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Immunology beliefs as a factor in vaccine opposition among complementary and alternative medical providers

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Abstract

Objectives: Parental pediatric vaccine decisions are influenced by parents' health provider networks. Complementary and alternative medical providers may be key influences in the networks of those parents who do not vaccinate their children.

Methods: From March to July 2013, we conducted semi-structured interviews of Oregon complementary and alternative medical providers ($N = 36$) in five disciplines likely to treat parents or children, or both, and whose practitioners are known to express opinions about vaccines and vaccination. We interviewed them concerning their immunology beliefs, vaccine positions, and what these providers recommend to their patients concerning vaccines. We conducted face-to-face interviews and analyzed the interview data using thematic analysis methodology.

Results: This article identifies the range and type of immunological beliefs of complementary and alternative medical providers concerning pediatric vaccine recommendations. From repeated readings of the data, we identified three areas of alternative immunological beliefs among complementary and alternative medical providers (i.e. "natural is best," "innate intelligence," and "the fragile immune system"). In addition, complementary and alternative medical providers who embraced mainstream medicine were likely to be vaccine accepters and to mention vaccines as a positive health measure to their patients—these themes were "vaccines prevent illness" and "herd immunity."

Conclusion: Complementary and alternative medical providers influence their patients' vaccination decisions, particularly urging caution or complete vaccine avoidance, and may be a major influence in states like Oregon with high non-medical exemption rates. Complementary and alternative medical providers come to their anti-vaccine positions largely through post-graduation continuing education courses and seminars. In Oregon, such courses are unregulated and not vetted.

Keywords

Vaccine, complementary and alternative, thematic analysis, providers, parents

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Introduction

Vaccines save thousands of American lives each year and millions worldwide.[1] Despite demonstrated benefits to individual and community health, some parents choose to delay or completely avoid vaccines for their children.[2] As a result, outbreaks of vaccine-preventable diseases (VPDs) occur where high rates of non-medical exemption (NME) populations cluster.[3] Parents who decide to delay or not vaccinate their children believe that vaccines pose health risks and few benefits for their children.[4] Moreover, past research has shown that parental beliefs concerning the human immune system are robust correlates of modifying or refusing pediatric vaccinations.[2,5,6] The vaccine-avoiding beliefs include, for example, that a child's immune system can be weakened by vaccines, and that vaccines are unnatural and impure.[7] In addition, and somewhat contradictorily, that healthy children do not need vaccines.[2,8] Understanding the source of these vaccine-avoiding beliefs may provide a better understanding of needed strategies for communicating vaccine risks and benefits. In this study, we sought to expand our knowledge from interviewing a larger sample of complementary and alternative medical (CAM) providers, as these providers do

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offer vaccine advice to parents, as our earlier research found.[9] This advice is often in terms of "what I do for my children."

We have loosely defined CAM using the description provided by Tippens et al.[10] as "any practice with health-promoting intent that has not yet been adopted by conventional medicine." The National Center for Complementary and Alternative Medicine (NCCAM)[11] of the National Institutes of Health uses simply "non-mainstream practice" to refer to alternative medicine. We sought to probe deeply into vaccine-avoidance rationale among CAM providers.

In the United States, Oregon has some of the highest levels of NMEs among parents of elementary school children.[12,13] Vaccination exemptions for Oregon kindergartners rose steadily from 2% in 2001 to 7% in 2013 and parental exemptions, according to the Oregon Health Authority, climbed to 7.5% of schoolchildren in 2018.[14] In 2016, only 58% of all Oregon children under the age of 2 years had received the recommended regimen of vaccines. Oregon was among the states with the lowest vaccine completion rate, well below the national average of 71%.[15]

Past research has shown that parental beliefs concerning the human immune system are robust correlates of modifying vaccine schedules or refusing pediatric vaccinations,[2,8] including that "natural is best," or that too many vaccinations, or vaccinations in close temporal proximity, will "overwhelm" the child's immune system and cause them harm.[16] These immune beliefs are not supported by current scientific evidence[17–19] but they provide parents with a science-like rationale with which to explain why vaccines pose health risks to young children.

