



Editorial

Vaccine education spectrum disorder: the importance of incorporating psychological and cognitive models into vaccine education

A major issue in contemporary public health and vaccinology concerns the significant reversal of popular opinion about vaccines from broad acceptance, to common concern about safety and efficacy. Vaccine fear and anti-vaccine sentiments have led to decreased vaccine coverage rates and, quite predictably, to vaccine-preventable disease (VPD) cases and outbreaks. Many, including one of us, have written extensively about the role of the anti-vaccine movement in this regard [1,2].

Given heightened concerns about vaccine safety and efficacy, despite more information than ever, why has so little attention been directed toward evaluating current vaccine education and messaging efforts? It is our belief that critical to improving vaccine use and coverage rates is the process and content of educational efforts and framing to increase awareness, knowledge, and behavior in terms of vaccine acceptance. However, it has been our observation that vaccine education efforts have been unimodal, of low yield, and are rarely adapted to the preferred cognitive or decision-making style of the intended recipient of such education—a problem we call vaccine education spectrum disorder—as it highlights the lack of acknowledged “spectrum” in such educational efforts. Such efforts have proceeded from the assumption that decisions such as vaccine acceptance are rational and motivated by analysis of facts—despite a significant body of literature demonstrating that this assumption is untrue and instead made on the basis of cognitive biases and heuristics, among others [3]. This decades-long propensity toward a single educational mode that we would characterize as a fact-based, left-brain approach, is notable for its lack of appreciation of how the *spectrum* of cognitive decision-making styles differs among our patients, and is uninformed by how such knowledge might otherwise lead to improved attempts at education and message framing.

Human beings appear to behaviorally accept, or not accept, vaccines for a limited number of prime reasons: fear, coercion, and bandwagoning (also described as self-efficacy theory in the psychology literature). Fear may be fear of the consequences if not immunized (or alternately fear of vaccine side effects in accepting a vaccine), and bandwagoning refers to the sociological/psychological idea, applied to vaccines, of accepting (or not accepting) vaccines because others either individually or collectively esteemed by the decision maker, accept (or not) vaccines [4]. This is similar to self-efficacy and social norming theories that state we are more likely to engage in an action that perceived peer experts engage in, as it raises our self-efficacy or confidence in our ability to protect ourselves, or in behaviors that we view as normative among others [5,6]. We hypothesize that reasons of fear

and bandwagoning are both amenable to educational efforts and message framing, and this is the focus of our commentary.

Defining the audience spectrum

It is critical to define the audience toward whom educational efforts should be directed. Such knowledge informs education content, framing, and process. In the realm of vaccines, this spectrum includes providers (physicians, nurses, pharmacists, etc.), policy makers, payers, the public, and specific at-risk patients. Importantly, educational efforts are usefully directed at key influencers of a specific patient or at-risk group such as the spouse or child of a patient at higher risk for a VPD.

Defining the audience is also important because each audience group is likely to have different educational needs, find value in different modes or styles of education, and even come to us with quite differing levels of cognitive ability and emotional baseline characteristics. Knowledge of emotional baselines are important in deciding whether to provide gain-based or loss-based framing of health messages [7]. Adolescents and young adults may find educational efforts delivered through social media (and hence social norming) more alluring than dry “fact sheets.” Younger adolescents (and others) might be reached through the use of gaming technology to frame and deliver educational messages and knowledge of the importance of vaccines. Providers may find scientific reviews or fact sheets more useful. Thus, it is critical to understand that such a spectrum of opportunity exists; otherwise, it is unlikely that appropriate educational content and modalities will be developed for each specific group.

The spectrum of cognitive styles

Much has been written about education theory and its relationship to health education and behaviors. Such is beyond the scope of this commentary. Rather, we wish to illustrate an important point not well articulated or present in the vaccinology literature—and that is the value of understanding the preferred cognitive decision-making style used by providers and patients. Current vaccine educational efforts, particularly those developed by governmental and public health authorities, invariably adopt a unimodal fact-based, left-brain cognitive style. This reflects the preferential style used by the developers and approvers of such materials—a style that may not be favored by the intended recipients—and quite obviously not a style that has changed vaccine acceptance behavior in the population. Instead, we believe it is worthwhile to identify pre-

ferred cognitive decision-making styles at the individual and group level, and adopt educational strategies and message framing specific to each style. Table 1 provides examples of some of these styles (not intended to be exhaustive).

