequency of mention, in agreement with research highlighting the non-rational factors of vaccine confidence.<sup>10,15,16</sup> However, appeals to emotions or non-rational decision heuristics only exhibited a slight increase in frequency of mention. Fact- and science-based appeals remained the most dominant recommended kinds of explanations or arguments in the literature. This suggests either insufficient communication between researchers and those making recommendations, or opposition to 'non-rational' strategies. In addition, recommendations related to the HCP's manner of communication increased in frequency, suggesting greater attention to good communication skills and cultural competencies. Responses to vaccine refusal increased in mention, perhaps a sign of the growing rate of vaccine refusals encountered by HCPs due to waning public confidence. Of the minor categories, the author chose to examine recommendations to tailor responses to individual family backgrounds and concerns. She hypothesized that a change in frequency would appear in virtue of the comparatively recent adoption of the term 'vaccine hesitancy' to distinguish the heterogeneous group of vaccine-concerned individuals from those who are staunchly anti-vaccine and unlikely to change their minds.<sup>6</sup> This was confirmed by the observed increase in frequency.

That public confidence in vaccines has continued to wane notwithstanding emphasis on manner of communication and on appeals to facts or science suggests that these strategies are ineffective. Alternately, it may be that the recommendations are not being followed due to time constraints during the clinical encounter and lack of training. In addition, the fact that recommendations to appeal to parents' emotions and decision heuristics, most consistent with research on vaccine hesitancy, are less dominant in the literature may explain the continuing decline in public confidence. However, in the introduction of this article, a 2014 study was described that failed to demonstrate greater effectiveness of anecdotes and visual imagery in persuading parents with unfavorable attitudes towards vaccines to vaccinate.<sup>13</sup> It may be, then, that both recommended appeals are ineffective for vaccine risk-benefit communication.

This study has several limitations. First, a total of 150 sources could not be found. Second, the study was conducted by a single investigator, which may have magnified the effect of bias during the screening process and categorization of recommendations. Third, only articles written in English and available through PubMed and Embase were searched and reviewed. Despite these limitations, it is concluded that current recommendations focus on the explanations and arguments for vaccine safety, in which appeals to facts or science are preferred; on the HCP's manner of communication, in which individualizing responses to the family's specific concerns and background is emphasized; and on the HCP's responses to vaccine refusal, in which discontinuing medical care is mostly discouraged. Further study of the efficacy of pro-vaccine messages and strategies, described in this article, will be necessary to determine whether recommendations to HCPs characterized here require revision to bolster public confidence in vaccines and improve vaccine uptake in the United States.