It is important to consider where these anti-vaccine immune beliefs may originate. Prior studies have found that beliefs concerning vaccines are associated with parents' health information networks (e.g. physicians; friends; and the popular media, including social media), with health care providers being the major source of recommendations to vaccinate or not vaccinate children.[2,20–22] CAM providers, in particular, are sources of vaccine beliefs that can influence parents' decisions to delay or refuse to vaccinate their children.[23] Oregonians may be even more likely than residents of other states to seek CAM treatment and, thus, to solicit and heed the advice of those providers. We used chiropractic density as a proxy for all CAM finding 4.1 chiropractors in Oregon for every 10,000 people. Across the United States, there are 3.2 chiropractors for every 10,000 population.[24] By comparison, Oklahoma, a state with a similar population to Oregon's, has half as many, or 2.2 chiropractors for every 10,000 people. We therefore speculate that (a) Oregonians are more likely than residents of states like Oklahoma to seek alternative health care and (b) CAM providers are an important source of information on immune beliefs and advice on vaccinating for parents in Oregon.

Little is known, however, of CAM providers' immunological beliefs. The impact of CAM providers on the health practices and choices of their clients is an interesting area that remains under-researched in mainstream health journals.[25] The present exploratory study provides formative data on the nature of CAM belief systems and how they may affect CAM providers' self-reported recommendations to parents regarding pediatric vaccines. Prior work[9] has shown that CAM providers do vary in their acceptance of pediatric vaccinations, and this earlier work provided some initial evidence that recommendations may be associated with believing that "natural is best," and regarding vaccination as unnatural and impure,[7] and therefore as harmful.

Methods

Participant sample and sample selections

The study was approved by the Institutional Review Board at Oregon State University.

To refine our semi-structured interview instrument, we used a sequential process, conducting seven pre-test semi-structured interviews, analyzing these data, and then fielding a revised semi-structured interview instrument to 36 CAM providers and 2 key informants who critiqued our semi-structured interview schedule and discussed early findings with us. The seven pre-test interviews were not included in the present data. CAM providers in this study were selected from diverse communities in Oregon, ranging from small towns to larger cities (53% female, mean age = 48 years, median income = US$61,000–US$80,000). Our final interview population included acupuncturists, acupuncturist-naturopaths, chiropractors, homeopaths, homeopath-naturopaths, midwives—two of whom were nurse-midwives and one a midwife-naturopath—and naturopaths. For the purposes of analysis, the dual-disciple narratives were coded separately for both disciples.

To access CAM providers, we began with a small list of local providers obtained from local sources and chain referrals. To this list, we added CAM providers identified from the Healthgrades website (http://www.healthgrades.com/). Healthgrades (Healthgrades Operating Company, Inc.) is a commercial website that provides information on an estimated 3 million US health care providers. For the purposes of timing and expense (our study was self-funded), we decided to focus on western Oregon, USA, and sites within a half-day's drive of our home base. We contacted all CAM providers in the 14 cities within this radius. The five CAM disciplines listed above were selected for their likelihood to treat parents or children, or both, and were defined according to the Institute of Medicine[26] 2005 report. Midwives, although not strictly defined as CAM providers, were included because research has shown them to favor alternative medical concepts[9,27] and because midwife-attended births have been on the rise. In Oregon, midwife-attended births increased from 9% in 1990 to 16% in 2009[28]—in 2009, this equated to 7550 live births.[29] This density of midwifery places Oregon in the top 10% of states in use of midwives for vaginal births.

Table 1. Introductory interview guide questions.

What was the one thing that persuaded you to become a/an [x[a]]?
Tell me about your professional preparation? Where? How long?
What about other continuing education or additional specialized training? What was the focus?
Did you participate in residency or work with another experienced practitioner when you first started your professional career?
Did your professional training include education about the human immune system?
Please describe this training. How did you feel about it? Did it fit your worldview, resonate with you?

[a]Indicates profession: acupuncturist, chiropractor, homeopath, midwife, or naturopath.

We created a list of 251 CAM practitioners, all of whom were contacted by phone and invited to review study materials that would be sent via email. Of the 251 providers contacted, 82 requested materials about the study, but more than half of those providers declined to participate or did not reply to a request for an interview. We attempted to conduct a non-response interview, but, unsurprisingly, the non-responders did not respond; thus, we can only speculate as to their reasons for declining to participate in the study. The recruitment letter itself may have factored in non-response. We explained in the first paragraph that our research aimed at understanding "views about vaccines and the immune system." Judging by the reaction of the 36 providers who did agree to participate, many despite misgivings, those reasons may have included distrust of the public health establishment, lack of interest or time, or a belief that the interviewer would introduce bias into the analysis. Interviewees were purposively drawn from urban and rural Oregon (i.e. Albany, Ashland, Bend, Cave Junction, Cheshire, Corvallis, Eugene, Hood River, La Grande, Pendleton, Portland, Salem, and The Dalles), thus we hoped to represent a cross-section of CAM providers in Oregon (indeed, some towns had only one CAM provider; many towns within the chosen geographic range had none). Recruitment continued until at least six participants were obtained for each provider category. We selected six because the literature shows that data saturation is possible with as few as six participants.[30] Our interview experience with participants corroborated this finding—data saturation occurred after as few as three interviews in a given discipline. Interviews took place only once and in the participants' offices. Transcripts were not returned to the participants for their review.

