Vaccines in the 21st century: Clarifying the factors that promote vaccine hesitancy, delay, and rejection

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Abstract:

Vaccines have been crucial in reducing mortality and morbidity around the world, particularly in low- and middle-income countries. Furthermore, vaccinations have also resulted in a considerable amount of economic savings. However, there are a growing number of individuals who express a strong skepticism of vaccine safety and effectiveness. These "vaccine-hesitant" individuals choose to reject or delay vaccine administration. A number of strategies have been developed to address the various socioeconomic and cultural circumstances of each vaccine-hesitant individual. However, there is a need to clarify the various factors that promote vaccine acceptance, delay, and rejection. In this article, we discuss the factors that promote vaccine hesitancy from recent research, describe some of the interventions we know to be effective in reducing hesitancy, and develop an agenda for researchers and students interested in vaccine hesitancy research.

Introduction to vaccines, vaccination, and vaccine hesitancy

Vaccines are the backbones of health care systems. They are among the most effective public health interventions; widespread vaccination has dramatically reduced disease burden worldwide, especially in low- and middle-income countries where vaccine-preventable diseases have slowed socioeconomic progress [1]. Research has demonstrated that vaccines have reduced mortality and morbidity, and contributed to a considerable amount of economic savings. For example, Ray and colleagues estimated that the meningococcal vaccine alone saved the United States government $1.5 billion in direct and indirect costs from 1993 to 2002 [2].

Despite successes, there is a growing group of individuals with an increasing skepticism of vaccines. In particular, there are more and more parents who are choosing to forego vaccines today, which has given rise to an increasing number of cases of vaccine-preventable diseases such as measles [3]. There is a continuum of attitudes towards vaccines ranging from full acceptance to full rejection (i.e., "anti-vaxxers"). The SAGE Working Group on vaccine hesitancy defines vaccine hesitancy as the "delay in acceptance or refusal of vaccination despite [the] availability of vaccine services" [4]. The decision to delay or reject vaccines depends on a compendium of factors including negative interactions with healthcare providers and an orientation towards natural living.

Some may incorrectly believe that vaccine hesitancy is a 21st century phenomenon; however, there are instances in our history that say otherwise. In the 1920s, an anti-vaccination group in a United Kingdom county appealed to make the smallpox vaccine optional [5]. Although these appeals were rejected, this example illustrates that vaccine hesitancy has existed since the advent of vaccines, even though we know it allows people to live healthy and productive lives. What is new are the far-reaching implications that vaccine delay or rejection has on children's health, and the cultural and lifestyle factors that promote it.

Due to the novel implications of vaccine hesitancy on public health today, there is a need to develop interventions tailored to the socioeconomic and cultural circumstances of each parent's vaccine hesitancy. However, to develop and test such interventions, healthcare professionals require clarity on the various factors that promote vaccine acceptance, delay, and rejection. To address the lack of clarity in the literature, in this article we: 1) discuss the factors that promote vaccine hesitancy, 2) describe interventions that have been effective in reducing hesitancy, and 3) develop an agenda for researchers and students interested in vaccine hesitancy research.

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Reviewing the factors that promote vaccine hesitancy in parents

Recently, Dube and colleagues published a systematic review of 22 qualitative studies to clarify the determinants of vaccine hesitancy at multiple levels of society (i.e., individual, community, and policy levels). The determinants include experiences, emotions, ways of thinking, information sources, family and friends, perceptions of disease risk, and trust in healthcare systems [6]. The majority of factors pertained to individual, interpersonal, and community attitudes and behaviors. They found few primary studies that have examined the determinants at the organizational and public policy level, representing a significant gap in research. Although this work is helpful to conceptualize the different levels at which vaccine hesitancy operates, it does not illustrate the mechanisms through which these factors encourage or discourage vaccine hesitancy beliefs. For this reason, we conducted an interpretive review of 34 qualitative studies on parents' decision-making process with regards to childhood vaccines using a qualitative research integration approach [7]. We identified overlaps and relationships between 7 factors that promote vaccine hesitancy: previous experiences; "natural" and "organic" living; perceptions of other parents; experiences interacting with healthcare providers; information sources, challenges, and preferences; distrust in health system players; and mandatory vaccine policies. These factors can be conceptualized using the metaphor of a gear train from the physics discipline. The gear train metaphor illustrates that while a parent may prioritize up to two factors to make their vaccine decision, the parent still considers all other factors but to a lesser degree. Previous works have also explored parents' rationale behind vaccine hesitancy. For example, in a systematic review of qualitative studies on the reasons why parents in the United Kingdom vaccinate their children or reject vaccines, Forster and colleagues found two types of decision-making: *non-deliberative* (i.e., parents felt that they had no choice, were happy to vaccinate their child, and/or relied on the social and cultural norms of their community) and *deliberative* (i.e., parents sought information from a variety of sources to weigh the risks and benefits of vaccinating, as well as considering others' advice and experiences) [8]. Additionally, a study by Brunson generated a grounded theory of the vaccine decision-making process of 15 mothers and 3 couples which comprises the following components: awareness, assessing, choosing, stasis, and ongoing assessment [9]. Brunson's work illustrated that vaccine-hesitant parents make the decision to not vaccinate for each individual vaccine rather than all vaccines as a whole. For this reason, parents' decision to not vaccinate is susceptible to change based on their environment and as new information is made available by trusted sources for each vaccine [7].

