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Vaccine Hesitancy, Acceptance, and Anti-Vaccination: Trends and Future Prospects for Public Health

Ève Dubé,^{1,2} Jeremy K. Ward,^{3,4} Pierre Verger,^{4,5} and Noni E. MacDonald⁶

¹Centre de Recherche du CHU de Québec, Université Laval, Québec G1V 4G2, Canada

²Institut National de Santé Publique du Québec, Québec G1E 7G9, Canada; email: eve.dube@inspq.qc.ca

³CERMES3, INSERM, CNRS, EHESS, Université de Paris, 94076 Villejuif, France; email: jeremy.ward.socio@gmail.com

⁴Aix Marseille Université, Institut de Recherche pour le Développement, Assistance Publique-Hôpitaux de Marseille, Service de Santé des Armées, VITROME, 13005 Marseille, France; email: pierre.verger@inserm.fr

⁵Observatoire Régional de la Santé Provence-Alpes-Côte d'Azur, 13005 Marseille, France

⁶Department of Pediatrics, Dalhousie University, Halifax, Nova Scotia B3K 6R8, Canada; email: noni.macdonald@dal.ca



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Keywords

immunization, vaccine acceptance, vaccine refusal, anti-vaccination, vaccine hesitancy

Abstract

An often-stated public health comment is that “vaccination is a victim of its own success.” While the scientific and medical consensus on the benefits of vaccination is clear and unambiguous, an increasing number of people are perceiving vaccines as unsafe and unnecessary. The World Health Organization identified “the reluctance or refusal to vaccinate despite availability of vaccines” as one of the 10 threats to global health in 2019. The negative influence of anti-vaccination movements is often named as a cause of increasing vaccine resistance in the public. In this review, we give an overview of the current literature on the topic, beginning by agreeing on terminology and concepts before looking at potential causes, consequences, and impacts of resistance to vaccination.

INTRODUCTION

Since the publication in January 2020 of the genetic sequence of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which causes coronavirus disease 2019 (COVID-19), scientists around the world are working faster than ever to develop a vaccine against this deadly disease (125). At the same time, rumors that the pandemic is a hoax to sell vaccines are spreading faster than the virus in a social media “infodemic” (57). The COVID-19 pandemic has heightened global awareness on the importance of understanding complex political, social, and behavioral factors influencing public acceptance of effective, scientifically rigorous, and ethically sound recommendations to reduce transmission, including future vaccine acceptance. Resistance to vaccinations is not a new phenomenon, and people have been skeptical about vaccines since the first smallpox vaccination programs (87). However, all around the globe, an increasing number of parents are choosing to delay and/or refuse some or all vaccines for their children, leading to declining community protection against vaccine-preventable diseases (72, 117). Vaccine hesitancy, or the reluctance to receive recommended vaccination because of concerns and doubts about vaccines (81), was identified by the World Health Organization (WHO) as one of the top 10 threats to global health in 2019 (145).

In 2015–2016, the human papillomavirus (HPV) vaccination programs in Denmark and Ireland were derailed owing to reports in the media of different symptoms falsely alleged to be caused by the vaccine. In both countries, the HPV vaccine uptake rates dropped dramatically from above 85% to below 40% (33, 123). Parental concerns about vaccine safety, which led to the decline in vaccine uptake, were caused by widespread misinformation spread by documentaries broadcasted on national television and lobbying by anti-HPV vaccine groups (<http://regret.ie/>). Of note, these localized vaccine scares did not spill over to neighboring countries (e.g., rates of HPV vaccination remained stable in Sweden). More than 30 years ago, in 1982, the TV documentary “DTP Vaccine Roulette,” which alleged that the pertussis component of the combined diphtheria, tetanus, and pertussis (DTP) vaccine was causing severe brain damage, seizures, and mental retardation, had similar detrimental effects on parental acceptance of the vaccine, especially in the United States (62). It is now acknowledged that these conditions were not causally linked with immunization but were temporal associations (i.e., most cases were due to Dravet’s syndrome, a genetic condition with general onset around 5 months of age) (1, 7). In 2018, due to an unvaccinated traveler, a large measles outbreak occurred within orthodox Jewish communities in New York and New Jersey (86). Although vaccination is not against Jewish law, the disease spread rapidly within large families living in crowded housing because of the strong influence of some religious leaders who opposed vaccination (118). Measles outbreaks have occurred in Somali communities in Sweden, as well as in the United States where many parents have recently been declining the measles, mumps, and rubella (MMR) vaccine owing to fears that their children are at a higher risk of autism (46, 63). These concerns were fueled by a discredited 1998 study that falsely alleged a link between measles vaccination and autism (131). In Minnesota, the disgraced author, a former UK gastroenterologist who has been struck off the physician registry, held meetings with Somali community groups to promulgate his misinformation, and vaccine uptake rates plummeted soon after within these communities (46). Widespread public concerns regarding the safety of vaccines can even result in discontinuation of vaccination programs, as was the case in the 1990s for the hepatitis B vaccination program in French schools (141) (owing to concerns that the vaccine caused multiple sclerosis) or the HPV vaccination program in Japan more than 20 years later (88) (owing to a cluster of complex, multisystem symptoms alleged to be caused by the vaccine).