Data collection and management procedures

Participants were interviewed using a semi-structured interview schedule between March and July 2013, in one-on-one, single face-to-face audio-recorded interviews that lasted between 30 and 70 min (S.J.B. conducted all the interviews). At the time of this research, S.J.B. was a doctoral candidate, with decades of journalistic experience interviewing subjects and writing profiles for organizational and news publications. The pre-test of seven CAM providers revealed that responses were affected by the query order. Based on the pre-test, direct vaccine-related questions were shifted to late in the interview so that rapport could be established in the early stages of the interview encounter. All interviews consisted of questions related to the provider's professional choice, training, and practice; beliefs about health and the immune system; recommendations for good health practice; and the efficacy, benefits, and safety of vaccines, including community benefits or herd immunity (see Table 1 for the initial, rapport-building questions on our semi-structured interview instrument). The interviewer took extensive field notes following interviews.

Interviews were transcribed verbatim by a professional transcriptionist, and then transcripts were cleaned and cross-checked for reliability against the original audio files. The initial interviewer performed several rounds of active listening, in addition to hand-coding[31–33] all transcripts. All transcripts were prepared as documents using Microsoft Word™ (Seattle, WA). The interviewer then read each transcript numerous times. Personal narratives were explored in this study, and themes were coded as the researcher discovered them; patterns and themes were identified and selected for research interest.[33] For our analytic purposes, the unit of analysis was an embedded story or phrase in the narrative, coded by theme.[33] We continually combined and recombined themes. The primary researcher created theme documents for each discipline (24 to 28 documents per discipline). In addition to thematic analysis, we employed a modified grounded theory approach[34] because we had ascertained several themes in our earlier research. In this study, all themes were compared within and across the five CAM disciplines. Inductive and deductive codes were categorized and thematic analysis was used for the interview data. J.A.C. reviewed and critiqued all theme documents. For our simplified code summary of the major themes (prevention, immunology beliefs, and herd immunity), see Table 2.

Results

Vaccine positional themes

Three vaccine positional groups emerged: full acceptance ($n=7$), full opposition ($n=10$), and conditional acceptance of vaccines ($n=19$). *Conditional vaccine acceptance* reflects acceptance of some, but not all vaccines or vaccine protocols (e.g. scheduling and dosage). Other researchers call conditional vaccine accepters "fence-sitters."[35] All 10 of the

Table 2. Codebook.

Structural code	Description
Disease prevention	Statements regarding the ability of vaccines to prevent disease(s). Also includes statements regarding the ability of a vaccine to affect (a) an individual's risk of getting disease(s) and (b) transmission of disease(s) from one person to another.
Immunology beliefs	Statements that describe (a) how the human body and its systems and organs prevent or overcome infection or disease and (b) how vaccines help or harm the immune system.
Herd immunity	Statements regarding (a) prevention of suffering in individuals or groups, (b) prevention of disease spread at the population level, (c) role of vaccines in population protection, and (d) role of herd immunity in individual protection against VPD(s).

VPD: vaccine-preventable disease.

opposers reported unscientific beliefs about the immune system.[23,36] All participants admitted giving advice to parents, often in terms of "what I do for my children" rather than "what you should do," as none was qualified to provide medical advice.

Immunological belief themes

Variations in immunological beliefs, categorized as *science-based* and *alternative* beliefs, were coded and examined across all three reported conditions. Science-based beliefs were defined as views consistent with Western biomedical concepts and research. For instance, research has determined that the immune system is (a) fully developed at birth, (b) constantly replenishing itself, and (c) robust (e.g. in a vaginal birth, the neonate is exposed in the birth canal to a wide array of potentially harmful bacterial populations against which the infant's immune system protects).[37] Thematic analysis identified three overlapping categories of immunological beliefs that were defined as alternative: (a) "natural is best," (b) "innate intelligence," and (c) the "fragile infantile immune system."

