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BUILDING 'NATURAL' IMMUNITIES: CULTIVATION OF HUMAN-MICROBE RELATIONS IN VACCINE-REFUSING FAMILIES

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> Once, we were taking the train to visit the grandparents and I saw [my child] licking the gate handle in the train's play area. You know, the metal handle that everybody touches. She was really going at it, with her tongue stuck way out. [Interviewer: OK, wow.] So, I see microorganisms as our friends, unlike my sister who's a doctor and is almost hysterical about handwashing; she thinks that you have to wash your hands after you've walked from the living room to the bedroom (Jessica).

THIS QUOTE PRESENTS TWO DIFFERENT ATTITUDES TOWARDS THE MICROBES that surround us. In the quote, Jessica, the mother of two unvaccinated children, describes her own attitude of embracing coexistence with microbes. She contrasts her attitude with that of her sister, a medical doctor who sees microorganisms as enemies and tries to shield herself with practices such as handwashing and, no doubt, vaccination. Jessica's quote is from one of the ethnographic interviews I conducted to understand why some parents in Finland did not want to vaccinate their children. Her presentation of these two opposing perceptions was one reason I began to consider how human-microbe relations might intermix with vaccine refusal.

Vaccine refusal is marginal in Finland; the country has high rates of childhood vaccination and a relatively high trust in vaccines. A survey conducted in 2019 found that 95% of Finns completely or mostly agreed that vaccines are effective and safe, and 89% reported trust in the information about vaccines provided by experts and authorities (Kiljunen 2019). Childhood vaccines are offered free of charge as part of the public preventative healthcare provided to all children at child health clinics, and only 1% of children are not vaccinated by the age of three (THL 2019). However, in the same 2019 survey, as many as 32% of respondents completely or mostly agreed that the adverse effects of vaccines are not discussed enough, and 13% agreed that vaccines are given to children because it is profitable for the pharmaceutical industry (Kiljunen 2019). Thus, vaccines are not quite universally accepted in Finland – there is a certain level of distrust in health experts and there is worry about the possible harmfulness of immunisation.

Research has identified factors such as fear of adverse effects, negative vaccination experiences and lack of trust in the efficacy of vaccines as possible reasons for vaccine refusal (e.g. Blaisdell et al. 2016; Brown et al. 2010). In social research, contestation of vaccination is often interpreted in the framework of neoliberal individualistic responsibility and intensive parenting (Laudone and Tramontano 2018; Reich 2014, 2016). In this chapter, I approach vaccine refusal from an angle that has not yet been examined in social research on vaccine hesitancy: the connection between new understandings of human-microbe relations and vaccination acceptance.

Research and public discussions often cite the pursuit of a 'natural lifestyle' or 'alternative health practices' as some of the elements in which vaccine hesitancy and refusal are rooted (Attwell et al. 2018; Reich 2016). Jennifer Reich (2016) has noted that vaccine-refusing parents in the US relied on a strong dichotomy between 'natural' and 'artificial' in their rejection of vaccines. However, social research on vaccine hesitancy and refusal has not attempted to understand the effects of novel human-microbe relations on vaccination acceptance. Similarly, the shifting and complex everyday human-microbe relations and their implications warrant more diverse and thorough analysis (Greenhough et al. 2018).

The term 'natural' is commonly used in opposition to 'artificial' or, in the case of health practices, biomedical, technological or pharmaceutical. However, I do not consider 'natural' health practices as something untouched by culture or technology but as practices which combine social and biophysical elements. These practices are always 'naturalcultural' (Haraway 2003) and never out of reach of the social or cultural. Drawing from a multispecies approach (Kirksey and Helmreich 2010), I will deepen our understanding of what the 'natural' lifestyle of vaccine-refusing families entails. This chapter thus focuses on parental understandings of the role of microbes in human health and the kinds of human-microbe practices that emerge as parents abandon vaccination as part of promoting 'natural' immunity.

