

Vaccine hesitancy: global problem, local solutions

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Executive summary

Vaccine hesitancy – defined as ‘delay in acceptance or refusal of vaccination despite availability of vaccination services’¹ – is a global problem. However, it appears to arise for different reasons in different times and places. There can thus be no global solution. Instead, there can only be local solutions, adapted for the local context yet informed by what has worked elsewhere. The problem of vaccine hesitancy has been brought to the fore by the COVID-19 public health crisis, but predates it by centuries. This means that there exists a huge wealth of existing research literature, both on vaccine hesitancy itself and on interventions designed to address it.

This report is divided into three sections. The first and shortest briefly surveys the evidence that vaccine hesitancy is on the increase in certain parts of the world, as well as taking note of the severe harms that have resulted from suboptimal vaccine coverage. The second section surveys the research literature on the correlates and causes of vaccine hesitancy. While it begins with a global scope, it narrows its focus to the global north, as it is there that the problem of vaccine hesitancy appears to be most pronounced. This involves taking a particular look at the role of social media disinformation and conspiracy theories, as these have repeatedly been linked to vaccine hesitancy in that part of the world. The third section looks at solutions which have been proposed, noting the evidence base for each. It argues that attempts to oppose vaccine disinformation through rational argument are often misguided, and are in any case probably unnecessary: firstly because, once identified as such, disinformation can legitimately be removed from online platforms without argument, secondly because the purveyors of disinformation pride themselves on their ability to turn any sort of attention to their advantage, and thirdly because acceptance and rejection of vaccines appears to be more a matter of social identity, perceived norms, and emotional persuasion than of rational debate. None of these sections focuses entirely or even primarily on COVID-19 vaccine hesitancy, but the intention throughout is to provide a summary of existing knowledge that may be applied both to COVID-19 vaccination campaigns and to vaccination campaigns relating to other diseases.

If the wealth of existing evidence shows anything, it is that the causes and correlates of vaccine hesitancy vary by place, community, and the specific vaccine. Indeed, this variation is so great that it seems plausible that ‘vaccine hesitancy’ is not the name of a single phenomenon but an umbrella term applied (for the sake of convenience) to multiple

¹ Noni E. MacDonald and SAGE Working Group on Vaccine Hesitancy, "Vaccine hesitancy: definition, scope and determinants," *Vaccine* 33 (2015): 4163.

phenomena, each having the result of suboptimal vaccine uptake. There being no single problem, there is probably no single solution either. Extensive social research is thus likely to be needed in order to design and target each campaign.

Recommendations

1. Messaging should be positive and focused on the benefits of vaccination, whether to the individual, the family, the community, or the wider world
2. Vaccination should be presented as normative rather than controversial
3. Vaccination campaigns should be closely tailored to their local context and intended audience, as well as to the specific vaccine
4. Anti-vaccination campaigners and conspiracy theorists should not be flattered through engagement in debate; instead, they should be discretely removed from mainstream platforms and publicly ignored
5. The vaccine hesitant should neither be stigmatised nor argued with unnecessarily; instead, they should be treated sympathetically (but without validating any false beliefs which they may have come to hold)
6. Although there are good reasons for caution with regard to mandatory vaccination, it is one of the few interventions with strong evidential support and should not be ruled out as a method of last resort
7. However, even where mandatory vaccination is used, it does not remove the need for carefully designed public health communication campaigns

Above all, it is important to resist any temptation to respond negatively to the problem of vaccine hesitancy. Vaccine hesitancy is a continuum, and relatively few individuals are inflexibly opposed to all forms of vaccination; it is far more common for people simply to feel unsure. If the goal is to increase vaccine uptake, it is likely that this will be most efficiently achieved by helping the ambivalent to view vaccination positively. This can be done by focusing on the benefits of vaccination, both to the individual and to the community. Moreover, the overall strategy should be to promote the perception of vaccination as *normal*, rather than as something that people might have arguments about whether or not to engage in.

There is no one-size-fits-all approach to achieving this. Rates and forms of vaccine hesitancy vary according both to community and to the individual vaccine. Public health campaigns aiming to reduce vaccine hesitancy thus need to be tailored very carefully to their context and intended audience, on the basis of empirical research. Communications campaigns of this type can usefully be conceived as a form of marketing, as they employ techniques developed within the commercial marketing industry and share analogous goals, i.e. behavioural change on the part of specific social groups. Thus it makes sense to consider how a given vaccine might be 'marketed' to particular ethnic or religious communities, to different age groups, to men and women, or to any other division of the population. Just as when marketing a commercial product, the process of social marketing begins by understanding the viewpoint of the group in question, and proceeds by developing and testing a campaign that will be maximally persuasive to that particular group. The full range of social research methodologies – focus groups, interviews, surveys, A/B tests, etc – can be

used to understand why it is that some people choose to avoid or delay vaccination, and how they can be supported towards embracing it instead.