In terms of vaccine acceptance, the themes that emerged were (a) "vaccines prevent illness" and (b) "herd immunity." Exemplar selections from interviews grouped by accepter, conditional accepter, and vaccine opposer are included in Table 3.

All vaccine-opposing providers ($n = 10$) expressed strong alternative immunological beliefs and their entire focus was on health for the person, not the population. By contrast, CAM providers who accepted immunization were more likely to have science-based beliefs as well as to understand and appreciate how vaccines protect at the individual and the population level (i.e. herd immunity).

Naturopaths in this study fell into the conditional category. All of the naturopaths interviewed at the time of this study, including those with a physical science background, fully embraced the 1991 canon of the American Association of Naturopathic Physicians. This document (a) states that some of the current childhood vaccinations "have been associated with significant morbidity and are of variable efficacy and necessity," (b) urges caution in recommending any vaccine, and (c) calls for "safer, more effective vaccinations," and recommends delaying administering any vaccine until after 2 years of age.[38] The canon also fails to note any public health benefit related to vaccines. Most naturopaths endorsed vaccination, but none, for example, endorsed the vaccine needed to prevent rotavirus or the hepatitis B vaccine administered at birth.

CAM providers interviewed did have pre-conceived notions about how mainstream medicine approaches health and health care, but providers in this study did not choose their CAM modality because of pre-existing vaccine beliefs. In fact, formal training for a particular CAM profession often supported vaccines, however cautiously (i.e. naturopathic and chiropractic education).

Most CAM practitioners became more cautious about all vaccines following their formal education, and became even more cautious following completion of various continuing education (CE) courses. They were thus decreasingly likely over time to recommend vaccines to their patients/clients or to accept them for themselves or their families than they had been before their training. The providers who accepted some vaccines and opposed others (conditional) held either fully science-based beliefs or co-mingled (mixed) science-based and alternative beliefs.

Natural is best. "Natural is best" reflects a collection of beliefs that the human body, when it is healthy, is capable of fighting off, or suppressing, any disease. Such belief systems were held most notably by those CAM providers who opposed pediatric vaccines. Many of these vaccine opposers admitted to explaining their opposition to parents in their practices. One midwife asserted that she refused to accept into her practice a birthing couple who planned to vaccinate their baby.

Innate intelligence. A belief described frequently by naturopaths, homeopaths, and chiropractors is that the body has an innate ability to heal. Of course, this is the definition of innate immunity[39] as contrasted with immunity acquired from a previous infection or from prophylactic vaccination. Susceptibility to infections was seen as the result of poor personal management of, for instance, diet, stress, exercise, and body alignment (i.e. chiropractors emphasized body

Table 3. Immune and vaccine beliefs of Oregon complementary and alternative medical providers: exemplar quotes.

Beliefs	Vaccine accepters ($n=7$)	Conditional accepters ($n=19$)	Vaccine opposers ($n=10$)
Vaccines prevent illness	I'm pretty pro for childhood vaccines … there are risks with everything we do. Every time we climb in a car there's a risk that as we go down that highway, we may not come home … If [a] child gets sick and dies from the disease that [a] vaccine is preventing, how do you answer to that? I definitely believe in the vaccines. I encourage women to get the hepatitis B vaccine. I'm impressed with people—what they will put in their bodies and yet they will argue about vaccines … We eat foods that are so full of chemicals, and then we worry about something that has really been studied, and studied, and studied. It's amazing. I mean, we—you and I are here … because of some of these vaccines. (MW15) I believe that vaccines have a role in preventing illness … Do I have homeopathic vaccines? My answer is "no." I have prevention and treatment, but homeopathics haven't been shown—there's no data available—[that they] actually stimulate the immune system like a vaccination does. I want to be real clear about that. (HM01)	There are certain diseases that obviously carry more risk, such as pertussis in young infants versus maybe tetanus … (ND06) I think we need to have the DTaP, we need to have the polio (vaccine) … and measles vaccine … Measles is highly contagious, so it makes sense to vaccinate for that. You have to look at the evidence … look at the [vaccine] spectrum—what are you comfortable with? Do you want to do just a few vaccines, like the vaccines of the really scary things? Like polio … maybe mumps, measles? (ND01) My heart said don't do it (vaccinate my daughter against hepatitis B); but, I couldn't deal with it if down the line if she caught something and it could have been prevented. (AC04)	I have tetanus vaccine in my refrigerator here. I think the potential consequences of the vaccine are less than the potential consequences of tetanus, and that tetanus is in the soil. So I provide that vaccine and keep it all the time. (NDMW04)
Natural is best		The body—in the right environment, given all of the things that it needs to be strong and have the immune system working—is capable of dealing with anything. (ACND09)	Nothing beats naturally acquired immunity versus artificially acquired through vaccinations. (CH11) Vaccines are a rather unnatural way of introducing infectious disease to the body, especially when you're introducing multiple infections at one time. That's not the way nature has ever done it. (HMND10)