VACCINE REFUSAL AND HUMAN-MICROBE RELATIONS

Contestations of childhood vaccination can be understood as assemblages (e.g. Marcus and Saka 2006; Salmenniemi et al. 2019) that are continuously being pulled together using diverse sets of arguments, experiences, practices and objects. As microbiological research is shifting societal understandings of microbes from pathogenic threats to beneficial companions to humans (Rees et al. 2018), I suggest that human-microbe relations are present in these assemblages and may play an important role in the development of vaccine-critical views. I understand these human-microbe relations to be part of *microbiopolitics*, concerning 'the recognition and management, governmental and grassroots, of human encounters with the vital organisms of bacteria, viruses and fungi' (Paxson 2008: 18) that can happen on individual, community and societal levels.

In the public health framing of vaccination, vaccine-refusing parents are often defined as 'bad' (i.e. irrational, risk-taking) microbiopolitical citizens. However, this chapter maps the inner logics of vaccine-refusal related to human-microbe relations rather than focusing on the public health consequences. I will trace *lay immunologies* (Enticott 2003) concerning 'natural' immunity as practised by vaccine-refusing parents. Studying defenders of unpasteurised milk in rural

England, Gareth Enticott (2003) pointed out that proponents of raw milk understood unprocessed milk as part of a strategy of 'natural immunology' to prevent and cure disease. They subscribed to an 'impure immunology' which did not discriminate between good and bad bacteria and instead considered all bacteria necessary to build a healthy immune system. I suggest that lay immunologies are present in vaccine-refusing parents' understandings of microbes as well as in entanglements of microbes, microbiomes and the health practices of the parents. Interspecies cooperation manifests in these practices, which are often interpreted as the health choices of human individuals, but also simultaneously rely on human-microbial symbiosis.

A multispecies approach that emphasises the agency of 'organisms whose lives are entangled with humans' (Kirksey and Helmreich 2010: 566) and focuses on contact zones between 'nature' and 'culture' is helpful in understanding how vaccine-refusing parents relate to microbes in ways that differ from mainstream lay perceptions and expert understandings. Multispecies approaches emphasise connectedness rather than separation between humans and non-humans. From this perspective, vaccine-refusing parents' health practices present fascinating cases of joint human-microbial agency that manifest in parents' accounts of how and why they seek to improve immunity without vaccines. Subjectivities in these alternative health practices are perhaps best understood as cooperative and interspecies, potentially destabilising notions of the human subject as central, separate and oppositional in relation to non-human entities (Braidotti 2019; Haraway 2008). This perspective is further supported by microbiological research suggesting that the notion of human individuals as entities separated from their environments is questionable due to the extent of human-microbial symbiosis (Lorimer 2016; Rees et al. 2018).

RESEARCH MATERIALS AND METHODS

This chapter is based on ethnographic interviews with 34 parents who had opted out of vaccinating at least one of their children according to the national vaccination programme. I recruited participants through an open Finnish

vaccine-sceptic Facebook group and via participants who referred other vaccine-refusing parents to the study. I conducted the interviews between 2016 and 2019 with participants living in southern, western and central Finland. All but two of the participants were women, and their children aged between two months and 22 years. There was a total of 78 children, of whom 35 were non-vaccinated, 30 partially vaccinated and 12 fully vaccinated until at least the age of six. All participant names are pseudonyms.

The interviews were loosely structured around three themes: 1) what led participants to refuse childhood vaccinations, 2) which health-promoting and illness-preventing practices participants used, and 3) participants' experiences in the healthcare system. In most interviews, participants freely shared their stories of how they became vaccine-hesitant. I prompted many themes, including lifestyle, diet and perceptions about immunity. However, I did not initiate discussions about human-microbe relations. While this limited the amount of data on human-microbe relations, it does indicate that engaging with microbes was something that many participants practised consciously, and that they connected these practices with immunity and non-vaccination. Obviously, the interview material only gives access to the parents' understandings of and their reported practices with microbes. In addition, I have used field notes describing the interview situations as background material.

My objective is not to evaluate the participants' claims about immunity or vaccines from a biomedical perspective. Rather, I analyse their understandings as lay immunologies (Enticott 2003). In doing this, I have subscribed to a fluid researcher position that navigates between the opposing polarities of the vaccination debate (see e.g. Koski 2019). This kind of position entails risks such as participants' expectations for advocacy (ibid.). However, it may also create new insights into how non-vaccination makes sense to parents as part of their health practices.