Findings from the Forster and Brunson both illustrated the dynamic nature of parental vaccine-hesitancy. These studies demonstrate that every vaccination decision is considered separately by parents and their stance on vaccination is subject to change according to the information available to them by trusted sources of information [7].

Strategies for addressing vaccine hesitancy

When designing and implementing interventions to address vaccine hesitancy, researchers and decision-makers need to understand that there is a compendium of reasons and combinations that uniquely position each parent in their rationale to delay or reject vaccines. Reasons may also differ between vaccines; all reasons must be considered together when determining which interventions will be effective.

We have found that parents' expectation of shared decision-making – a component of informed consent whereby patients and healthcare providers make collaborative health care decisions [10] – in vaccine decisions conflicts with healthcare providers' orientation towards vaccines. Parents may enquire about the benefits and possible health risks of vaccines to make an informed decision. However, allopathic healthcare providers may perceive this enquiry to challenge their knowledge, expertise, and experience, especially when providers report a lack of up-to-date knowledge about recent vaccine research [11]. As a result, healthcare provider behaviours may conflict with parents' needs for specific information about vaccines before making a decision. For a considerable number of parents, this conflict may entrench them in their vaccine-hesitancy beliefs which may cause some parents to discontinue their relationship with allopathic medicine [12]. Parents may then seek information from the media or internet, or complementary and alternative providers [13].

Previous research has found a scarcity of evidence-based approaches to address vaccine hesitancy [14]. Existing interventions that have been somewhat successful in improving vaccine acceptance are multicomponent- and dialogue-based (e.g., social media, mass media, and information-based tools for healthcare providers) [15]. While Walling and colleagues' systematic review found 2 informational interventions, 18 behavioural interventions, and 31 environmental interventions to improve vaccine uptake [16], Dube and colleagues identified no strong evidence supporting the effectiveness of any specific vaccine uptake promotion strategy in their survey of 15 literature reviews [14]. These findings illustrate that there is a need to focus attention and resources to develop newer and more innovative interventions tailored to the compendium of reasons and rationales that parents use to delay or reject vaccines.

A three-part agenda for future vaccine hesitancy research

Based on our discussion, we suggest three directions for future vaccine hesitancy research:

1. Focus on interventions targeting vaccine-hesitant parents instead of vaccine rejectors

There will always be groups who will reject vaccines for various reasons, and we do not need 100% acceptance for all vaccines. As long as vaccination rates are sufficiently high, herd

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immunity may still be achieved; this is a phenomenon where an immune subpopulation slows the spread of a disease, indirectly protecting unvaccinated individuals [17]. Although we do need high acceptance for some vaccines in order to achieve herd immunity, our efforts will be more efficient if we target those who are most likely to seek new information and try to address their beliefs. Therefore, resources should be dedicated to better understanding partial acceptance, partial rejection, and delay of vaccines. Understanding which factors are more influential for which parents under certain circumstances will clarify the elements of interventions that will most likely improve outcomes.

2. Focus energy and resources on tailoring existing interventions and testing the effectiveness of these interventions in different contexts

We have a reasonable amount of effectiveness research on interventions to address vaccine hesitancy. We need to continue testing their validity and applicability in different contexts (e.g. countries, populations, and reasons for vaccine hesitancy). We also need a more robust understanding of how to tailor existing interventions for different values and beliefs regarding vaccine hesitancy. Tailoring is an effective strategy to improve the impact of interventions, particularly when considering the behaviour, belief, population, and demographic variables [18]. The assumption is that since there is a multitude of reasons and rationales that promote hesitancy, interventions need to be tailored for each parent; for example, we have found that vaccine-hesitant parents are more likely to have the financial capacity to not vaccinate (i.e., placing their children in more expensive private schools that do not mandate vaccination, or creating a healthier and more "natural lifestyle" for their children). However, developing a different intervention for each parent is impractical. There is a need for research to identify how we can balance an intervention's ability to target a wide range of vaccine-hesitancy beliefs while simultaneously be effective in addressing the unique rationales of each parent.

3. Develop robust continuing medical education that promotes shared decision-making in vaccine discussions

Negative experiences with allopathic health providers are among the most commonly cited reason for parents to entrench in their vaccine hesitancy beliefs [7]. Shared decision-making is uncommon for vaccine discussions because it is more relevant for *preference-sensitive decisions*, where there are multiple treatment options each with their pros and cons. Vaccination is not a preference-sensitive decision because vaccines have important benefits when administered and deleterious risks otherwise. However, since the parents' expectation of shared decision-making is increasing [19], it is important to identify which elements of shared decision-making are most appropriate, and train healthcare providers to incorporate these elements in their discussions with vaccine-hesitant parents. In this way, vaccine hesitant parents may feel more welcomed and invited, and as such, be more amenable to accepting vaccines for their children.

Vaccine hesitancy is a complex phenomenon; parents express a compendium of reasons and rationales for rejecting or delaying vaccines. As the number of vaccine hesitant parents increase worldwide, the values and assumptions that ground public health is being challenged. In the face of such challenges, healthcare professionals might consider not reacting with judgement or ignorance; rather, healthcare providers need to identify why vaccine hesitancy persists and how they can tailor interventions to address or alleviate such beliefs for the goal of improving public health. This article provides an overview of vaccine hesitancy research to promote better and more relevant research.

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