(Continued)

Table 3. (Continued)

Beliefs	Vaccine accepters ($n = 7$)	Conditional accepters ($n = 19$)	Vaccine opposers ($n = 10$)
Innate intelligence			
	There are a lot of chiropractors that believe that the human body can heal itself if we get out of the way and let it happen. … I believe that that's correct to a certain degree, but … if the body is haywire, it's just not going to fix. Then you have to go to other means. [For example], … there are patients [who] were in so much pain that … what I was doing was not providing enough relief fast enough so I referred them to a medical doctor, or the ER, in order to get some pain meds. (CH18)	You've got the innate immunity … skin keeps us in and the rest of the world out. Well, if the rest of the world gets through our skin, then we have to have cells there primed and ready to clean up the mess and get the foreign organisms. So, basically, what I see clinically is there's two things going on with the immune system. It's protecting us from invading infection by a variety of different mechanisms. So in the long-term infection, our body will make antibodies. We've also got the cellular-mediated immunity where the white blood cells find the foreign organism and they don't need an antibody attached to it; they just engulf it and kill it. (ND01)	When your spine is in alignment, there are nerve energies in the blood circulation … and, if they're impinged in any way, that will interfere with the process of the body and, thus, the immune system. All I do is put the bones back into place and let the body adapt … and do what it's supposed to do. (CH17) (T)he body always works towards healing as part of its kind of goal of keeping homeostasis … If you give your body what it needs to do all its various tasks, then it tends to function much better. (MW14)
Fragile immune system			
	Mercury does cross the blood–brain barrier in pregnant women for the placenta for babies, and I think that's something women should really think about when they're pregnant, when they're getting the vaccine. (MW15)	(T)the blood–brain barrier (in children) doesn't mature until about 18 months. So if their blood–brain barrier (isn't) mature, then anything they're exposed to is getting into their brain … So, for that reason I'm also in favor of a delayed (vaccine) schedule. (ND01) If I had a kid, I think what I would probably do is I would probably do even more research into the issue. You know, get really up to date with it, try and narrow it down to the most essential ones. Not super-load the body, (but) do one (vaccine) and then space it, and then give my kid time to recover from that. (AC05)	The blood–brain barrier does not exist in infants, and that's when most of the shots—vaccinations—are being given to children, right fresh out of the womb practically. And that I do not agree with at all. (CH17) So essentially what you are doing by introducing a latent pathogenic factor [like a vaccine] is you are putting something in a closet … and that is going to be space that you can't use otherwise … There is this sort of latent taxing of the system that is … unable to eradicate [from inside] out to the surface and so it just stays at this quiet level. The body could probably handle that if it's a handful [of vaccines], but seeing how many [a child is] required to have for school is *insane* … Is it a good idea to be giving the body all of this to work with and especially at the same time? (AC01) (I worry about) introducing intense vaccines into the body of young children who are vulnerable, especially at the increased rate of vaccination that we have today. (AC06)

Table 3. (Continued)