With the Table as context, we can approach vaccine education and messaging based on the spectrum of preferred style. For example, for a patient with a preferred analytic style, instead of simply telling what they need to do (i.e., “You need the MMR vaccine.”), a better route would be to provide data, and engage the patient in understanding the role of vaccines in their personal health, and empower them to make healthy decisions. For a denialist, motivational interviewing may be more useful. Motivational interviewing is “focused on responding differentially to client speech, within a generally empathic person-centered style . . . a guiding principle of motivational interviewing is to have the client, rather than the counselor, voice the arguments for change [8].” The idea behind this technique is that an individual tends to respond more favorably to the accurate empathy of the health professional in dealing with resistance to a health behavior. When the patient is simply told what to do, the health care provider isn’t addressing the resistance, and may actually make the patient more firm in their belief. Motivational interviewing is particularly helpful when added to the other techniques addressed throughout this paper.

For many individuals, particularly for fear-based, bandwagoning, heuristic, and perhaps innumerate styles, the Transtheoretical Model, developed by Prochaska and DiClemente, provides a useful perspective on the stages of change an individual goes through when making a behavioral change (such as deciding to protect health by receiving a vaccine) [9]. These stages include precontemplation, contemplation, preparation, action, maintenance, and relapse [10]. By understanding each of these stages and their importance, we can assist patients who are not even considering vaccination to accept vaccines to protect their health throughout their lifetime. Implicit in this model, and our general belief about vaccine education, is the idea that change is a time-intensive process, and this we believe identifies another key failure in current approaches to vaccine education. Too often we expect a “30-second” program to increase vaccination acceptance. Often that will not be the case, and consideration of consistent educational efforts over a longer time frame—delivered through a trusted health care provider—is key to success.

The self-efficacy theory may also play an interesting role in an individual’s decision-making process as part of the interplay with cognitive-behavioral theory. Albert Bandura suggests that “self-beliefs of efficacy play a key role in the self-regulation of motivation. Most human motivation is cognitively generated. People motivate themselves and guide their actions anticipatorily by the exercise of forethought. They form beliefs about what they can do [6].” As this theory suggests, thoughts lead to behaviors, and the thoughts of the individual has a great deal of importance to the behaviors they will decide upon for their (or their child’s) life.

Finally, another important dimension in the discussion of vaccine education and behavioral change is a basic understanding of the Health Belief Model. This is a health, behavioral, and psychological model for studying and promoting the uptake of health services, and has been used to predict health behaviors [11]. This model suggests that individuals make health decisions based upon the following factors: “perceived susceptibility to disease, perceived severity of disease, perceived benefits of preventive action, perceived barriers to preventive action, modifying factors such as demographic variables, cues to action such as advice from others, and media reporting” [12]. Other models exist too, such as ecologic models that consider interpersonal relationships, communities, public policies, and other environmental factors that together influence an individuals’ decision-making.

Critical to our approach is the idea that an individual’s preferred cognitive style, emotional baseline, and subsequent behavior, are all intertwined. Notably, this is the central idea around which cognitive behavioral therapy proceeds, and is therapeutically used in the mental health field through a process of understanding how one’s thoughts affect subsequent feelings and behavior. Thus, behind each behavior, there is believed to be a set of thoughts and feelings that influenced and informed the choices made by the individual. Conscious knowledge and awareness of these thoughts and feelings is therefore critical to both communication, and change. As an example, perhaps an individual is exposed repeatedly through the media to the Wakefield hypothesis that MMR vaccine causes autism. A follow-on thought might be “MMR vaccine causes autism and why don’t the experts tell the truth about the vaccine?” This may lead to a feeling such as, “I don’t trust what I am being told and I don’t want to harm my child.” This thought and feeling would then predictably lead to a behavior such as, “I’m not giving my child that vaccine.” Of course, examining the behavior alone is a small and insufficient part of a larger story playing out in the thoughts and perceptions of the individual. Unless we can understand the whole story, we cannot fully communicate with the individual, educate them, or aid them through the decision-making process.

The way forward

So how to make progress? We present several initial ideas about preferred cognitive styles and acknowledge the importance of understanding the follow-on spectrum of vaccine education and message framing we believe may be improvements to the current unimodal, fact-based analytical style of vaccine education commonly used. We hope this may spark discussion and encourage new styles and models of vaccine education and communication in an effort to inform and improve popular cultural perceptions about vaccines. Ultimately, effective education programs will increase immunization coverage rates, which in turn has been demonstrated to be the most significant strategy in controlling/preventing VPDs. To that end, we suggest the following:

Expand the spectrum of vaccine education. As previously discussed, an appreciation for the spectrum of vaccine educational efforts—including “right brain” efforts, are warranted. Cognizant of preferred cognitive styles, and psychosocial theories of decision making, these efforts need to be translated into compelling and winsome educational material based on audience need. Educational efforts aimed at highly knowledgeable and medically sophisticated providers are different than that needed by adolescents, and likely to be further different from that required for parents.