The topic of vaccine acceptance and resistance has always been of interest to medical and social sciences researchers (15, 90). However, within the last 10 years, an increasing number of studies

Table 1 The 5 A's model

The 5 A's	Description
Access	The ability of individuals to be reached by, or to reach, recommended vaccines
Affordability	The ability of individuals to afford vaccination, in terms of both financial and nonfinancial costs
Awareness	The degree to which individuals have knowledge of the need for, and availability of, recommended vaccines and their objective benefits and risks
Acceptance	The degree to which individuals accept, question, or refuse vaccination
Activation	The degree to which individuals are nudged toward vaccination uptake

in this area have been published; the breadth and depth of the articles reflect a broadening of the field of study. In this review, we provide an overview of the current literature on the topic, starting by discussing terminology and concepts before looking at potential causes, consequences, and impacts of resistance to vaccination.

FROM ANTI-VACCINATION TO VACCINE ACCEPTANCE: AGREEING ON CONCEPTS AND TERMINOLOGY

First, key determinants of vaccine uptake rates include basic awareness that vaccines are needed, along with access to vaccines and vaccination services (i.e., “the supply side”) (126). The 5 A's model, developed by Thomson et al. (126), can facilitate grasping the complex structural, organizational, sociocultural, and individual factors influencing vaccine uptake rates (Table 1). Despite the importance of access, affordability, and awareness in understanding why people are not taking up the recommended vaccines, this article is focused mainly on acceptance and activation of vaccination, which refer to how vaccine recipients and vaccine providers understand and engage in immunization.

Second, the term “anti-vaccine” is often used interchangeably with vaccine hesitancy, but these concepts are not the same. The concept of vaccine hesitancy represents a shift from the dichotomous anti- versus pro-vaccine perspective to an approach characterizing behavior on a spectrum of potential attitudes and behaviors, ranging from active demand for vaccines to complete refusal of all vaccines. Vaccine-hesitant individuals are a heterogeneous group along this continuum. A vaccine-hesitant person can delay, be reluctant but still accept, or refuse some or all vaccines (81). This state of ambivalence toward vaccination should not be seen as irrational or “anti-science”; rather it often reflects legitimate doubts and concerns about vaccines (13). Vaccine hesitancy is thus quite different from activism against any form of vaccination by strong-willed and committed people who constitute what should be understood as the “anti-vaccine” movement. It is important to move away from words that polarize. Most people—even those who are the most critical—do not recognize themselves as “anti-vaccine,” and, given the negative connotations associated with this term, this labeling is unproductive in moving people toward vaccine acceptance (24, 147). Having doubts and concerns when making a decision about vaccines is legitimate, especially as people are asked to be “entrepreneurs of their own health” (3; 99, pp. 185–86).