In an earlier analysis, I identified three main reasons that parents in Finland reported for refusing childhood vaccines (Nurmi and Harman 2021): 1) adverse effects, 2) distrust toward vaccine technocracies, and 3) health perceptions and a preference for practices pursuing 'natural' immunity. This chapter focuses on the perceptions of and practices related to 'natural' immunity and illness

prevention without vaccines, examining their diverse and even contradictory manifestations. In the next section, I present the different ways participants perceived microbes. I then show how they constructed 'natural' immunities in cooperation with microbes and, finally, consider the unpredictable agency of microbes.

COEXISTENCE: BEING PART OF THE 'NATURAL SYSTEM'

According to Jennifer Reich (2016: 104), vaccine resistance is situated at the intersection of two ideologies:

> One that expects parents to intensively invest in their children and the other that calls for individuals to become savvy consumers of technology and health interventions. As they meld these cultural definitions, parents prioritize 'natural' as health promoting and manufactured products as potentially harmful.

This resonates somewhat with my observations of Finnish parents. While many participants expressed their preference for 'natural' health practices over biomedical and pharmaceutical ones, most had still taken courses of antibiotics, some had had surgery, and many acknowledged that they would not be here today without modern biomedicine. Thus, in the pursuit of natural immunity, 'natural' was never completely free from biomedical technologies. However, while Reich notes that the vaccine-refusing parents in her study did not necessarily include microbes in their definition of 'natural', many of the parents in my study were very much aware of the presence of different microbes within the realm of 'natural'. To them, microbes made things natural as opposed to over-sanitised, artificial or chemical-laden.

While some parents discussed microbes in terms of pathogens that should be avoided if possible, none of them talked about microbes principally in this sense. Understandings that positioned microbes as predominantly beneficial or commensal – and indispensable – were prominent in the interviews. For

instance, parents talked about the role of microbes in training and strengthening the human immune system, or how the gut microbiome affects our overall health. It is worth noting that the parents did not strictly categorise microbes into 'good' and 'bad', beneficial and pathogenic, but rather focused on the bigger picture, on a natural 'system' in which all kinds of microbes were inseparable from other life forms and as such needed to be accepted and perhaps worked with. Emma's account provides a good example of these understandings. At the time of the interview, Emma was in her late twenties, a university-educated mother of two, juggling self-employment and stay-at-home parenting. She had vaccinated her first child but stopped doing so after the child developed severe allergies and eczema which she interpreted as being caused by a combination of antibiotics and vaccines in the first months of life.

Emma repeatedly brought up the human-nature connection, which she felt most people in today's industrialised societies had lost. This connection included being in tune with the surrounding world and its microbes, which she described as ancient and intelligent beings. She blamed the loss of this connection partly on modern biomedicine, a 'proud science, men's science' that had developed and carelessly used technologies such as antibiotics, thinking it could conquer and control the microbial world. She was very much aware of the threat that antimicrobial resistance poses to human health. This was a battle people could never win: 'we may be ahead [of the resistant bacteria] for a moment. But of course they are much more intelligent than us'.

But it was not just antibiotics that had interrupted the human-nature connection. Emma saw vaccines as an equally disruptive technology:

> We can momentarily beat diseases with, let's say, antibiotics. Or we can momentarily eradicate diseases with vaccines. But they're a million times more intelligent than us, they'll cause new forms of the diseases. I'm not sure, was it whooping cough that had these altered forms that our drugs [vaccines] do not work on? The vaccine does not make you immune.

The parents sometimes drew connections between antimicrobial resistance and the mutation of bacteria and viruses that the use of vaccines might cause. They

stated that when you vaccinate against one strain of virus or bacteria, other strains may get stronger. While it may not be that simple and may not concern all pathogens targeted by vaccines, the precipitation of pathogenic evolution by vaccines has been increasingly studied in recent years (Moyer 2018). For instance, in the case of *B. pertussis*, mentioned by Emma, bacterial evolution has been associated with the immune pressure from vaccination (Xu at al. 2015). Participants often used these kinds of examples as a proof that pathogenic microbes are in the process of outsmarting not just antimicrobial treatments, but also vaccines.