Beliefs	Vaccine accepters (*n* = 7)	Conditional accepters (*n* = 19)	Vaccine opposers (*n* = 10)
Herd immunity			
	[T]here's something called herd immunity—if everybody in the group has been vaccinated, then you're not as likely to get (that illness) if you haven't been vaccinated. However, there's not a guarantee. And, as far as the vaccine goes, there is risk with vaccines, but there's (sic) pretty significant risks with not getting the vaccine. (MW15)	I mean, herd immunity is a beautiful thing, but) only if a herd "immunes." So the outbreak of pertussis … we heard a lot, about healthy babies suddenly dying and things like that … I don't like scare tactics but I think, hopefully, we've taught people through that (outbreak) that vaccines aren't evil. (MW13) [H]erd immunity … is helpful for a lot of different conditions … so it's more of people making the right decision for their family. And sometimes their decisions on vaccines change from one baby to the next … because your risk factors are different when there's two at home versus when you're a parent of one and you're at home all the time, and there's not the same exposure (to VPDs). (NDMW08) [W]hen we look at vaccinations we have to look at it from a global or a community point of view. Overall general community health has improved. But when you look at individually, you have to look at that there is (sic) some risks with some of them, and some have different kinds of risks that that individual takes on. (MW12)	I am aware of the concept of herd immunity. And I think that that's really valid. Also, it's used as a … pressure tactic, like you're failing the human race if you don't, you know, get on the bus … (AC06) [T]there's a lot of pressure on people to get vaccinated, and a lot of this feeling that people who don't vaccinate are being selfish because we need herd immunity … (HM03) I don't get (herd immunity). (ND05) [T]here may be herd immunity, which is protective of society as a whole. But there's also individuals that are harmed … So what level of collateral damage are we willing to take? And you talk to a parent of an autistic child who is sure that their child was damaged by the vaccine, and they could care less about societ(y). (NDMW10) It seems like everything in healthcare is a risk-reward ratio. It's a cost-benefit analysis on (the) individual level but you (in public health) are kind of on a community level. At an individual level, it seems like if something has been shown to be safe for generations? … in Chinese medicine something has to prove itself for hundreds of years before it is accepted as part of the medicine. (AC01)

MW: midwife; HM: homeopath; ND: naturopath; DTaP: diphtheria, tetanus, acellular pertussis vaccine; AC: acupuncturist; CH: chiropractor.

alignment)—thus disrupting innate immune processes. However, if a person has good management, the human body is strong and is fully capable of resisting infections and other illnesses (including cancer). As acupuncturists explained: health means that one's *qi* is strong (*qi* is said by ancient Chinese medical theory to be the circulating life force; it is considered to be a fixed quantity and can be depleted). In this regard, good health management means prophylactic use of certain natural products, and correcting imbalances through health care strategies that align and re-balance the body (e.g. chiropractic adjustments, acupuncture treatments, and herbal supplements). Use of pharmaceutical treatments, such as vaccines and antibiotics, is to be avoided—as these will disrupt innate immunity. All naturopaths in our study, for instance, shared the 1991 canonical belief that the immune system is nearly impervious to disease when a person is healthy. Acupuncturists interviewed for this study said they avoided all vaccines and admitted that they counsel others to avoid vaccines. If they were willing to endorse any vaccine, it was for vaccines against tetanus and polio, which they perceived as severe and outside the realm of the body's ability to naturally combat illness.

The CAM providers in this study provided thick and rich descriptions of innate immunity. One naturopath explained, "The body has an inherent ability to heal, so the physician's role is to try to understand what obstacles to healing are in place and to address those, rather than trying to dictate health to the body." Corollaries to this belief are beliefs that (a) fever should never be reduced because fever acts to kill off disease, including cancer cells; and (b) the body's response to disease is to confer what they described as a powerful "humoral" immunity, as opposed to a lesser cell-mediated, or "acquired immunity" (i.e. immunity conferred by a vaccine). Providers interviewed considered the body's innate intelligence as superior to immunity conferred by vaccines.

Fragile immune system: pediatric vaccination. Specific immunological beliefs also formed around infancy and development. Those CAM providers who adhere to an alternative immunological perspective believe, in seeming contrast to the "innate intelligence" belief, that the immune system of a child is too fragile to handle the physiological challenge produced by vaccines, particularly multiple vaccines administered together. The seeming contradiction between "innate immunity" and "the fragile immune system" is resolved if we consider the three core beliefs as sequential—natural solutions allow for the innate immunity to become robust, thus overcoming the initial postpartum immune fragility. Out of the 10 acupuncturists interviewed, 4 said that vaccines "overwhelm" an infant's immune system. A vaccine is seen as poisonous and impure, and as compromising innate immunity (according to the acupuncture paradigm: as depleting *qi*).

Specific beliefs concerning the timing of pediatric vaccine administration were also identified. For example, the naturopathic canon at the time of this research stated a preference for withholding all vaccines until after 2 years of age[38]—a preference echoed by all 11 naturopaths interviewed, including those who allowed for some vaccines but not others (conditional group).

A belief expressed by three providers is that the blood–brain barrier (BBB) "does not exist in infants." This supposed undeveloped barrier, as one chiropractor explained, "allows vaccines to go through and, thus, it (sic) affects what's going on in [an infant's] brain" resulting in neurological damage. A midwife believed that mercury in vaccines for pregnant women crosses the BBB, entering babies through the placenta. She held that all vaccines should be avoided and advised parents against vaccinating their children.