Finally, even the concept of vaccine hesitancy has been the subject of different definitions and can be challenging (101). It should be used to refer to situations where people have doubts and concerns toward vaccinations, without referring to actual vaccine receipt (43). Vaccine uptake rates are high in some situations (e.g., where vaccination is mandatory to attend school or to travel), but vaccine hesitancy still exists. Similarly, vaccine acceptance is not a synonym of vaccine uptake either. Vaccine acceptance is defined as the individual or group decision to accept or refuse, when presented with an opportunity to vaccinate (43). Acceptance can be active (adherence by an

informed public that perceives the benefit of and need for a vaccine) or passive (compliance by a public that defers to recommendations and social pressure) (93). Vaccine uptake is used to refer to the proportion of a population that has received a specific vaccine. Vaccine uptake does not equal vaccine acceptance because it does not consider the opportunity to accept or refuse (i.e., in situations where access to vaccination services is problematic, low vaccine uptake does not equal low vaccine acceptance) or the fact that some may vaccinate despite having important doubts and concerns. For this reason, vaccine uptake rates cannot be used to assess the level of vaccine acceptance or hesitancy within a country or a subgroup. Anti-vaccination also refers to very specific attitudes and behaviors that are described in the next section.

THE “ANTI-VACCINE MOVEMENT”: HISTORICAL TRENDS AND POTENTIAL IMPACT

The “anti-vaccine movement” is a term commonly used to designate people who devote part of their time and resources to publicly voice their concerns regarding vaccines, actively trying to convince others to join the movement in the hope that changes will be made to vaccination policies. The expansion of the literature on vaccine hesitancy has also led to debates surrounding this concept. Several social scientists have criticized the term because it implies that “anti-vaccine” activists reject vaccination in general and have suggested that the term vaccine critics better reflects the fact that many activists are opposed only to specific vaccines or specific products contained in vaccines (58, 65, 132). Among vaccine critics, we find activists who are known mainly for their action against vaccines as well as support groups for purported victims of vaccines. But we often forget that there are other groups, such as political parties, whose main focus is not vaccination, but a broader cause (such as a political ideology, the interests of a specific social group, a religion, etc.) that has included vaccines in the portfolio of examples used to illustrate the importance of the cause. Compared with activists focused on vaccines, these parties rarely tend to produce new vaccine-critical arguments. However, they play a crucial role in the wider diffusion of their views, and they contribute to the framing of such arguments in wider political, moral, philosophical, or cultural worldviews.

The tendency to think of doubts about vaccines as the product of ignorance, irrationality, and anti-science sentiment also bears heavily on our understanding of vaccine-critical activism. This can be seen in the pervasive idea that today’s crisis of trust in vaccines is just a new chapter in the “age-old struggle against antivaccinationism” (103, 148). Vaccine criticism is thus presented as reflecting the forces of tradition and superstition pitted against the progress brought over by science. As we discuss below, common themes emerge between the concerns of activists back then and those of today. But disentangling what is old and what is new in vaccine criticism is crucial to understanding its appeal in such different historical contexts.

Perceptions of Vaccines

From 1796 through to the present day, the principle of vaccination has been rejected by proponents of a wide variety of medical philosophies (in high-, middle-, and low-income settings). These philosophies are incompatible with the microbiological paradigm, which explains how vaccines, and more broadly the immune system, work. These alternative medical philosophies include, but are not limited to, homeopathy, Christian Science, chiropractic, hydrotherapy, and crystal healing, among others (6, 27, 45, 65, 90, 106, 148). The continuous presence of alternative health practitioners in the ranks of anti-vaccine activists should not make us overlook the major changes from the past 200 years in the world of vaccines and their effects on vaccine-critical activism.

First, it is important to remember that (*a*) the exact biological mechanism behind vaccination was not definitively understood before the last decades of the nineteenth century (i.e., occurred with the progress of microbiology), (*b*) the capacity of public administrations to build reliable statistics on vaccine efficacy and side effects was very limited until the 1930s, and (*c*) the conditions of hygiene in which the antigen was produced and stored were often questionable at the beginning of the vaccine era (49, 90). Thus, for almost a century, the principle, efficacy, and safety of vaccination were the objects of legitimate scientific debates, which took place in the most prestigious academic arenas (49). Vaccine-critical activists often defended medical philosophies, such as various forms of vitalism (i.e., that diseases are due to imbalance in vital forces), which were deemed at least partly legitimate in the scientific world at the time or in the near past. These obsolete medical philosophies have now completely vanished from medical textbooks and training curricula, but also from most vaccine critics' pamphlets and books.