Other parents also emphasised that while wild strains of viruses are natural, vaccination can cause them to mutate and act unpredictably and more virulently than they would if left alone. As vaccination was also understood as disruptive for the development and workings of children's 'natural' immune systems, causing impaired immunity and autoimmunity, biomedical technologies were thus named as one of the main culprits for why people and their immune systems were out of balance. Many traced their children's health problems (especially autoimmune conditions) back to vaccines and antibiotics and the damage they thought these interventions had caused to their children's microbiomes and immune systems.

Emma's solution was to try to restore the lost connection with the natural world and its microbial diversity: 'I have to be a part of this system, this microbiology that has revolved here for millions of years. Yeah, it can kill me or my kids. But… I'd rather live with that knowledge'. She believed most vaccine-refusing parents perceived themselves as part of this bigger entity – nature. They 'understand that when we're not against it but go with it and take on certain things, some of us die from diseases and others don't'. Several parents talked about accepting coexistence with both beneficial and pathogenic microbes. They felt it was important not to be fearful and controlling in the face of this coexistence. Elisa, the mother of an unvaccinated one-year-old, talked about the risk of disease in a similarly accepting tone:

> That's life. I think non-vaccinating people have a healthier attitude toward life and death and being sick, toward the fact that life doesn't mean being in a bubble, […] we get cuts, we get pains, we get illnesses. In my opinion, the typical way of thinking for non-vaccinating people is that, well, that's life

> and when it happens, I'll do my best. But vaccinating people seem to think that 'Oh no, can you die from this?! I'm afraid'.

In these accounts, humans were not portrayed as intellectually superior and separate from non-human beings. On the contrary, humans were far behind some of the non-human beings, especially bacteria and viruses, whose capabilities were not properly recognised by most people or even medical science. Humans are simultaneously one with the non-human world ('a part of this system') but also separate in the sense that we can turn against microbes and microbes can turn against us, using their intelligence to adapt and transform so that they can continue existing and functioning despite antibiotics and vaccines. According to these accounts, humans have never been at the top of the natural order, but in a co-dependent relationship with other entities on this planet.

This view thus decentres the human subject as the point of interest (Braidotti 2019; Friese and Nuyts 2017). Simultaneously, it blurs the binary distinction between 'good' and 'bad' microbes; some viruses or bacteria may be pathogenic to some human individuals, but this might not ultimately make them 'bad'. Microbes that cause human diseases were also seen as performing the important work of controlling human overpopulation. Irene noted that 'Nature and … the planet protects itself so that there aren't too many people here'. Thus, these microbes had multiple effects on different actors, not just on humans.

Not all statements about human-microbial coexistence were this fatalistic, and they often focused more on the positive side of coexistence with microbes. Many parents talked about microbes – including pathogens – as helpful co-operators in the pursuit of 'natural' immunities. In the next section, I will explore instances in which gut microbiomes, immunities and healthy children were produced in collaboration between humans and microbes.

CO-PRODUCING 'NATURAL' IMMUNITIES

In the face of antimicrobial resistance and increasing rates of autoimmune diseases, for Emma, there was no choice but to try to live in harmony with

the natural world, to live as if antibiotics and other modern medical technologies did not exist, and to follow 'that plan, whatever it is, that has made the bacteria develop into the form we're in these days, this whole complex'. At times, there was no separation between herself and the other life forms that had developed in this 'complex'. In her assemblage, refusing vaccines was just one of the elements brought together in an effort to help her children build robust immune systems. She was using as few pharmaceuticals as possible. She embraced coexistence with microbes through exposure to environmental microbes and by not washing her children's hands too often or with soap. In this way, Emma seemed to perceive herself and her children as composed of microbial and human cells; taking care of the skin and gut microbiomes was not detached from care for her own health and that of her children. Her other health practices included long-term breastfeeding and the avoidance of chemicals in cleaning products. All these practices together would strengthen her children's immunity:

> The younger one is unvaccinated, he has sat on the floor of the cowshed and eaten animal feed with the cow from the same container. Literally, he's been covered in cow shit and eaten that too. […] If my kid is in the sandbox eating sand with his hands […] I'll give him a shovel [so he can eat more]. Children's guts need it. […] The stronger your gut flora, the better it fights disease.

