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## Communication Strategies to Address Vaccine Hesitancy in Healthcare Settings and on Social Media

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## Communication Strategies to Address Vaccine Hesitancy in Healthcare Settings and on Social Media

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## Introduction

In 2019, the World Health Organization (WHO) listed vaccine hesitancy under its top ten threats to global health.<sup>1</sup> The organization's Strategic Advisory Group of Experts on Immunization working group asserted that "vaccine hesitancy is complex and context specific, varying across time, place and vaccines. It is influenced by factors such as complacency, convenience and confidence."<sup>2</sup> As this statement suggests, vaccine hesitancy can have a variety of causes and is best thought of as a spectrum of concerns. People may be vaccine hesitant simply because they fear the pain associated with an injection, or they may have more complicated concerns about vaccine ingredients or alleged side effects. When discussing approaches to communication, it helps to differentiate vaccine-hesitant individuals from anti-vaccine individuals. Vaccine-hesitant people question vaccines but have not necessarily made a decision about vaccination yet and may be persuaded to immunize. Anti-vaccine individuals have already made a decision not to vaccinate and are difficult to persuade otherwise. Although anti-vaccine individuals are difficult to persuade, it is important to keep communication open with them, as they may switch to vaccine hesitant and eventually to vaccine accepting with time and experience.

It is important to recognize vaccine hesitancy and address it early before it leads to vaccine refusal. Vaccine refusal is increasing both nationally and in Texas. The National Immunization Survey-Child 2018 found that 1.3% of children born in 2015-2016 had zero doses of vaccines, which is an increase from 0.9% of children born in 2011.<sup>3</sup> This refusal increase is also reflected in increasing numbers of kindergarteners who claim vaccine exemption upon school entry in the United States.<sup>4</sup> In Texas, parents who choose not to vaccinate their children can file for a "conscientious exemption" to school vaccine requirements. In 2003, the first year conscientious exemptions were allowed in Texas, there were 2314 exemptions filed.<sup>5</sup> By the 2018-2019 school year, this number had exploded to 64,176 exemptions filed.<sup>6</sup> To help reverse this trend, it is important for healthcare providers and parent advocates to address the issues important to vaccine-hesitant patients and parents. In this article we describe best-practice communication techniques to address vaccine hesitancy, both from the perspective of a primary pediatric provider persuading parents of patients in the office setting, and of a parent vaccine advocate addressing vaccine hesitancy on social media.

## Healthcare Provider Communication with Vaccine-Hesitant Parents

Healthcare provider communication with patients and parents is an essential target of any effort to decrease vaccine hesitancy. In its 2016 statement, “Countering Vaccine Hesitancy”, the American Academy of Pediatrics (AAP) Committee on Infectious Diseases and Committee on Practice and Ambulatory Medicine concluded that communication with a caring, trusted, and concerned provider is the most important factor in eventual parent vaccine acceptance.<sup>7</sup> Multiple studies have shown strong provider recommendation is one of the most important determinants of ultimate vaccine acceptance in vaccine-hesitant parents.<sup>8–13</sup> In fact, a study by Opel et al found when physicians persistently engaged parents on vaccines during the same visit, 47% of parents who were initially resistant ultimately accepted vaccination.<sup>14</sup> Communication between the parent and provider can be broken down into two stages: the introduction of the need for vaccination, and the discussion of any vaccine concerns. These are conversations which might need to be repeated over multiple visits.

The first stage in provider vaccine communication involves initial introduction of the need for vaccination. There is evidence that using a “presumptive” style of communication, rather than a “participatory” style, is associated with a higher likelihood of vaccine acceptance by the parent.<sup>14–19</sup> In presumptive styles of communication, the provider initiates the topic of vaccination presuming the patient will be vaccinated at the visit. Examples of a presumptive introduction to the discussion are as follows: “Maria is due for three vaccines today: Tdap, HPV, and meningitis” or “When I am done with the exam, the nurse will be in to give Alex his flu shot.” This is in contrast to the participatory style, in which the provider may still be recommending vaccination, but it is done in a way that asks for parent participation and may invite doubt into the discussion. With this participatory style the provider might say, “Are we going to give Maria her vaccines today?” or “Do you want Alex to get the flu vaccine this year?”<sup>14</sup> Although it may seem awkward at first to some providers who are used to using a participatory style when it comes to vaccine conversations to switch to a presumptive style, this style mimics the communication used for introduction of many medical treatments where the provider assumes that the parent wants evidence-based care. For example, when an asthmatic child is found to be wheezing on exam, a typical provider might say, “I am going to give some albuterol now to open up Elizabeth’s airways” (presumptive style) rather than “Do you want to give albuterol now?” (participatory style). In the vaccination context, if the parent consents to vaccination, and they have had the opportunity to review the Vaccine Information Statement provided

by the Center for Disease Control and Prevention (CDC) outlining the risks and benefits of vaccination, then the vaccine conversation may end there. If the parent has questions or concerns about the proposed immunization after the presumptive style is initially used, then the discussion moves into the second stage and switching communication styles becomes important.