## FIGURES



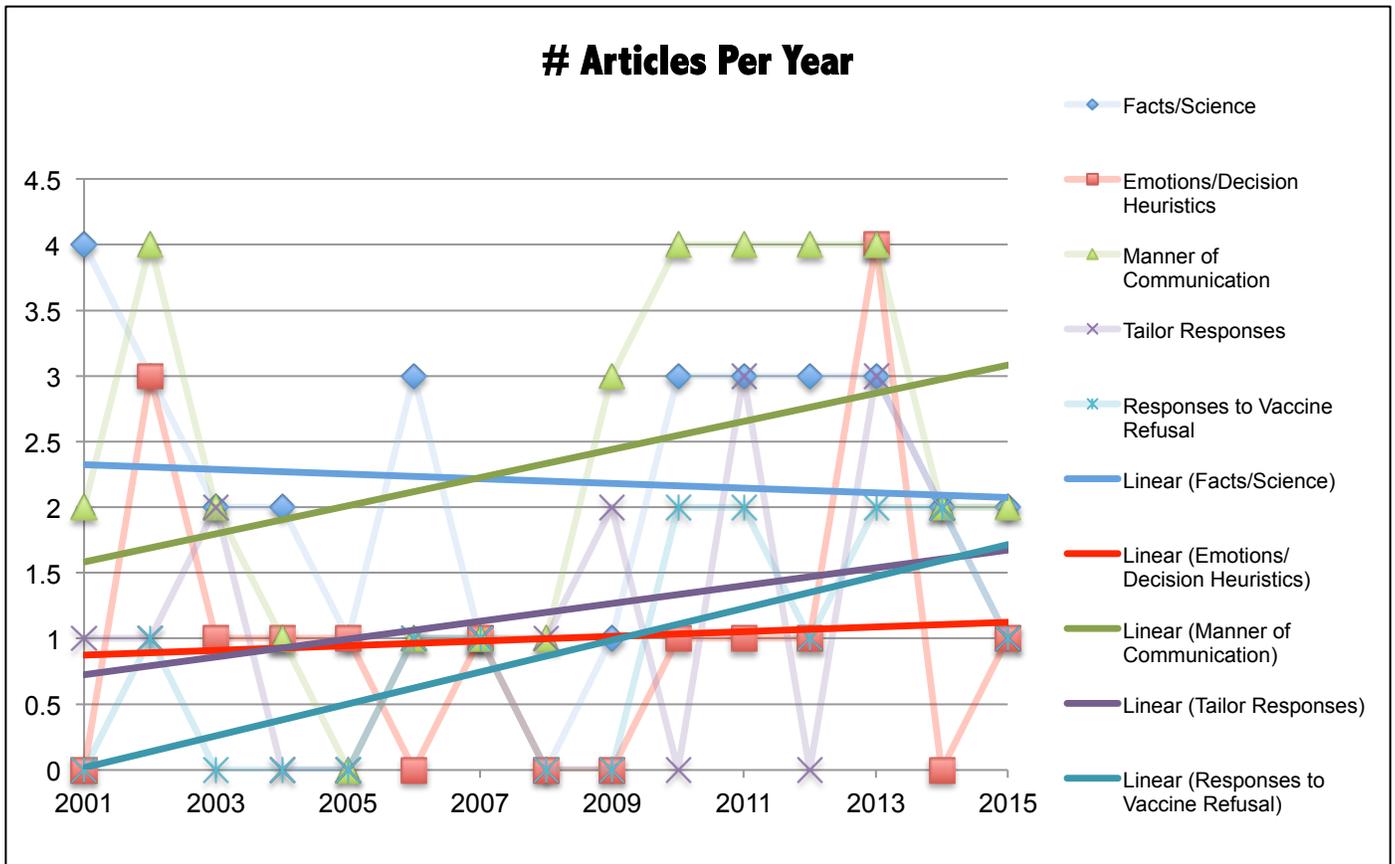
**Figure 1.** Flowchart of the search strategy. A broad search was performed on PubMed and Embase using terms representing the search criteria. This yielded 2613 articles, which were screened by title, abstract, and full-text. 150 sources accepted by title or abstract could not be found. As a result, 52 full-texts were analyzed by the investigator.