Mainstream immune beliefs

CAM providers who embraced mainstream medicine were likely to have been trained in biology and to be vaccine accepters. They mentioned vaccines to their patients as a positive health measure.

Vaccines prevent illness

Education based in the sciences and knowledge of severe, incurable diseases (such as polio and tetanus) was persuasive in promoting vaccinations as key to VPD prevention, even among CAM providers who otherwise avoided all vaccines. Personal experience with an illness, especially influenza, persuaded some providers to get vaccinated, but other illnesses were not so persuasive. One naturopathic practitioner had even seen pertussis firsthand in his own child, and this event did not persuade him to recommend to his patients or to vaccinate himself against pertussis.

Herd immunity

In terms of benefits from vaccination, the concept of herd immunity was seldom mentioned by providers in this study. Only the public health-educated CAM providers (i.e. two midwives and one acupuncturist) and other vaccine accepters acknowledged the importance of immunity of the surrounding community as a playing a key role in protecting both individuals and communities.

Discussion

Overview

Substantial and consistent differences were identified in immune beliefs between CAM providers who strongly opposed pediatric vaccinations (alternative beliefs) versus providers who strongly recommended pediatric vaccinations (i.e. those who expressed science-based immunology beliefs). CAM providers who recommended some, but not

all vaccinations (conditional vaccine accepters) tended to evince a mix of science-based and alternative immune beliefs. Many CAM providers interviewed considered the body's innate intelligence as superior to immunity conferred by vaccines. Several researchers, however, have noted that there can be as many patterns of immune responses as there are immune cells, and acquired and "humoral" immunity are scientifically the same.[40,41] In addition, the body does not differentiate the source of the acquired immunity.[39] According to a professional immunologist, the array of vaccines required for school entry—sometimes referred to by CAM providers as an "onslaught" (see below)—contain fewer proteins (about 120 in all >30 doses) than the single smallpox vaccine had contained (about 200 proteins) (Dr Malcolm Lowry, personal communication, 6 April 2017).

Vaccine accepters and conditional accepters

Vaccine accepters expressed beliefs primarily grounded in science, but even one (see Table 3) was misinformed about the infantile BBB. The conditional group expressed a reasoned perspective at least partially based in science. It should be noted that since 2016, the Naturopathic Academy of Primary Care Physicians (NAPCP) has shifted its position to accept and endorse the American Pediatric Association's childhood immunization schedule, including the 3-series hepatitis B vaccine the first dose of which is administered within 24 h of birth.[42]

Thus, conditional providers may be more willing to change their opposition to specific vaccines if they receive convincing scientific reasons for doing so, for example, in their CE courses and from science-based peer education. Unfortunately, few CE courses are currently vetted for their scientific rigor (Oregon Board of Chiropractic Examiners, personal communication, April 2014). Perhaps, the vaccine-accepting health care providers, including members of NAPCP, can be enlisted to play an instructional role with their science-averse peers, in providing sound reasoning and support for science-based views of vaccines, VPDs, and the immune system.

Alternative immunological beliefs

Sources and structure. CAM providers holding alternative immune beliefs believed that their positions on vaccines were correct. A common concern voiced about the human papillomavirus (HPV) vaccination by this group is that this vaccine has not been examined long enough at the population level to know whether it poses substantial risks. However, the HPV vaccine has been shown to be highly effective in large-scale clinical trials examining multi-year data,[43] as well as very safe, as shown by several studies.[44–46] Yet, it is unlikely that providing this information will help to shift this population from opposing to accepting the HPV vaccine.[47]

Experiencing a VPD must also be direct and personal. For example, the naturopath whose child suffered from pertussis was not even persuaded of the benefits of the pertussis vaccine from witnessing his own child's suffering. From our study, it seems that only being ill and personally experiencing the debilitating effects of a VPD causes a sufferer to accept vaccination against subsequent infections and to try to persuade others to vaccinate. Witnessing the suffering of others, even a child is less persuasive. Paradoxically, suffering from a VPD is regarded by many CAM providers as beneficial and as boosting the immune system, whereas alleged suffering from a vaccine adverse effect is harmful and depletes the immune system.

Content and modifiability. Although the internal logic of providers holding alternative immunological beliefs appears to be consistent, components of this belief system are based on misunderstandings and inaccuracies. One midwife perceived vaccine administration to infants as an "onslaught" to a child. Several CAM providers believed, for example, that an infant's BBB is undeveloped, when, in fact, neurological research has shown that it is effective in the embryo and fully developed at birth.[18] The misinformed perception provides an internally consistent logic. That is, the belief in an undeveloped immune system and a porous BBB strongly "anchor"—according to the heuristic model outlined by Smith et al.[48]—the judgment that babies will be harmed when assaulted by what these providers believe to be too many vaccines. When confidently expressed by a valued provider, this and similar views may sound to parents as if they have scientific validity.