Understand vaccine psychology and cognitive decision making. The psychology of decision making about vaccines needs a much deeper science base and accelerated research efforts. How individuals make personal and family decisions, and under what conditions, about vaccine acceptance and refusal is critical to informing education efforts to reach these individuals. Accelerants and inhibitors of those decisions need to be defined. An excellent starting point is for public health authorities to fund research, carried out by scientists in the areas of psychology, sociology, anthropology, and their related subspecialties, aimed at understanding these issues. Harnessing and leveraging knowledge of social norming, self-efficacy, and cognitive behavioral interviewing styles is likely to be highly rewarding if they can be feasibly adapted to vaccine education.

Learn from other health education endeavors. Most recently in the U.S., the FDA approved, and will require, candid, highly visible, emotional photographs and written warnings on individual packs of

Cognitive style	Main effect	Verbal expression	Approach
Denialist	Disbelieves accepted scientific facts, despite overwhelming evidence. Prone to believe conspiracy theories	"I don't care what the data show, I don't believe the vaccine is safe"	Provide consistent messaging repeatedly over time from trustworthy sources, provide educational materials, solicit questions, avoid "hard sell" approach, use motivational interviewing approaches
Innumerate	Cannot understand or has difficulty manipulating numbers, probabilities, or risks	"One in a million risk sounds high, for sure I'll be the 1 in a million that has a side effect, I'll avoid the vaccine"	Provide nonmathematical information, analogies, or comparators using a more holistic "right brain" or emotive approach
Fear-based	Decision making based on fears	"I heard vaccines are harmful and I'm not going to get them"	Understand source of fear, provide consistent positive approach, show risks in comparison to other daily risks, demonstrate risks of not receiving vaccines, use social norming approaches
Heuristic	Often appeals to availability heuristic (what I can recall equates with how commonly it occurs)	"I remember GBS happened in 1977 after flu vaccines, that must be common, and therefore I'm not getting a flu vaccine"	Point out inconsistencies and fallacy of heuristic thinking, provide educational materials, appeal to other heuristics
Bandwagoning	Primarily influenced by what others are doing or saying	"If others are refusing the vaccine there must be something to it, I'm going to skip getting the vaccine"	Understand primary influencers, point out logical inconsistencies, use social norming and self-efficacy approaches
Analytical	Left brain thinking, facts are paramount	"I want to see the data so I can make a decision"	Provide data requested, review analytically with patient

cigarettes regarding the risk of use of tobacco. Could similar visual and emotional appeals be made in the interest of increasing vaccine coverage?

Expand the intended audience. Key influencers on vaccine decision making need to be included in vaccine educational efforts. For example, when seat belt laws were first put into place in the U.S., a highly successful campaign was developed to educate elementary school children (not drivers themselves) about the value of engaging in this health behavior, and the risks of not doing so. Could such lessons be applied to vaccines?

Expand the platform of vaccine education. New technologies such as use of the social media, gaming, information "push" technologies, podcasts, and others, can and should be experimented with as valuable adjuncts in education. Experiments across different groups and sub-populations need to be carried out. However, such efforts will require acknowledgment of the importance of these efforts, and funding to test them.

Conclusion

The benefits of the current, primarily unimodal, model of developing and delivering vaccine education materials are limited and of generally low value. For example, the educational efforts of the last two decades to educate the populace that MMR vaccines are safe, effective, and are unrelated to autism—as measured by population coverage rates—have been unrewarding, low yield, and should be abandoned as a stand-alone strategy. Governments and public health agencies spend millions of dollars developing websites and fact sheets, but with questionable measurable effect. Certainly, the goal of enhancing the populace's understanding of the importance of vaccines, followed by health behaviors of high rates of vaccine acceptance and coverage has not been met. Indeed, multiple Healthy People 2010 vaccine goals set for the U.S. population have failed to be met [13]. Substantial efforts, including years of scientific advancement at costs of billions of dollars in direct and indirect costs, go wasted when both time-tested and newly licensed vaccines go unused due to public fears and misperceptions about vaccines. As an example, we and others have demonstrated that despite intensive and long-standing traditional education programs, nurses commonly have misperceptions about influenza vaccine safety and efficacy, and consequently, low rates of influenza vaccine acceptance [14].

We believe wisdom resides in approaching issues such as vaccine decision making from a scientifically informed perspective—identifying issues, framing questions, developing models, testing hypotheses in the context of appropriate study designs and clinical studies, and attempting to replicate and generalize results. Unfortunately, this model has been generally ignored in the modern generation of vaccine education efforts, to our collective peril. We need scientists and content experts from fields outside of medicine, nursing, immunology, and epidemiology to work with us to achieve the ideas discussed herein. This requires that such efforts be valued, and an excellent start is to provide research funding to seed such collaborations. In particular, cognitive and health psychologists have much to offer to the field of vaccine education and decision making and we would be foolish, and dismissive of our patients' needs, to not so engage and thereby make real progress in vaccine education efforts.

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