Year	Type of Article	Title	Author(s)	
2013	Commentary	Cochrane in context: Vaccines for measles, mumps and rubella in children	Demicheli, V., Rivetti, A., Debalini, M. G., Di Pietrantonj, C.	
2013		Telling stories of vaccine-preventable diseases: why it works	Cunningham, R. M., Boom, J. A.	
2012		Dispelling vaccine myths: MMR and considerations for practicing pharmacists	Mormann, M., Gilbertson, C., Milavetz, G., Vos, S.	
2010		Communicating with parents of children with autism about vaccines and complementary and alternative approaches	Gupta, V. B.	
2007		Preserving relationships with antivaccine parents	Fortune, J., Wilson, K.	
2004		Vaccine safety: No link between thimerosal and autism	Hayney, M. S.	
2003		Immunization myths and realities: responding to arguments against immunization	MacIntyre, CR., Leask, J.	
2009	Conference summary report	A summer school on vaccinology: Responding to identified gaps in pre-service immunisation training of future health care workers	Vorsters, A., Tack, S., Hendrick, G., Vladimirova, N., Bonanni, P., Pisto, A., Metlicar, T., Alvarez Pasquin, M.J., Mayer, M.A., Aronsson, B., Heijbel, H., Van Damme, P.	
2002		Vaccination and risk communication: Summary of a workshop, Arlington Virginia, USA, 5-6 October 2000	Leask, J.	
2015	Content analysis study	Googling for information about alternative vaccination schedules	Babaoff, C., D'Auria, J. P.	
2005		Vaccine criticism on the world wide web	Zimmerman, R. K., Wolfe, R. M., Fox, D. E., Fox, J. R., Nowalk, M. P., Troy, J. A., Sharp, L. K.	
2014	Cross-sectional study	Immunization uptake in younger siblings of children with autism spectrum disorder	Kuwait, G. A., Roberts, W., Zwaigenbaum, L., Bryson, S., Smith, I. M., Szatmari, P., Modi, B. M., Tanel, N., Brian, J.	
2013		Does the relative importance of MMR vaccine concerns differ by degree of parental vaccine hesitancy?	Gowda, C., Schaffer, S. E., Kopec, K., Markel, A., Dempsey, A. F.	
2014	Editorial	Vaccine safety activists on the Internet	Wolfe, R. M.	
2014		Understanding vaccines: a public imperative	Federman, R. S.	
2011		Straight talk about vaccination	Daley, M. F., Glanz, J. M.	
2009		A new method for dealing with ethical issues in the area of vaccines and vaccination	Spier, R.	
2009		There is no evidence that...	Kushner, B.	
2009		How to "Be wise and immunize!" in the information age	Killeen, R.	
2008		Improving uptake of MMR vaccine	McIntyre, P., Leask, J.	
2004		How many more times do I have to tell you?	Easton, G.	
2001		10-minute consultation: MMR immunisation	Harnden, A., J. Shakespeare	
2002		Antivaccination web sites	Davies, P.	
2002	Letter to the editor	Antivaccination web sites	Abbey, D. M.	
2002		Antivaccination web sites	Wolfe, R. M.	
2001	Health professionals should strongly recommend this immunisation	Elliman, D., Bedford, H.		
2001	Focus group study	Parents' perspectives on the MMR immunisation: a focus group study	Evans, M., Stoddart, H., Condon, L., Freeman, E., Grizzell, M., Mullen, R.	
2010	Policy statement	Increasing immunization coverage	Committee on Practice and Ambulatory Medicine and Council on Community Pediatrics (American Academy of Pediatrics)	
2006	Review	Factors underlying suboptimal childhood immunisation	Tickner, S., Leman, P. J., Woodcock, A.	
2015		Vaccine safety: Medical contraindications, myths, and risk communication	Smith, M.	
2013		Building confidence in vaccines	Smith, J. C., Appleton, M., MacDonald, N. E.	
2013		Story and science	Shelby, A., Ernst, K.	
2013		Working with vaccine-hesitant parents	MacDonald, N. E., Finlay, J. C.	
2012		Anti-vaccination movement and parental refusals of immunization of children in USA	Olpinski, M.	
2012		Responding with empathy to parents' fears of vaccinations	Haller, K., Scalzo, A.	
2012		Addressing public questioning and concerns about vaccination in South Africa: A guide for healthcare workers	Burnett, R. J., Larson, H. J., Moloi, M. H., Tshatsinde, E. A., Meheus, A., Paterson, P., Francois, G.	
2011		Vaccination refusal: ethics, individual rights, and the common good	Schwartz, J. L., Caplan, A. L.	
2011		Addressing the vaccine confidence gap	Larson, H. J., Cooper, L. Z., Eskola, J., Katz, S. L., Ratzan, S.	
2011		How to communicate with vaccine-hesitant parents	Healy, C. M., Pickering, L. K.	
2010		Navigating parental vaccine hesitancy	Smith, M. J., Marshall, G. S.	
2010		The anti-vaccination movement and resistance to allergen-immunotherapy: a guide for clinical allergists	Behrmann, J.	
2009		Autism: An update	Goldson, E.	
2007		Addressing immunization barriers, benefits, and risks	Kimmel, S. R., Burns, I. T., Zimmerman, R. K.	
2006		Vaccine refusal: Issues for the primary care physician	Lyren, A., Leonard, E.	
2006		Immunizations and autism: a review of the literature	Doja, A., Roberts, W.	
2003		Communicating science to the public: MMR vaccine and autism	Offit, P. A., Coffin, S. E.	
2002		Immunization and children at risk for autism	Roberts, W., Harford, M.	
2002		Perception of risk of vaccine adverse events: a historical perspective	Spier, R. E.	
2001		Challenges and controversies in immunization safety	Chen, R. T., DeStefano, F., Pless, R., Mootrey, G., Kramarz, P., Hibbs, B.	
2012		Semi-structured interviews	UK parents' decision-making about measles-mumps-rubella (MMR) vaccine 10 years after the MMR-autism controversy: A qualitative analysis	Brown, K. F., Long, S. J., Ramsay, M., Hudson, M. J., Green, J., Vincent, C. A., Kroll, J. S., Fraser, G., Sevdalis, N.
2004		Survey	Parental vaccine safety concerns: The experiences of pediatricians and family physicians	Freed, G. L., Clark, S. J., Hibbs, B. F., Santoli, J. M.
2001		Testimonial	Cybersearch: Quick clicks to answer clinical questions	Risdon, C.