Second, the continuous emphasis on the “unnatural” character of vaccines hides strong differences in what is meant by “natural.” In her book on the transformation of debates surrounding vaccinations in the United States since World War II, Conis shows how the rise of an environmental movement transformed the types of arguments used by vaccine critics (30). The development of the chemical industry combined with advances in immunology has enabled the production of new types of vaccines during the twentieth century, such as limiting the microbial components of pertussis from the whole organism to only a limited number of antigens and subunit vaccines, e.g., hepatitis B. Scientists also progressively added other components—such as carrier proteins, adjuvants, and preservatives—to vaccines to improve their efficacy or safety. In parallel, an environmental movement denouncing the health risks presented by overuse of many chemicals grew in prominence in the 1960s and 1970s. This movement had a significant impact on how vaccines became publicly criticized both because environmental activists added vaccines to their list of issues—alongside pesticides or artificial sweeteners, for instance—and because vaccine-critical activists drew inspiration from the ideas and methods of environmental activists. This development led to a shift in focus from arguments focusing on a supposed opposition between “natural” and “artificial” immunity to a focus on the industrial nature of vaccines: how they are produced and tested as well as their unnatural contents (i.e., chemicals).

Third, by focusing on the continuous presence of those who criticize the principle of vaccination, we tend to forget the less radical forms of criticism. This is particularly important now that the number of vaccines administered is thankfully much larger than during the nineteenth century and that vaccines contain a wide variety of ingredients. From the end of the nineteenth century until now, vaccination has become one of the main symbols of the progress brought about by science, and, in parallel, vaccine criticism has become the symbol of anti-science forces (24, 135). In this context, it becomes crucial for vaccine critics to avoid the stigmatizing “antivaxxer” label. In her work on critics of the MMR vaccine in the United States at the turn of the 2000s, Kirkland showed that groups of purported victims of the vaccine strived to present themselves as concerned solely with this particular vaccine containing mercury (71). In the case of the groups she studied, this approach was merely a communication strategy designed to appear more credible, but other case studies documented actual rejection of anti-vaccination activists and arguments (58, 76). Social scientists working on contemporary vaccine criticism in France, Great Britain, and the United States have noted the growing success of critics who present themselves as different from anti-vaccination activists, using slogans such as “green our vaccines” and phrases such as “I am not an antivaxxer but. . .” and promoting so-called “alternative vaccination schedules” (58, 76, 106).

The example of France illustrates the importance of these more moderate forms of vaccine criticism. The anti-vaccine movement has never been very strong in France (8). The first major

vaccine scare emerged very late, following a large vaccination campaign against hepatitis B at the end of the 1990s. Debates over the safety of vaccines have multiplied since 2009, touching on the safety of the pandemic flu vaccine, the use of aluminum-based adjuvants, and the vaccine against HPV (134). On each of these issues, the media gave voice only to the actors who chose to distance themselves from anti-vaccination activists and presented arguments restricted to each vaccine or substances contained within these vaccines (133, 136). The existence of less radical forms of vaccine criticism may be more important today than during the nineteenth century and beginning of the twentieth, but it is not a new phenomenon. Historians working on nineteenth-century France and Great Britain and the early twentieth century United States have noted that a number of doctors labeled as “anti-vaccine” criticized only the way vaccination was performed (e.g., poor hygiene, limited technical training of vaccinators) rather than the scientific principle of vaccination (45, 49, 65).

Politics and Vaccination

Medical arguments on vaccine safety are inseparable from political arguments that target public and private actors involved in vaccination. Saying that a recommended vaccine is unsafe necessarily implies that authoritative bodies who are in charge of safeguarding the safety of a specific vaccine are not doing their job correctly. For instance, a child’s death that was falsely attributed to vaccination (the child died from fulminant meningococemia) was used as a political weapon to incarcerate the Minister of Health of Ukraine (129). Throughout history, vaccine critics have drawn great inspiration from the political ideologies of their time, and, reciprocally, a wide variety of political actors have added vaccination to the long list of issues on which they choose to focus. For vaccine critics, this connection with wider political forces (e.g., cultural trends, social movements, political parties) is often crucial to grow and gain visibility.