If the parent expresses concern or has questions about vaccination, it is imperative for providers to address those in an honest, straightforward manner.<sup>7</sup> Even when they express concerns, parents cite the advice of their child's provider as a strong influence on their decision to vaccinate.<sup>8</sup> Studies show it is important for providers to persist at this point during the same visit.<sup>10,14</sup> At this point in the vaccine conversation (ie, after the presumptive statement has already been made and the parent has further questions), the literature does not point to any one communication style or technique as superior over another.<sup>17,20-26</sup> Some studies have looked at motivational interviewing as a method to increase provider confidence in communication and to increase vaccination rates.<sup>27-29</sup> Motivational interviewing is defined as "a collaborative conversation style for strengthening a person's own motivation and commitment to change."<sup>30</sup> A promising study described the use of motivational interviewing as one component of a successful intervention to increase human papillomavirus (HPV) vaccination rates.<sup>27</sup> Although researchers are working on briefer educational sessions, motivational interviewing when taught and practiced as originally described is time consuming, taking as long as 9 hours to teach and 10-20 minutes of healthcare provider time during the visit.<sup>31</sup> Some experts have developed shorter communication models based on the principles behind motivational interviewing to increase parent vaccine confidence and motivation. These include the Corroborate, About Me, Science, Explain (CASE) model; the Elicit, Acknowledge, Share, Explain (EASE) model; and the Ask, Acknowledge, Advise model.<sup>17</sup> These have in common the goals of drawing out concerns, recognition of concerns without judgement, offering evidence-based information, and strongly recommending vaccination. As an example of a model that the authors have found to be helpful, the CASE model is described in the following paragraphs. Developed by Allison Singer at the Autism Science Foundation, the CASE model is a brief, structured, and easily taught way for providers to address parent vaccine concerns.<sup>20,32-34</sup> In this model, the provider "Corroborates" that the parent and provider are working together, provides an "About Me" statement to establish knowledge, addresses the "Science" related to the concerns, and "Explains" the provider's advice to vaccinate.<sup>34,35</sup>

After eliciting the specific concern from the parent, the CASE model calls on the provider to begin this part of the discussion by establishing

rapport with parents and acknowledging their concerns.<sup>34,35</sup> It is crucial that the overall tone is one of respect, not one of dismissal or annoyance. The purpose of this statement is to establish the provider and parent as on the same “team” working for the good of the patient. Once it is established that the provider and parent are working together, it is important to describe why the provider is an important member of the team. The CASE model suggests providers give an “About Me” statement to establish how they have authority on the subject matter.<sup>34,35</sup> The goal here is just a short statement to show the parent that the provider has the educational training to assert the scientific statement which will come next.

Crucial to any communication with vaccine-hesitant parents is discussion of the science which addresses their specific questions or concerns. In order to do this, it is incumbent on providers to know the science, and to know where to go for evidence-based information about any questions or concerns for which they do not immediately know the answers. Fortunately, there are several excellent resources for this information. The CDC has a website on vaccine safety that links to specific information by vaccine and by common parent concerns (<https://www.cdc.gov/vaccinesafety/index.html>). If the provider wants to read the source literature on vaccine safety issues, the AAP has a list of resources on its website (<https://www.healthychildren.org/English/safety-prevention/immunizations/Pages/Vaccine-Studies-Examine-the-Evidence.aspx>). The AAP’s 2016 statement “Countering Vaccine Hesitancy” contains information on how vaccines are assessed and monitored for safety, as well as evidence on how to address common parent concerns about vaccine contents and the number of vaccines.<sup>7</sup> The 2019 clinical review “Addressing Vaccine Hesitancy” by Shen and Dubey has a table that provides brief answers to commonly asked questions which would fit well into the “science” statement for the CASE model.<sup>26</sup> For examples of “science” statements for influenza vaccine, see Table 1. It is important in the discussion of the science for the provider to address only the specific question asked by the parent. If the provider discusses other common concerns, they may unintentionally give the parent new areas of concern.

Common Parent Concerns <sup>13,36,37</sup>	Sample Response
I heard that the vaccine doesn't work very well.	Even if the vaccine is not 100% effective, it will decrease your child's chance of catching the flu, developing serious complications like pneumonia, and becoming hospitalized or dying from the flu. <sup>38,39</sup>
The flu vaccine gave me the flu.	The vaccine is not scientifically able to cause the flu. You can have side effects such as feeling achy or a sore arm, or rarely fever, but that is not the flu. It is part of your body's immune response to the vaccines, and these symptoms last for only a day or two. <sup>40</sup>
The flu vaccine has side effects.	You can have side effects such as feeling achy all over, having a sore arm, or rarely fever. These side effects are all much less severe than the flu infection itself. <sup>40</sup>
We never get the shot and we've never had the flu.	Each year in the US, the flu causes between 9.3 and 49 million cases of illness and 12,000 to 79,000 deaths. Not everyone catches it, but your chances are high enough that it is worth it to vaccinate. <sup>41</sup>

Table 1. Examples of "Science" Statements for Flu Vaccine Concerns

The last component of the CASE model for communication with vaccine-hesitant parents is for providers to "explain" their recommendations.<sup>34,35</sup> This last statement can be an opportunity for the provider to incorporate brief personal anecdotes into the discussion, which several studies have recommended as a method to combat anti-vaccine propaganda.<sup>7,42-44</sup> These should be brief, but powerful, statements that bring the communication from a scientific discussion to a more emotional one. The intent is for the provider to give both logical and emotional arguments in support of vaccination, since the parent may find one type of argument more persuasive.<sup>34</sup> Figure 1 below gives an example of a conversation using the CASE method with a parent concerned about the flu vaccine. All members of the healthcare team should practice

communication strategies prior to patient encounters and be prepared to answer common vaccine concerns.