Indeed, many participants described their relaxed attitude toward their children's relationship with microbes as one of the key elements in optimising their immune systems: 'we are not overly hygienic, [our child] can crawl around [outside] and he certainly gets germs and develops immunity that way. […] And our dog and cat, he kisses them on the mouth and stuff so he probably gets every germ possible' (Melissa). The 'alternative' health practices that many of the participants described – extended breastfeeding, avoidance of excess hygiene and chemicals, and eating high fibre and non-processed diets – were often aimed at optimising or restoring gut microbiomes. Thus, people were only one part of this 'natural' immunity assemblage in which numerous actors (such as pathogens

and microbes in the human gut, in the home, in the forest, in the cowshed and in different foods) came together to build human immunities.

Similar to Lorimer's (2016) observations about the therapeutic use of helminths as an 'ecological model of immunity as involving a multispecies community', many participants talked about natural immunity as a cooperative effort between humans and microbes. Irene explained that she had built up her daughter's immune system after it had been severely disrupted by the antibiotics used during birth and by several different antibiotics given to her daughter after surgery. For two years after the surgery, her daughter suffered recurring respiratory infections that Irene traced back to antibiotics and the early introduction of solid foods. Irene felt that all this had compromised her daughter's gut health and, relatedly, her immune system. She started to build back her daughter's immunity, skipping antibiotics for her ear infections and using vitamin C and garlic oil instead. In a process of 'species coshaping one another' (Haraway 2008: 42), she was consciously trying to rebuild her daughter's gut microbiome with probiotic supplements, sauerkraut and fermented drinks, and by avoiding cow's milk, sugar and grains. As Irene understood it, these practices eventually helped reshape the child's microbiome, which inextricably reshaped her daughter's immune system and her life in general. After two years of this interspecies work, she was no longer getting sick once a month.

Linda explained that she had alleviated her young child's severe food allergies by using raw milk: '[goat's milk] made her vomit less than other milks and first I mixed it with hot water, trying to pasteurise it, but after that I gave it to her unpasteurised'. Others also described following a diet of unprocessed food and probiotics to prevent illnesses. Preventative care for one's immune system and those of family members can then become a sort of microbiopolitical project in which the potential effects of everything coming into contact with one's microbiome are carefully considered. You care not just for your health but also for your home environment, the quality of your food and the soil where it grew or the animals that produced it. In short, you care for your relationship with microbes. For the participants, vaccines obviously disrupted this carefully crafted balance of 'natural' immunity, just as many 'pro-vaccine' health-conscious individuals think antibiotics disrupt the gut microbiome. Participants felt that

the practices used to strengthen individual immune systems could also be harnessed to contribute to the fight against antimicrobial resistance or the mutation of pathogens due to vaccination.

While it may seem, for instance, that Irene and her daughter could have worked with microbes *and* still be vaccinated, to Irene, foregoing vaccines was firmly enmeshed with other practices of strengthening her child's immune system. Suffering from an autoimmune disease, Irene had come across information stating that vaccines containing aluminium might be connected to autoimmunity and wanted to avoid this risk with her daughter. Her strategy was a combination of non-vaccination and the building of a robust immune system with microbial companions. Moreover, she had found information that suggested that some vaccine-preventable illnesses (VPDs) were connected to positive health outcomes:

> I found a study that said that children who've had rotavirus had significantly lower rates of severe respiratory illnesses and pneumonia. Then I read about measles – that it has […] a protective effect against certain types of cancer, same with mumps […] It may be nature's way of strengthening your immunity so that you'll live longer and be healthier.