The more political side of vaccine criticism is often reduced to conspiracy theories and radical denial of the legitimacy of the state to intervene into private citizens’ health. Conspiracy theories attributing malevolent intentions to hidden actors have indeed been a continuous part of vaccine-critical discourse across history as has the rhetoric of various radical political movements rejecting the state, such as extreme forms of libertarianism, environmentalism, antiglobalization, or socialism (27, 45, 90, 148). Pharmaceutical companies today are at the center of these conspiracy theories, which reflects changes in the world of vaccines. Since World War II, private actors have played an increasingly important role in research on immunization and in the manufacturing of vaccines (16). More importantly, criticism of vaccination policies often mirrors more mainstream social concerns regarding the capacity of public authorities to resist the pressure of corporate interests and to regulate the risks of manufactured products. In the past, vaccine critics have also pointed to the shortcomings of early pharmacosurveillance systems, and their claims have contributed in part to the establishment of compensation schemes for vaccine injuries (27).

It is also important to note that large movements of resistance to vaccination campaigns often found their impetus in the very real ethical shortcomings of public authorities’ actions. As Durbach has shown, the British anti-vaccine movement of the nineteenth century was grounded in working-class resentment against the Victorian state’s government of poverty (45). Enforcement of the mandatory vaccination laws focused unjustly on the members of the working class who were seen by politicians as responsible for their own demise, morally corrupt, and second-class citizens. Vaccine resisters found support in the political activists fighting against the Poor laws (such as Liberal reformers and the corporatist movement), which allowed the movement to become one of the greatest health movements in European history. This link between vaccine resistance and tensions surrounding unequal treatment of the disadvantaged and minorities runs across the

history of vaccination (27, 60). The great anti-vaccine riots of the 1900s in Brazil were also a response to the unfair treatment of the poor in the context of a great push toward “modernisation” (79). In the United States, vaccine refusal among African Americans and other minorities has often been grounded in legitimate concerns about structural racism and discriminatory practices (30, 64). In nineteenth-century India, vaccine refusal was often part of wider movements of resistance against colonial rules (2, 19), and in the 1970s, resistance to polio vaccination performed by American doctors in India and Bangladesh was a response to intimidation or coercion (54).

More generally, vaccination can suffer from every type of tension that can exist between the public and all the types of actors involved in public health decision-making at every level (60). There are therefore a wide variety of forms of the politicization of vaccines, depending on local contexts and vaccines. The introduction of the vaccine against HPV made this point particularly clear. In the United States, some conservative and religious groups were among the most prominent critics of this vaccine, whereas in France, the association between the vaccine and sexuality was much less central in mobilizations against it (130). Instead, the early vocal critics of the vaccine were found among very progressive and environment-friendly activists who resented the fact that the vaccine contained aluminum and who balked at its price. The case of HPV vaccination also underlines the importance of vaccine mandates in the genesis of vaccine-critical activism. The suggestion that the vaccine could become mandatory for school entry in several US states in 2005–2006 pushed conservative organizations to enter the fray, voicing arguments pertaining to both sexual morality and also vaccine safety and efficacy (130). Recourse to coercion can exacerbate these political and social tensions. Lack of trust in public health authorities or the belief that vaccination does not work is a private affair for many parents. Mandates can push some of them toward activism: growing the ranks of vaccine-critical activists who dedicate time and resources to convince as many people as possible and helping other parents avoid sanctions. For instance, the passing of new mandates or the reinforcement of sanctions was crucial to the rise of the English anti-vaccine movement during the nineteenth century and to igniting the riots in Brazil in 1904, as well as in the emergence of a small anti-vaccine movement in France after World War II (45, 79, 90). More recently, proposals to introduce new mandates in Poland, Germany, and Serbia also seem to have energized vaccine-critical activism. For this reason, public authorities have often designed mandates in a way that allows the most motivated refusers to opt out of vaccination, e.g., via philosophical exemptions (5, 85).

Finally, we turn to vaccine resistance in low- and middle-income countries. The tendency to associate vaccine refusal with traditions, alternative conceptions of health, and religion is even stronger in discourses on vaccine resistance in these settings. Most of the issues we have just evoked are also at the core of vaccine-related tensions in low- and middle-income countries (76, 95). They simply tend to be exacerbated in contexts of corruption, political instability, weak public institutions, and ethnic tensions. In some contexts, resistance to vaccination can be a way to garner other interventions to meet community needs (e.g., safe water, access to health services) (61).