**Provider:**  
It is the time of year for your daughter to get her flu vaccine. My nurse will come in after I am done here to give it today.

**Parent:**  
I'm not sure about the flu vaccine. I've heard it doesn't work that well. What's the point?

**Provider:**  
I'm so glad you asked me this question. I know we both want what is best for your child. I keep up on the science on this and just read an article about it the other day. Even if the vaccine is not 100% effective, it will decrease your child's chance of catching the flu, developing serious complications like pneumonia, and becoming hospitalized or dying from the flu. The reason I feel so passionately about this vaccine is that every year we see perfectly healthy kids die of the flu and I would be devastated if that were your child.

Figure 1. Sample conversation using CASE model.

### **Communication with Vaccine-Hesitant Patients and Parents on Social Media**

In addition to addressing vaccine hesitancy in the clinical setting, it is important that vaccine advocates engage with vaccine-hesitant parents on social media. Messages from health care providers and scientific journals are often slow in reaching the general population and are insufficient to address vaccine hesitancy on their own.<sup>45,46</sup> Increasing numbers of people are turning to the Internet to discuss health decisions and using information sourced from social media outlets to influence their decision-making when it comes to vaccines.<sup>47-50</sup> In some cases, information from a social circle or an individual seen as an ally can be perceived as more valuable than information delivered by a medical provider.<sup>51-53</sup> Studies have shown that while comment forums on news articles and outlets like Facebook and Twitter lead to polarization,<sup>48,54</sup> there is room for directing messages towards those who are vaccine hesitant, pregnant, or adolescents and children who will eventually become responsible for vaccination decisions for themselves or their children.<sup>47,49,51,55-58</sup> Additionally, certain social media



outlets and fundraising sites, such as Facebook, Instagram, and GoFundMe, have attempted to take action to combat misinformation by redirecting searches for vaccines to reputable sources, blocking anti-vaccine hashtags from their platforms, and removing anti-vaccine content, but it is proving to be a difficult problem to tackle.<sup>59–61</sup>

Unfortunately, vaccine-related material available online currently is of mixed quality, and users are often brought to anti-vaccine websites that propagate myths and conspiracy theories.<sup>62</sup> This sometimes leads to instances where, in seeking quality information about vaccines, a person will encounter anti-vaccine literature disguised as evidence-based and factual.<sup>63</sup> Research and our own experience show that anti-vaccine arguments and tropes are often repetitive and fall into broad categories: 1) professed loss of medical freedom (“my body, my choice”); 2) perceived parental knowledge and intuition as superior to medical and scientific expertise; 3) supposed lack of informed consent (eg, requiring vast amounts of information, such as the vaccine excipient list, to qualify as informed consent); 4) fear of “Big Pharma’s” vested interests and profits leading to cover-ups and biased studies; 5) alleged side effects of vaccines, covering myriad conditions including ones that have been demonstrated to have no connection to vaccination; 6) the perceived benign nature of vaccine-preventable diseases (“measles was considered a mild childhood disease”); 7) professed vaccine ineffectiveness (eg, flu vaccine being less than 100%); 8) claims of being pro-vaccine safety as opposed to anti-vaccine; 9) preferred “natural” diseases over “unnatural” vaccines; 10) claims of other causes for decreasing disease incidence (such as sanitation); and 11) allegations of being persecuted for speaking “the truth.”<sup>48,49</sup> Others have narrowed the topics to five core ones: 1) threat of disease; 2) alternatives to vaccines; 3) effectiveness of vaccines; 4) trust in health authorities; and 5) safety of vaccines.<sup>64</sup>

While it is tempting to spend a great deal of time refuting the above anti-vaccine arguments in an effort to encourage individuals who are anti-vaccine to vaccinate, this tactic produces negligible results because it often leads to a strengthening of anti-vaccine beliefs and a stronger adherence to misinformation.<sup>43,48</sup> Providing corrective information about vaccines can actually lead to a decrease in the intent to vaccinate while also reducing misperceptions in strongly anti-vaccine individuals.<sup>65</sup> However, it is important again to separate the people who are anti-vaccine from those who are vaccine hesitant when thinking about effectiveness of social media approaches to affect vaccination decisions. While anti-vaccine users are very vocal online, vaccine-hesitant individuals are more likely to be silent observers and exposure to social media content may be responsible for

their vaccine hesitancy.<sup>49,50,56,66</sup> Vaccine-hesitant individuals are also more likely to seek vaccine information, leading to a cycle where searching for answers leads users to anti-vaccine content, thereby increasing hesitancy.<sup>51</sup> Due to the increased likelihood of persuading a vaccine-hesitant individual over someone who is anti-vaccine, websites like Vaccines Today define their goal as targeting vaccine-hesitant individuals instead of anti-vaccine individuals and organizations.<sup>62</sup> Simply viewing pro-vaccine messages may influence vaccine-hesitant people to more favorably view vaccines and give less weight to assertions that have been proven false.