**Figure 2.** Table of the 52 articles analyzed in the study. Publication year, type of article, title, and authors are provided.

<b>Explanations and Arguments</b>	<b>40</b>		<b>% (out of 40)</b>	<b>Manner of Communication</b>	<b>35</b>	<b>% (out of 35)</b>
<b>Appeal to Facts or Science</b>	<b>33</b>	<b>% (out of 33)</b>	<b>82.5</b>	Foster trust	10	28.6
Discuss dangers of non-vaccination	10	30.3	25	Engage parents in dialogue	7	20.0
Acknowledge risks of vaccinating	9	27.3	22.5	Listen carefully, respectfully, and empathetically	8	22.9
Explain evidence and research	12	36.4	30	Avoid defensive or judgmental behavior	7	20.0
Explain the scientific theories behind vaccines	5	15.2	12.5	Tailor response to the individual family or specific concerns	18	51.4
Provide references to scientific/medical literature	19	57.6	47.5	Avoid technical or scientific language	7	20.0
<b>Make Use of Parents' Emotions or Decision Heuristics</b>	<b>15</b>	<b>% (out of 15)</b>	<b>37.5</b>	<b>Responses to Vaccine Refusal</b>	<b>13</b>	<b>% (out of 13)</b>
Do not rely on reason, evidence, and education	6	40.0	15	Do not discontinue medical care	8	61.5
Tell stories	9	60.0	22.5	Perhaps discontinue medical care	2	15.4
Exploit decision heuristics	6	40.0	15	Permit alternative vaccine schedules	3	23.1

**Figure 3.** Table of recommendations. Articles were read by a single investigator and recommendations to HCPs for responding to parents' vaccine safety concerns in the clinical context were identified. They were found to generally correspond to three themes: explanations and arguments for vaccine safety, manner of communication, and responses to vaccine refusal. One recommendation per minor category, e.g. 'tell stories', per publication was counted. The majority (82.5%) of recommended explanations and arguments were appeals to facts or science. In addition, more than half (51.4%) of recommendations related to manner of communication emphasized tailoring responses to the concerns and backgrounds of individual families. Finally, most recommended responses to vaccine refusal (61.5%) urged HCPs to avoid discontinuing medical care.



**Figure 4.** Frequency of types of recommendations from 2001 to 2015. First, the number of articles published each year making recommendations to appeal to facts or science, appeal to emotions or decision heuristics, adjust manner of communication, individualize responses, and respond to vaccine refusal in some way were scatter-plotted. Next, trend lines for each category of recommendation were generated using Microsoft Excel 14.5.5. It appears that appeals to facts or science are slightly less frequently recommended in 2015 than in 2001. In addition, the manner of communication, including the tailoring of responses, and responses to vaccine refusal have increased in mention. In contrast, appeals to emotions or decision heuristics have remained mostly constant in frequency over the 15-year period.

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