IDENTIFYING ROOT CAUSES OF VACCINE HESITANCY, VACCINE REFUSALS, AND ANTI-VACCINE SENTIMENT

The degree to which vaccine-critical discourses influence vaccination attitudes and behaviors in the general population remains an important but complex domain for investigation. Research on vaccination decisions has focused mainly on the metrics of vaccine uptake (coverage rates, delays, refusals). The potential detrimental effects of vaccine critics on attitudes toward vaccination remain to be fully assessed, owing in part to the lack of validated tools to identify patterns of vaccine acceptance and hesitancy in individuals, subgroups, and populations over time. Obtaining these

data would help researchers differentiate outright refusers from the hesitant and the passive and active accepters (74, 77). Tools to assess vaccine hesitancy in children and adolescents, and for specific vaccines, have been developed and validated mainly in the United States and Western Europe (e.g., 12, 51, 80, 98, 116). Promising work is under way at the global level to develop a set of tools to measure and address the reasons for undervaccination and to track consistent and comparable data over time (144). Longitudinal monitoring of vaccine hesitancy and refusal using comparable methods such as tracking surveys is crucial to monitor temporal shifts over time and geography and to evaluate the possible negative consequences of vaccine-critical discourses (23, 50).

For example, Wellcome conducted a study in 2018 among 140 countries and found out that sentiment toward vaccination was positive overall but that negative attitudes toward vaccine safety were not uncommon (139). Furthermore, countries with high levels of education and adequate access to health services were associated with higher levels of negative sentiment regarding vaccination (73). Using the results of the 2015–2017 WHO and UNICEF Joint Reporting Forms (JRFs) on immunization, Lane et al. showed that vaccine hesitancy was common and reported by 90% of countries. The main reasons mentioned globally were related to concerns about vaccine risks and benefits, lack of knowledge, and barriers related to religion, culture, gender, or socioeconomic factors. Although vaccine hesitancy is widespread, only one-third of the countries reported having conducted studies to better understand the causes and impact of vaccine hesitancy (72).

These surveys emphasized that vaccine hesitancy or refusal is complex and varies for different vaccines and across time and context. Over the past decade, a plethora of studies assessed factors associated with the intention to receive specific vaccines or vaccination in general, and many models of vaccination decisions have been proposed (e.g., 101, 144). In general, key determinants of vaccine acceptance or refusal include risk perceptions of diseases, concerns regarding vaccine safety, perceived need and usefulness of vaccines, past experiences with health services, emotions, routine ways of thinking, information sources, (dis)trust in institutions and health care providers, social networks, and social norms as well as different sociodemographic characteristics (e.g., age, gender, revenue, level of education) (17, 31, 32, 39, 41, 113, 149).

Acceptance and refusal of vaccines are also highly context-dependent, which underlines the importance of understanding “local vaccination cultures” (20, 68, 106, 120, 122). Social, cultural, historical, and political factors influence how people feel about and decide on vaccination (76, 106, 119). In communities that adopt alternative lifestyles outside of the mainstream, vaccine hesitancy and refusal can serve to reinforce social identities (4, 121), whereas in low-income countries vaccine refusal can be seen as a way for economically and politically deprived communities to express dissatisfaction with wider socioeconomic conditions, as noted above (61, 124).

As mentioned in the introduction, vaccine controversies that are largely diffused in traditional media (e.g., newspapers, magazines, television) have a tremendous impact on vaccine uptake (70, 96). Celebrities that publicly criticize vaccines in public spheres can have an important impact on their fans’ views about vaccination (59, 89, 97). People who actively criticize vaccines in public are often motivated by profit (e.g., selling alternatives to vaccines or other health products that fit into an alternative lifestyle) (89). The media balance (i.e., presenting both sides of a news story) can influence the audience’s perception of vaccine safety and negatively impact vaccine intentions by giving the false impression that there is no scientific consensus regarding vaccine safety and efficacy (37). When dealing with vaccine hesitancy, the Internet and social media play a key role.