As the social media landscape evolves, patterns and comparisons emerge from user-generated content relating to vaccination. Anti-vaccination misinformation is easy to find and lends itself to “going viral” and self-propagating.<sup>49,54,62,67,68</sup> Pro-vaccine advocates are now in the position of trying to combat that misinformation. However, the two sides show several differences in their approach. Pro-vaccine users in spaces like Twitter grew in numbers and pro-vaccine content was far more voluminous than anti-vaccination content overall between 2010 and 2019. In comparison, anti-vaccine accounts, while still significantly smaller in total number when compared to pro-vaccine accounts, nearly doubled between 2015 and 2018 and displayed a more cohesive system.<sup>69</sup> Analysis of Facebook users similarly indicates the pro-vaccine community is more fragmented than the anti-vaccine community.<sup>54</sup> As demonstrated in the list of common anti-vaccine messages above, through a reliance on language that is more digestible by the average person and more definitive, anti-vaccine content more closely embodies an echo chamber, wherein those consuming the content strengthen their preconceived notions and beliefs.<sup>48–50,54</sup> In contrast, pro-vaccine messages tend to be more technical, with links to paywalled articles, and less certain in their conclusions.<sup>48</sup> While it has been argued that shaming vaccine deniers might influence vaccine-hesitant parents,<sup>55</sup> there is no conclusive supporting evidence of this assertion. Instead, sarcasm and ridicule have not been shown to be persuasive in convincing users on the other side; their use leads to sarcastic or ridiculing statements in response or reinforcement of convictions between people who are already on the same side.<sup>48</sup>

A byproduct of social media’s encouragement of everyday users to create information is that appeals to authority and traditional measures of expertise have diminished.<sup>49</sup> In today’s world, facts, on their own, cannot change behavior.<sup>49,62</sup> It is important for pro-vaccine advocates to use tactics that emphasize a collaborative approach to vaccine decision-making and appeal to the needs and wants of vaccine-hesitant individuals.<sup>43,70</sup> When

sharing content, instead of sharing information that consists solely of evidence-based statistical information, articles or statements that also contain a bottom-line meaning or “gist” should be used.<sup>71</sup> For example, instead of relying on an evidence-based statement alone (“Measles can lead to pneumonia, deafness, lifelong brain damage, or even death and almost one-third of children with measles have to be hospitalized”), one could add on a gist (“Measles is serious and vaccination is the best way to protect your child from serious complications”). Content containing storytelling or direct answers to questions from vaccine-hesitant individuals are popular.<sup>43,62</sup> In addition, incorporating a feature on a website where users can ask experts questions and quality vaccine information can be provided in response can improve the likelihood of users vaccinating their children on time.<sup>47</sup> The choice of media type can also have an effect. Videos and other visually stimulating materials are more appealing over purely text-based content.<sup>62</sup> For instance, games and simulations using videos could be used to depict complex vaccination concepts.<sup>72</sup>

When developing a social media policy, advocates need to commit to a continuous process. Monitoring and analyzing engagement should be constant.<sup>43</sup> Pro-vaccine advocates should also passively involve themselves in anti-vaccine echo chambers to gain an understanding of the arguments that are trending and an insight into the motivations behind anti-vaccine activity.<sup>54</sup> It is also crucial for advocates to be aware of how quickly social media outlets and technology change. Over relatively short lengths of time, social media platforms may come and go, so it is important to recognize and respond accordingly if a method is outdated or needs adjustment.<sup>47,58</sup> Finally, it is recommended that pro-vaccine advocates and networks coordinate and share information to improve effectiveness and reach.<sup>62</sup>

Recently, projects aimed at improving vaccine uptake have placed emphasis on recruiting community members to advocate for vaccines.<sup>23,73</sup> For instance, parents who vaccinate can reduce vaccine hesitancy by vocalizing their reasons for vaccinating and thereby encourage adherence to the social norm of vaccinating.<sup>55,73,74</sup> Furthermore, messages promoting vaccine acceptance should be aimed at members of a parent’s social network in addition to parents themselves.<sup>52</sup> In our experience, both professionals and laypeople should advocate from a personal point of view. (see figure 2 below for a sample online conversation). Several toolkits and materials are available from sources such as the AAP and CDC to assist providers in framing and communicating their pro-vaccine messages. [\[https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/immunizations/Practice-Management/Pages/Immunization-](https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/immunizations/Practice-Management/Pages/Immunization-)

[Social-Media-Toolkit.aspx](#)

[\[https://www.cdc.gov/vaccines/partners/vaccinate-with-confidence.html\]](https://www.cdc.gov/vaccines/partners/vaccinate-with-confidence.html)

While establishing oneself as an authority by virtue of education or profession should not be avoided, due to the inherent difference between the social media setting and clinical settings, pro-vaccine advocates with a background in healthcare and/or science should use natural voices that rely on personal experiences coupled with facts and citations. The tone used should be gentle but firm, while exercising care to not push people into a more extreme position or encourage finding other reasons to oppose vaccination beyond the one being discussed at that point and time.<sup>75</sup>

**Parent on social media group:**

I am worried about my child's upcoming vaccines because after her last round of shots, she had several days of high fevers. What should I do???