Viruses such as mumps and measles were redefined as actors that could, together with the human immune system, benefit people in a reciprocal relationship. Many participants echoed this view and saw viruses such as chickenpox and measles as crucial participants in the 'natural immunity' assemblage. They explained that pathogens helped immune systems practise (see Reich 2016 for similar observations) and thus made them stronger and less prone to autoimmunity – another thread tying together gut health, non-vaccination and well-functioning immune systems.

Many viruses causing VPDs were understood as 'good old' viruses that caused easy-to-deal-with illnesses and were slow to mutate. Participants also often said they were not afraid of VPDs, as access to medical care is provided for everyone: 'Finland has really good and advanced medical care. I believe that if it comes to that, we will be treated in the same way as people who are vaccinated and still

get the disease' (Paula). Moreover, many participants would have much rather coexisted with the 'old' viruses than the less predictable 'new viruses':

> If we had the space to be ill with the so-called old-fashioned childhood diseases and to be home with those children, then these ear infections and other [secondary infections] would be considerably easier and we wouldn't have these new viruses and things that are much worse and that keep on coming. (Lea)

This coexistence, however, was not often possible; vaccine-preventable childhood illnesses have become rare, and many felt that those illnesses had been replaced by persistent viral respiratory illnesses or 'nasty stomach bugs' such as the norovirus. As Lea continued to explain: 'diseases these days are really gruesome, people get terribly sick. Being ill in a natural way is rare, but instead people can have like a cough or something for three months'.

Many participants believed that at least partial immunities could be produced through vaccination. However, they preferred the 'natural' way of encountering wild strains of pathogens because this would produce strong, lasting immunities without the possible side-effects of vaccines. One might argue that the immunities produced through vaccination could also be considered a 'natural' or 'probiotic' practice of co-producing immunity by engaging the human immune system with selected microbes, such as (parts of) viruses. However, participants found it safer to engage with wild strains of microbes through 'natural' channels of exposure (such as the respiratory or digestive systems) than with vaccines mostly administered by injection. Immunisation also meant coming into contact with adjuvants, such as aluminium, which were perceived as carrying considerable risks. Wild viruses and bacteria were thus understood as 'natural', whereas the vaccination strains or virus components in vaccines were rendered 'unnatural' and potentially unsafe due to the pharmaceutical processes of manufacturing vaccines. Thus, vaccines could not be considered 'probiotic' or seen as inducing 'natural' immunity.

MICROBES AS UNPREDICTABLE AGENTS

The agency of pathogenic microbes was often treated somewhat mechanically, with the idea that pathogens want to spread, multiply and cause diseases. However, well-functioning immune systems were perceived as limiting the disease-inducing agency of microbes while simultaneously co-producing immunities with them. Humans could also be carriers of viruses that enable their spread without necessarily getting (very) sick. In this mutually beneficial process, both humans and viruses needed each other. Laura, a mother of two partly vaccinated children, said that her son had had influenza (as proven by lab tests) but, having a robust immune system, he only had common cold symptoms for less than two days. As part of the vaccine-hesitant assemblages, these kinds of stories enforced the idea of personal responsibility in maintaining a healthy immune system to mitigate the risks of illnesses. For instance, Laura's family used probiotics and other supplements, avoided cow's milk and wheat, and used several complementary and alternative medicine (CAM) treatments to optimise their immune systems.

Some VPDs, such as chickenpox, mumps and measles, were considered 'ordinary' or even beneficial diseases that had been rebranded as dangerous by health authorities and the pharmaceutical industry. Because of the health benefits assigned to these illnesses, some participants felt positively about their children contracting them. Nora explained: 'I feel sad that [some VPDs] are not around because I'd like my son to catch chickenpox and measles. (…) In general, I'd like him to get certain illnesses as a child when they're usually [milder], especially when you use the right treatments'. A certain mitigation of risks was present, as parents sometimes said they might consider vaccinating against certain illnesses if their children were not exposed to them in childhood. For example, because the disease posed risks for male fertility, Nora was going to consider vaccinating her son against mumps if he had not contracted it before becoming a teenager.