The Internet and social media are increasingly used to communicate, learn, and make and reinforce decisions about vaccination, and many studies have shown that vaccine refusals or delays are more frequent in people who reported the Internet as their main source of information about vaccines (11, 21, 47, 140). Compounding exposures to negative messages are problematic features of

Internet search engines. Designed to benefit the user, search engines filter information to reflect an individual's previous search patterns. As such, if a user is searching and follows links related to hesitancy or refusal, they are more likely to be exposed to such content in future searches. The user in this case has no control over what they do not see (84). Furthermore, the Internet blurs the boundaries between the quality and perceived legitimacy of information and can lend apparent credibility to content deemed inaccurate by health experts (84). The volume of negative and inaccurate information about vaccines on the Internet and social media has been widely discussed (67, 75, 109, 137). Studies testing the impact of experimentally created fictitious websites and/or vaccines have demonstrated that viewing vaccine-critical Internet-based content and reading personal stories about negative consequences from vaccines increase users' risk perceptions about vaccination and decrease intention to vaccinate (9, 10, 56, 92). For example, Betsch et al. (9) showed that viewing an anti-vaccination website increased negative beliefs about vaccination, whereas viewing a pro-vaccination website had a minimal effect on beliefs. Five months after the study, vaccine coverage rates of children in the experimental group (anti-vaccination website) were significantly lower than those of children in the control group (pro-vaccination website) (9). Another study that measured HPV vaccine content on Twitter within the United States documented lower HPV vaccine coverage in states where safety concerns, misinformation, and conspiracies made up a higher proportion of tweets on HPV (44).

VACCINE CRITICISM AND HEALTH CARE PROVIDERS

Health care providers are known to be influential in shaping vaccine uptake for infants, children, adolescents, and adults. When health care providers communicate effectively with parents about vaccine benefits and risks, the value and need for vaccinations, and vaccine safety, parents are more confident in their decisions (26). However, to do this well, health care providers need to be confident themselves about the safety, effectiveness, and importance of vaccination (34).

Although few health care providers are overtly against vaccination, as with the public in general, vaccine hesitancy among them probably ranges from those who are overtly anti-vaccination to those who have doubts and concerns around the science of some vaccines to those who support vaccination. Research has shown that a significant proportion of health care providers, including those who administer vaccines, are vaccine hesitant in their personal and professional lives (40, 66, 69, 104, 128). For instance, a study of vaccination practices and attitudes among general practitioners in France has shown that up to 43% of the surveyed practitioners were not recommending vaccination to their target patients and that many were disagreeing with statements about the safety and usefulness of vaccines, especially those who were using complementary and alternative (CAM) treatments in their practice (127, 128). In another study, up to 60% of French practitioners were also doubtful regarding the safety of the HPV vaccine, and almost one-quarter of those with daughters did not intend to or did not have their daughters vaccinated (28). A review of studies published before October 2015 on vaccine hesitancy among health care providers has shown that providers' knowledge about particular vaccines' efficacy and safety was key in building their confidence and willingness to recommend the vaccines to others (100).

For most people, mainstream physicians and nurses have been found to be the most trusted source for vaccine information (52, 110). However, some vaccine-hesitant individuals have found it difficult to have an open discussion about vaccination with their physician and report feeling alienated when vaccines are discussed. In contrast, vaccine-hesitant individuals reported that discussions about vaccination with CAM providers were more in line with their perception of an ideal consultation (CAM providers were perceived as better listeners), and individuals perceived the vaccination information transmitted by CAM providers to be more understandable, useful,

and trustworthy (4, 36). Reciprocally, many health care providers find conversations about vaccines with vaccine-hesitant parents to be difficult and unproductive (146).

The relationship between CAM use and vaccine hesitancy or refusal is complex. Studies show that individuals who use CAM services are also more likely to hold negative attitudes toward vaccination (35, 42). Often CAM use and vaccine hesitancy are presented as discrete and measurable variables, without regard for the processes and pathways leading to CAM use or for the broader sociocultural context of vaccination refusal (142). Vaccine hesitancy often reflects deeper concerns about medicine, the state and the body, and a growing distrust of health professionals, the pharmaceutical industry, and government (149). Similarly, distrust of biomedicine and biomedical health care providers is a common driver of CAM use (6, 138). Patients may seek out health care providers whose vaccination attitudes and beliefs match theirs (29). Given providers' critical role in maintaining vaccine acceptance (102), understanding and addressing the specific concerns of mainstream and CAM health care providers along the vaccine hesitancy spectrum are crucial to ensure and sustain the success of vaccination programs.