**Sample response from healthcare professional in that group:**

I'm so sorry to hear about your child's fevers. My own child had the same experience after her 4-month shots and I know how scary it can be. Unfortunately, fevers are an entirely normal side effect of vaccines. In my own practice, I see it sometimes and I can assure you that all my patients have recovered with no long-term side effects. It is still very important for your child to be vaccinated on schedule to protect against some scary diseases. I'm linking to an article that discusses what happens in the body when we have a fever and what it means for our immune system. If you have any questions, feel free to message me.

Figure 2: Sample online conversation.

Immunize Texas is a pro-vaccine group of advocates from the general community. Similar to other groups and organizations that combat vaccine misinformation, such as CICADA (Community Immunity Champions and Defenders Association) and Shots Heard Round the World, Immunize Texas content is mainly propagated through the public Facebook page. After our own trial-and-error process and careful monitoring of analytics such as our number of likes, shares, and comments, the Immunize Texas page has developed its own set of posting and commenting guidelines. For instance, when the Immunize Texas page shares scientific studies or public health information, it is worded plainly so that any layperson will be able to comprehend the gist of the message. While information could be shared directly from scientific journal articles, we prefer to share the same message from more easily accessible sources that already have a large following and established credibility, such as *The New*

*York Times* or *Forbes*. The Immunize Texas page rarely engages with anti-vaccine users who may leave anti-vaccine messages in the comments, and when responses are provided, it is with the goal of demonstrating the fallacies of the anti-vaccine argument(s) to vaccine-hesitant individuals. If our page receives a large number of comments from anti-vaccine individuals, instead of the official page responding, we prefer to have pro-vaccine advocates in our network respond as individuals and encourage them to post positive messages supporting vaccination and refrain from sarcasm and ridicule. Our posts that utilize visual media such as informative videos or infographics, rather than just plain text, are viewed thousands of times and shared within personal networks. We also receive support and provide support to other pro-vaccination pages to build up our network and enhance our community. With consistent messaging and regular content generation, the number of Facebook page followers has grown considerably since our beginnings in 2016. We now have over 3000 followers, and our posts regularly receive dozens of likes, shares, and comments.

## **Conclusion**

Vaccine hesitancy can have a variety of causes and should be thought of as a spectrum of concerns. There is an opportunity to persuade vaccine-hesitant individuals to vaccinate, and it is important to identify them early before they become vaccine refusers. One of the most important strategies to increase vaccine uptake is improved healthcare provider communication. Using a presumptive style of communication instead of a participatory style when introducing the topic of vaccines increases vaccine acceptance. If an individual expresses vaccine concerns following introduction of the topic, there are various proposed communication models that providers might choose from to motivate parents towards vaccine acceptance. Most models are based on the principles of motivational interviewing, which attempts to use a conversational and collaborative style to motivate change. Based on personal experience, the authors recommend utilizing the CASE model as a brief intervention. In contrast to the clinical setting, on social media the most visible discussions are often between polarized groups of pro-vaccine supporters and anti-vaccine activists. Vaccine-hesitant individuals act as silent observers in this interaction, and their ultimate decisions relating to vaccines can be swayed for emotional and psychosocial reasons. Despite the relatively smaller percentage of anti-vaccine users that exist both in the real world and on social media, anti-vaccine content online is disproportionately present because it is simpler, appeals to emotion, and is

easily shareable. Rather than targeting vaccine refusers, pro-vaccine advocates should be conscientious in targeting vaccine-hesitant users when creating content or commenting online. Pro-vaccine users should use a collaborative tone in their messages and generate or share content that appeals to everyday people. Actively creating networks and inviting participation from voices outside the healthcare provider and scientific communities are crucial for addressing vaccine hesitancy. Future studies should evaluate the effectiveness of the CASE model and our approach to social media content on both the influence on long-term attitudes towards vaccines in vaccine-hesitant individuals and whether it leads to greater vaccine uptake. While our methods require an investment of time and effort, engaging in a more comprehensive approach to vaccine-hesitant individuals can reverse the current trends of vaccine refusal that threaten public health both locally and globally.