Herd immunity. Betsch and colleagues found that simply explaining the concept of herd immunity as a social benefit improved willingness to vaccinate, that is, communicating the benefit to society of vaccinating reduced free-riding and increased vaccination intentions, whereas emphasizing the benefit to the individual decreased intent to vaccinate.[34,35] This suggests that one component of an educational intervention with vaccine opposers may be to introduce the concept of herd immunity and to focus on health benefits at the population level. Because most CAM providers focus solely on personal health, introducing the idea of community protection in their formal and post-graduate training may help increase vaccine acceptance. In this study, herd immunity was an unknown concept for one naturopath and was regarded with derision by an acupuncturist, who scoffed, "[it's] like you're failing the human race if you don't get on the bus [and vaccinate]."

Intervention implications

If CAM providers influence parental beliefs, as other health care providers' beliefs and attitudes have been found to influence their patients,[49] it is conceivable that modifying CAM providers' immune beliefs would be an essential step in changing the views of parents who seek their advice, and,

ultimately, will improve vaccine uptake, especially among parents who cite NMEs for vaccination.

Recommendations

Based on the present research, only the conditional providers are likely to be amenable to training and continuing educational influences aimed at improving vaccine uptake, through changing their advice to parents.

Immune belief systems among the general public may be modifiable through school-based educational efforts that reach young people long before they become parents and begin to form strong belief structures concerning immunity and vaccines. Such efforts should especially include an explanation of herd immunity.[48,50] Prior work suggests that vaccine beliefs do indeed begin to crystalize during the parent(s) first pregnancy, at which point they begin to access health networks for relevant perspectives.[51] Large-scale surveys of the CAM population could provide an estimate of the contributions to public vaccine opposition attributable to conditional and vaccine-opposing CAM providers and could help to determine how much reach such an intervention could have. Addressing the conditional vaccine accepters—in other research called the "fence-sitters"[35]—may be the most productive way to bring about attitude changes through science-based educational efforts and science-based social marketing. In addition, repeating the concept of herd immunity as a social benefit[50,52] can improve acceptance of vaccinating as a community benefit.

Health care providers would do well to explain herd immunity to their patients in terms of the social benefit of vaccination. The state professional licensing agencies should also require incorporating the concept of herd immunity into all CAM CE courses. State legislators and public health authorities should be encouraged to establish oversight agencies to review CE course descriptions or syllabi for all licensed CAM providers in the state—especially for acupuncturists, certified nurse-midwives, chiropractors, and naturopathic doctors. Homeopathic providers are not licensed in many states, including Oregon, but practice informally or are licensed in other disciplines, often as naturopaths.

Limitations

In addition to the usual limitations of qualitative research, our study was confined to Oregon, and limited to locations within 4–5 h drive of the primary researcher's home. The findings described in this article may not therefore apply to other states. Another limitation is the subjective nature of thematic analysis. Nevertheless, this study was able to both achieve consistent narratives among all five CAM groups (i.e. data saturation) and identify a wide range of pediatric vaccine perspectives. In addition, the participants in this study were quite forthcoming in sharing their views, especially as the primary researcher allowed all participants to relate fully and without interruption the stories of their professional paths to their chosen CAM modalities.

Conclusion

CAM providers influence their patients' vaccination decisions, particularly by urging caution or complete vaccine avoidance, and, in states like Oregon with high NME rates, CAM providers may be a major influence. CAM providers come to their anti-vaccine positions largely through post-graduation CE courses and seminars. In Oregon, such courses are unregulated and not vetted. This exploratory study provides a broad conceptual understanding of immunological beliefs among CAM providers that can inform future study and may assist in devising vaccine intervention approaches aimed at further educating some of these health care providers. It is especially important to establish guidelines and to monitor CE course content to ensure its scientific accuracy.

This study identified a rich array of immunological beliefs among CAM providers, as described above. The strength or centrality of alternative immune beliefs may make these beliefs difficult to change. And yet, understanding the source of these beliefs and addressing them through CE courses grounded in science may lay the groundwork for ways to mitigate vaccine misconceptions among CAM providers and the general public, and thus improve pediatric vaccination rates in the state of Oregon.

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