Certain pathogens occupied a role similar to the probiotics and commensal microbes with which participants sought to collaborate. The agency of these pathogens was not only understood as a selfish drive to multiply but also as

symbiotic or therapeutic for the humans involved. For instance, Elisa described how after being vaccinated, her sister would have recurrent, long-lasting colds without 'a proper fever'. This lasted for years until she caught measles and 'was cured by [it]'. She now gets a fever when sick and the illness passes quickly. In Elisa's account, the measles virus thus helped her sister's immune system cancel out the harmful effects of previous vaccination.

Vaccine-refusing parents have been reported to consciously work with viruses to catch illnesses such as varicella or measles (Reich 2016). Likewise, in the interviews, some of the parents referred to seeking out interaction and cooperation with certain pathogens. However, they reported actively 'fetching' only varicella viruses from someone who had the illness. In this cooperation, however, the human subjects were never in control, as the agency of viruses was independent and unpredictable: they often did not cooperate in ways people wanted them to. Olga, for instance, talked about her difficulties in getting her children to come down with varicella:

> All these 'pox diseases' are possible to catch, but the percentage of contagion is lousy. For instance, chickenpox, we've looked for it for each of our children, but it has been bad at transmitting. Now I think we've gotten it for all of our kids, but sometimes it was hard to transmit. (…) You really had to go look for it.

This cooperation was not just about people *using* viruses. People had to accept the unpredictable agency of viruses. Participants also considered the possibility that the viruses may cause a severe illness with negative health consequences. For instance, Emma said that her children had not yet had chickenpox. She had recently had a chance to 'fetch' the virus from friends whose children had it. But because Emma was pregnant, she was cautious about the possible negative consequences to her unborn child and the unpredictability of the encounter between her immune system, the foetus and the virus. These concerns caused her to postpone the voluntary exposure of her children.

CONCLUSION

In this chapter, I have attempted to deepen our understanding of both vaccine refusal and everyday human-microbe relations by showing how vaccine-refusing parents perceive these relations and how 'natural' immunities are co-produced in interspecies health practices. Many participants in the study aimed to co-produce 'natural' immunities, avoid autoimmunity and possible adverse effects from vaccines, and live in a symbiotic relationship with their environment and the non-human actors in it. I have considered these health perceptions of vaccine-refusing parents as lay immunologies that can inform various health choices. These lay immunologies present human immune systems as complex organisations of interspecies and environmental relations. They entail three main elements: 1) coexistence with microbes, 2) interspecies co-production of 'natural' immunities, and 3) microbes as unpredictable agents.

Coexisting and working with pathogens allowed for uncontrolled microbial activity and narrowed the role of human control. Thus, these lay immunologies sometimes decentred human actors. Some of the parents ventured deep into the symbiotic understanding of human subjectivity, but while the 'microbial flows' (Lorimer 2016) were always out of the participants' full control, they all still presented some controlling tendencies – attempting to choose between interacting with microbes or avoiding them. The lay immunologies of vaccine-refusing parents also departed from previous conceptualisations of human-microbe relations such as reliance on the categories of 'good' and 'bad' microbes (Paxson 2008). This resembles the lay immunologies described by Enticott (2003), in which rural raw milk defenders saw all bacteria as necessary to build healthy immunity.

Vaccine-refusing parents' perceptions reflect the recent surge in research and popular science literature which states that the microbiome and potential disruptions to it play a central role in human health. Still, vaccine-refusing individuals often perceive immunity and human-microbe relations in ways that radically differ from the microbiopolitics of preventative healthcare promoted by public health authorities and healthcare institutions. This complicates communication with, for instance, most healthcare providers, who are not likely to recognise measles or varicella viruses as companions to work with.

From the perspective of vaccine-refusing parents, vaccines pose more risks (of adverse effects, autoimmunity and possible pathogen mutation) than 'natural' coexistence with microbes. While from the public health perspective the interaction between pathogens in vaccines and the human immune system happens in a controlled manner, this technologically managed exposure to antigens, pathogens and other substances in vaccines is in fact why vaccine-refusing parents do not consider vaccination a 'natural' practice. This is also why attempts to scale vaccine-promoting public health messaging to better resonate with vaccine-hesitant groups by framing vaccines as 'natural' (Reich 2016) might not be very successful.

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