### References

1. Friedrich MJ. WHO's top threats for 2019. *JAMA*. 2019;321(11):1041.
2. MacDonald NE, SAGE Working Group on Vaccine Hesitancy. Vaccine hesitancy: definition, scope and determinants. *Vaccine*. 2015;33:4161-4164.
3. Hill HA, Singleton JA, Yankey D, Elam-Evans LD, Pingali SC, Kang Y. Vaccination coverage by age 24 months among children born in 2015 and 2016—National Immunization Survey-Child, United States, 2016-2018. *Morbidity and Mortality Weekly Report*. 2019;68(41):913-918.
4. Mellerson JL, Maxwell CB, Knighton CL, Kriss JL, Seither R, Black CL. Vaccination coverage for selected vaccines and exemption rates among children in kindergarten—United States, 2017-18 school year. *Morbidity and Mortality Weekly Report*. 2018;67(40):1115-1122.
5. Texas Department of State Health Services. Conscientious exemption affidavits submitted to schools for school year 2003-04. <https://www.dshs.state.tx.us/immunize/coverage/conscientious.shtml> Published 2004. Updated September 30, 2016. Accessed April 14, 2020.
6. Texas Department of State Health Services Immunization Unit. Annual report of immunization status of students 2018-2019 school

year.

<https://webcache.googleusercontent.com/search?q=cache:CAExGLZ2caAJ:https://www.dshs.texas.gov/immunize/coverage/pdf/2018-2019-Annual-Report-of-Immunization-Status-of-Students.pdf+&cd=2&hl=en&ct=clnk&gl=us&client=safari>. Published 2019. Accessed October 15, 2019.

7. Edwards KM, Hackell JM, American Academy of Pediatrics Committee on Infectious Diseases; Committee on Practice and Ambulatory Medicine. Countering vaccine hesitancy. *Pediatrics*. 2016;138(3):e20162146.
8. Smith PJ, Stokley S, Bednarczyk RA, Orenstein WA, Omer SB. HPV vaccination coverage of teen girls: the influence of health care providers. *Vaccine*. 2016. 42(13): 718-725.
9. Gust DA, Darling N, Kennedy A, Schwartz B. Parents with doubts about vaccines: which vaccines and reasons why. *Pediatrics*. 2008;122(4):718-725
10. Shay LA, Baldwin AS, Betts AC, et al. Parent-provider communication of HPV vaccine hesitancy. *Pediatrics*. 2018;141(6):e20172312.
11. Leask J, Kinnersley P, Jackson C, Cheater F, Bedford H, Rowles G. Communicating with parents about vaccination: a framework for health professionals. *BMC Pediatr*. 2012;12:154.
12. Malo TL, Gilkey MB, Hall ME, Shah PD, Brewer NT. Messages to motivate human papillomavirus vaccination: national studies of parents and physicians. *Cancer Epidemiol Biomarkers Prev*. 2016;25(10):1383-1391.
13. Imburgia TM, Hendrix KS, Donahue KL, Sturm LA, Zimet GD. Predictors of influenza vaccination in the U.S. among children 9–13 years of age. *Vaccine*. 2017;35(18):2338-2342.
14. Opel DJ, Heritage J, Taylor JA, et al. The architecture of provider-parent vaccine discussions at health supervision visits. *Pediatrics*. 2013;132(6):1037-1046.

15. Sturm L, Donahue K, Kasting M, Kulkarni A, Brewer NT, Zimet GD. Pediatrician-parent conversations about human papillomavirus vaccination: an analysis of audio recordings. *J Adolesc Health*. 2017;61(2):246-251.
16. Moss JL, Reiter PL, Rimer BK, Brewer NT. Collaborative patient-provider communication and uptake of adolescent vaccines. *Soc Sci Med*. 2016;159:100-107.
17. Brewer NT, Chapman GB, Rothman AJ, Leask J, Kempe A. Increasing vaccination: putting psychological science into action. *Psychol Sci Public Interest*. 2017;18(3):149-207.
18. Kempe A, O'leary ST, Markowitz LE, et al. HPV vaccine delivery practices by primary care physicians. *Pediatrics*. 2019;144(4):e2011475.
19. Dempsey AF, Pyrzanowski J, Campagna EJ, Lockhart S, O'Leary ST. Parent report of provider HPV vaccine communication strategies used during a randomized, controlled trial of a provider communication intervention. *Vaccine*. 2019;37(10):1307-1312.
20. Williams SE. What are the factors that contribute to parental vaccine-hesitancy and what can we do about it? *Hum Vaccines Immunotherapeutics*. 2014;10(9):2584-2596.
21. Sadaf A, Richards JL, Glanz J, Salmon DA, Omer SB. A systematic review of interventions for reducing parental vaccine refusal and vaccine hesitancy. *Vaccine*. 2013;31:4293-4304.
22. Kempe A, O'Leary ST, Kennedy A, et al. Physician response to parental requests to spread out the recommended vaccine schedule. *Pediatrics*. 2015;135(4):666-677.
23. Leask J, Willaby HW, Kaufman J. The big picture in addressing vaccine hesitancy. *Hum Vaccines Immunother*. 2014;10(9):2600-2602.
24. Jarrett C, Wilson R, O'Leary M, et al. Strategies for addressing vaccine hesitancy - A systematic review. *Vaccine*. 2015; 33(34):4180-4190.