DEALING WITH VACCINE CRITICS

Addressing resistance to vaccination is complex because there is no consensus about the source of the problem or the most effective means for resolving it (107). The ubiquity of discourse against vaccination on the Web has led some social media platforms to limit the circulation of content against vaccines (48). Although this approach is certainly a valuable step in countering vaccine misinformation online, it is likely not enough; many groups opposed to vaccine(s) have managed to move beyond these restrictions, and many discussions are occurring in closed social media groups (18).

Public health needs to engage in social media discussions about vaccination (82). Communication strategies need to move beyond the knowledge deficit model to adopt more effective approaches (53, 108). Information is important in the decision-making process around vaccination (78, 91). However, simply communicating information about vaccine safety and efficacy to those who are vaccine hesitant is clearly insufficient to stem the growth of hesitancy (38). More information on vaccines does not automatically result in more trust in vaccines (25, 111). Worse yet, pro-vaccine messages can have unintended and undesirable consequences such as increasing resistance to vaccination (94). These backfire effects can occur when interventions are designed without taking into consideration key principles from psychology regarding how people think and act (22, 108). Effective risk communication strategies need to capitalize on heuristics rather than try to fight against them (14, 115). If social contagion has a negative impact on vaccine acceptance, this collaborative community approach can also be used to positively shift the negative vaccination discourses and address vaccine critics (22). Different initiatives that have mobilized parents who value vaccination and have provided them with tools to engage in positive dialogue about immunizations in their communities have shown promising results (3, 114; <https://iboostimmunity.com/>). From a programmatic perspective, managing risk communication is especially important when situations occur in which adverse events are rightly or wrongly associated with vaccination as these crises often fuel criticism against vaccination.

Using psychological research on persuasion as well as public health and communication studies, the World Health Organization Regional Office for Europe has highlighted three steps by which to address vaccine-critical activists in public spheres (143). The first step is to identify the technique used by the vaccine critics. Most of the arguments can be summarized under five key tactics: use of conspiracy theories, reference to fake experts, selectivity in evidence used to criticize vaccines (i.e., cherry-picking evidence from published studies), impossible expectations (e.g.,

a vaccine that is 100% safe), and misrepresentation or false logic. The second step is to identify the topic. Again, most arguments against vaccines fit within five categories: distrust in health authorities and health care providers, low threat of disease, lack of effectiveness of vaccines, unsafe vaccines, and alternatives to vaccines. The last step is to respond using a key message that (a) un-masks the technique used and (b) relates to the topic raised. A recent evaluation revealed that this strategy is effective to mitigate the influence of a science denier on the audience and does not backfire (i.e., misconceptions are not strengthened by the intervention) (112).

Finally, when faced with an increase in vaccine hesitancy and refusal, some experts are calling for stronger policies to enforce mandatory policies (105). While mandatory vaccination policies can effectively increase vaccine uptake, they do not adequately address the underlying causes of vaccine hesitancy and refusal (55, 83).

GENERAL CONCLUSION

In the past 30 years, several vaccine controversies have traveled around the world, from the allegations that the pertussis vaccine's component was causing severe brain damage, seizures, and mental retardation in the 1980s to the purported link between MMR vaccination and autism in the late 1990s and the alleged adverse events linked to the HPV vaccine in the 2010s. Vaccination resistance has always existed, but these controversies, along with outbreaks of vaccine-preventable diseases in un- or undervaccinated groups, have raised awareness among public health authorities that widespread acceptance of vaccines cannot be taken for granted. As discussed in this review, the causes, consequences, and impact of vaccination resistance have been the focus of much research in the past decade. While the world is waiting for novel vaccines to protect against coronavirus disease 2019 (COVID-19), it is more important than ever to pursue research to better understand community dynamics, sociocultural factors, and local knowledge, as well as how the influence of vaccine criticism may impact the acceptance of vaccines.

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