25. Henrikson NB, Opel DJ, Grothaus L, et al. Physician communication training and parental vaccine hesitancy: a randomized trial. *Pediatrics*. 2015;136(1):70-79.
26. Shen S, Dubey V. Addressing vaccine hesitancy: clinical guidance for primary care physicians working with parents. *Can Fam Physician*. 2019;65(3):175-181.
27. Dempsey AF, Pyrznowski J, Lockhart S, et al. Effect of a health care professional communication training intervention on adolescent human papillomavirus vaccination: a cluster randomized clinical trial. *JAMA Pediatr*. 2018;172(5):e180016.
28. Perkins RB, Zisblatt L, Legler A, Trucks E, Hanchate A, Gorin SS. Effectiveness of a provider-focused intervention to improve HPV vaccination rates in boys and girls. *Vaccine*. 2015;33:1223-1229.
29. Brackett A, Butler M, Chapman L. Using motivational interviewing in the community pharmacy to increase adult immunization readiness: a pilot evaluation. *J Am Pharmacist Assoc*. 2015;55(2):182-186.
30. Miller WR, Rollnick S. *Motivational Interviewing: Helping People Change*. 3rd ed. New York, NY: The Guilford Press; 2013.
31. Lundahl B, Moleni T, Burke BL, et al. Motivational interviewing in medical care settings: a systematic review and meta-analysis of randomized controlled trials. *Patient Educ Counseling*. 2013;93:157-168.
32. Schnaith AM, Evans EM, Vogt C, et al. An innovative medical school curriculum to address human papillomavirus vaccine hesitancy. *Vaccine*. 2018;36:3830-3835.
33. Finney Rutten LJ, St Sauver JL, Beebe TJ, et al. Association of both consistency and strength of self-reported clinician recommendation for HPV vaccination and HPV vaccine uptake among 11- to 12-year-old children. *Vaccine*. 2017;35(45):6122-6128.
34. Jacobson RM, van Etta L, Bahta L. The C.A.S.E. approach: guidance for talking to vaccine-hesitant parents. *Minn Med*. 2013;96(4):49-50.

35. Autism Science Foundation. Making the CASE for vaccines: a new model for talking to parents about vaccines. [http://autismsciencefoundation.org/wp-content/uploads/2015/12/Making-the-CASE-for-Vaccines-Guide\\_final.pdf](http://autismsciencefoundation.org/wp-content/uploads/2015/12/Making-the-CASE-for-Vaccines-Guide_final.pdf). Published 2017. Accessed April 14, 2020.
36. Flood EM, Rousculp MD, Ryan KJ, et al. Parents' decision-making regarding vaccinating their children against influenza: a web-based survey. *Clin Ther*. 2010;32(8):1448-1467.
37. Paterson P, Chantler T, Larson HJ. Reasons for non-vaccination: parental vaccine hesitancy and the childhood influenza vaccination school pilot programme in England. *Vaccine*. 2018;36(36):5397-5401.
38. Flannery B, Reynolds SB, Blanton L, et al. Influenza vaccine effectiveness against pediatric deaths: 2010-2014. *Pediatrics*. 2017;139(5):e20164244
39. Boom JA, Cunningham RM, McGee LU. Vaccine myths: setting the record straight. *J Fam Strengths*. 2018;18(1):13.
40. Centers for Disease Control and Prevention. Misconceptions of seasonal flu and flu vaccine. <https://www.cdc.gov/flu/prevent/misconceptions.htm>. Published 2019. Accessed April 14, 2020.
41. Centers for Disease Control and Prevention. Disease burden of influenza. <https://www.cdc.gov/flu/about/burden/index.html>. Published 2019. Accessed April 14, 2020.
42. Kempe A, Daley MF, McCauley MM, et al. Prevalence of parental concerns about childhood vaccines: the experience of primary care physicians. *Am J Prev Med*. 2011;40(5):548-555.
43. Jit M, McKenzie D, Odugleh-Kolev A, Suisse S. Building a new communication paradigm: can we influence influenza perception? *Vaccine*. 2015;33(49):7044-7046.
44. MacDonald NE, Desai S, Gerstein B. Working with vaccine-hesitant parents: an update. *Paediatr Child Health*. 2018;23(8):561-561.

45. Larson H, Cooper L, Eskola J, Katz S, Ratzan S. Addressing the vaccine confidence gap. *Lancet*. 2011;378(9790):526-535.
46. Poland GA, Spier R. Fear, misinformation, and innumerates: how the Wakefield paper, the press, and advocacy groups damaged the public health. *Vaccine*. 2010;28(12):2361-2362.
47. Glanz JM, Wagner NM, Narwaney KJ, et al. Web-based social media intervention to increase vaccine acceptance: a randomized controlled trial. *Pediatrics*. 2017;140(6):e20171117.
48. Meyer SB, Violette R, Aggarwal R, Simeoni M, MacDougall H, Waite N. Vaccine hesitancy and Web 2.0: exploring how attitudes and beliefs about influenza vaccination are exchanged in online threaded user comments. *Vaccine*. 2019;37(13):1769-1774.
49. Kata A. Anti-vaccine activists, Web 2.0, and the postmodern paradigm--an overview of tactics and tropes used online by the anti-vaccination movement. *Vaccine*. 2012;30(25):3778-3789.
50. Betsch C. Innovations in communication: the Internet and the psychology of vaccination decisions. *Euro Surveill*. 2011;16(17). pii: 19849.
51. Vrdelja M, Kraigher A, Verčič D, Kropivnik S. The growing vaccine hesitancy: exploring the influence of the internet. *Eur J Public Health*. 2018;28(5):934-939.
52. Brunson EK. The impact of social networks on parents' vaccination decisions. *Pediatrics*. 2013;131(5):e1397-e1404.
53. Opel DJ, Diekema DS, Lee NR, Marcuse EK. Social marketing as a strategy to increase immunization rates. *Pediatrics*. 2009;123(5):432-427.
54. Schmidt AL, Zollo F, Scala A, Betsch C, Quattrocioni W. Polarization of the vaccination debate on Facebook. *Vaccine*. 2018;36:3606-3612.
55. Silverman RD, Wiley LF. Shaming vaccine refusal. *J Law Med Ethics*. 2017;45(4):569-581.

56. Veerasingam P, Grant CC, Chelimo C, et al. Vaccine education during pregnancy and timeliness of infant immunization. *Pediatrics*. 2017;140(3):e20163727.
57. Arede M, Bravo-Araya M, Bouchard É, et al. Combating vaccine hesitancy: teaching the next generation to navigate through the post truth era. *Front Public Health*. 2018;6:381.
58. Wong CA, Merchant RM, Moreno MA. Using social media to engage adolescents and young adults with their health. *Healthcare*. 2014;2(4):220-224.
59. Naftulin J. Instagram banned anti-vaccine messaging, but anti-vaxxers are hijacking pro-choice hashtags to game the system. *Insider*. <https://www.insider.com/anti-vaxxers-are-finding-instagram-loopholes-to-spread-dangerous-message-2019-12>. Published December 13, 2019. Accessed April 14, 2020.
60. Bever L. Anti-vaxxers have been raising money with GoFundMe. The site just put a stop to it. *Washington Post*. <https://www.washingtonpost.com/health/2019/03/22/gofundme-joins-instagram-other-companies-crackdown-anti-vaxxer-misinformation/>. Published March 22, 2019. Accessed April 14, 2020.
61. Bickert M. Combatting vaccine misinformation. *Facebook*. <https://about.fb.com/news/2019/03/combating-vaccine-misinformation/>. Published March 7, 2019. Updated September 4, 2019. Accessed April 14, 2020.
62. Finnegan G, Holt D, English PM, et al. Lessons from an online vaccine communication project. *Vaccine*. 2018;36(44):6509-6511.
63. Moran MB, Lucas M, Everhart K, Morgan A, Prickett E. What makes anti-vaccine websites persuasive? A content analysis of techniques used by anti-vaccine websites to engender anti-vaccine sentiment. *J Commun Healthcare*. 2016;9(3):151-163.
64. Schmid P, MacDonald NE, Habersaat K, Butler R. Commentary to: How to respond to vocal vaccine deniers in public. *Vaccine*. 2018;36(2):196-198.

65. Nyhan B, Reifler J. Does correcting myths about the flu vaccine work? An experimental evaluation of the effects of corrective information. *Vaccine*. 2015;33(3):459-464.
66. Bianco A, Mascaro V, Zucco R, Pavia M. Parent perspectives on childhood vaccination: how to deal with vaccine hesitancy and refusal? *Vaccine*. 2019;37(7):984-990.
67. Ward JK, Peretti-Watel P, Verger P. Vaccine criticism on the Internet: propositions for future research. *Hum Vaccines Immunother*. 2016;12(7):1924-1929.
68. Dunn AG, Leask J, Zhou X, Mandl KD, Coiera E. Associations between exposure to and expression of negative opinions about human papillomavirus vaccines on social media: an observational study. *J Med Internet Res*. 2015;17(6):e144.
69. Gunaratne K, Coomes EA, Haghbayan H. Temporal trends in anti-vaccine discourse on Twitter. *Vaccine*. 2019;37(7):984-990.
70. Sobo EJ, Huhn A, Sannwald A, Thurman L. Information curation among vaccine cautious parents: Web 2.0, Pinterest thinking, and pediatric vaccination choice. *Med Anthropol Cross Cult Stud Health Illness*. 2016;35(6):529-546.
71. Broniatowski DA, Hilyard KM, Dredze M. Effective vaccine communication during the Disneyland measles outbreak. *Vaccine*. 2016;34(28):3225-3228.
72. Rosi A, Brighenti F, Finistrella V, et al. Giocampus school: a 'learning through playing' approach to deliver nutritional education to children. *Int J Food Sci Nutr*. 2016;67(2):207-215.
73. Schoeppe J, Cheadle A, Melton M, et al. The immunity community: a community engagement strategy for reducing vaccine hesitancy. *Health Promotion Pract*. 2017;18(5):654-661.
74. Opel DJ, Marcuse EK. Window or mirror: social networks' role in immunization decisions. *Pediatrics*. 2013;131(5):e1619-e1620.
75. Nyhan B, Reifler J, Richey S, Freed GL. Effective messages in vaccine promotion: a randomized trial. *Pediatrics*. 2014;133(4):e835-e842.