It is unfortunately the case that some individuals and organisations are working to achieve the opposite goal, for example by promoting the false idea that vaccines are unnecessary, ineffective, or unsafe. The evidence suggests that there is nothing to be gained from engaging with these people. There can be no meaningful debate with someone whose arguments are grounded in falsehood. But equally, there is no need to impinge upon such a person's right to free speech. Social media companies should take care to ensure that they are not allowing anti-vaccination messages to propagate. High profile anti-vaccination activists should be de-platformed without fanfare, and otherwise ignored. Ordinary people who adopt an anti-vaccination viewpoint should not be affirmed in any false beliefs that they have come to hold, but neither should they be stigmatised, ridiculed, or confronted.

There is strong evidence that mandatory vaccination is effective, both in that the introduction of mandatory vaccination policies results in greater vaccine uptake and in that relaxation of such policies results in decreased vaccine uptake. However, mandatory vaccination policies have so far been applied only with regard to vaccines that have been in use for a considerable period of time, and public authorities should be cautious about generalising from the experience of mandatory vaccination against diseases such as measles to mandatory vaccination against less familiar diseases such as COVID-19. It appears likely that one of the mechanisms through which mandatory vaccination achieves its positive effect is through promotion of the perception of vaccination as normative. Less draconian means of promoting that perception should always be preferred, although with recognition that a mandatory approach may be necessary as a last resort in the event that such means fail. Moreover, it must be recognised that recent examples of successful mandatory vaccination campaigns have integrated the requirement to vaccinate with an intensive drive to communicate the desirability of vaccination to the public. Social marketing thus remains key, even in the minority of cases where a mandatory approach has been deemed both possible and necessary.

The overall picture is of a clear need for a responsive, evidence-based approach to public health communication, bringing in state agencies, NGOs, commercial companies (such as the owners of social media platforms), and the public itself. Those who wish to promote vaccination should begin by acknowledging that vaccine hesitancy takes many forms, initiating and supporting communications founded in an empirically-grounded understanding of the reasons why hesitancy emerges in particular communities in relation to particular vaccines.

Vaccine hesitancy and its associated risks

Several studies have found prevalence of under-vaccination and/or delayed vaccination to be on an upward trend in the United States,² and, in Europe, vaccine hesitancy has been

² Daniel A. Salmon et al., "Vaccine hesitancy: causes, consequences, and a call to action," *Vaccine* 33 (2015): D68.

described as a 'cultural epidemic'.³ Even before the COVID-19 pandemic, vaccine hesitancy was identified as one of the greatest threats to public health on a global level.⁴ This puts lives in clear danger: even vaccinated individuals are at risk if living within communities with low vaccine coverage (especially where only a single dose of the vaccine was received).⁵ Moreover, vaccine hesitancy may in some cases place unvaccinated individuals at a higher risk of the most severe outcomes than they would have faced in an entirely unvaccinated population (in particular, by raising the average age of infection).⁶ Sadly, official policy sometimes becomes vaccine hesitant. For example, in Japan, unconfirmed media reports of adverse reactions to the HPV vaccine in 2013 led to a suspension of proactive recommendations and a consequent fall in uptake from above 70% to below 1%, which will likely mean failure to prevent tens of thousands of deaths unless the policy shift is reversed.⁷

There is substantial historical evidence regarding the dangers represented by sub-optimal vaccine uptake, especially in developed countries where there are few if any economic obstacles to vaccination. Rates of vaccination against pertussis (popularly known as whooping cough) collapsed in many western countries following campaigns in the 1970s, leading to incidence rates ten to 100 times greater than in neighbouring countries where pertussis vaccination remained widespread.⁸ The 1999-2000 measles epidemic in the Netherlands, which resulted in three reported deaths and an estimated 157 hospitalisations, was concentrated among unvaccinated individuals resident in areas with suboptimal vaccine coverage: 94% of known cases involved patients who had not been vaccinated (indicating a level of risk 224 times greater than that faced by vaccinated individuals), and 75% occurred in municipalities with low vaccine coverage.⁹ From 2005-2009, a number of European measles outbreaks occurred in religious and ethnic communities with low vaccine coverage.¹⁰ Measles cases in France rose from 40 cases in 2007 to 15000 (six of them fatal) in 2011, when the United States saw its largest number of individual cases since 1996.¹¹ The Disneyland measles outbreak in 2015, which led to 22 hospitalisations, can probably be

³ E. David G. McIntosh et al., "Vaccine hesitancy and refusal," *European Paediatric Association Pages* 175 (2016).

⁴ WHO, "Ten threats to global health in 2019," *World Health Organisation*, 2019, <https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019>.

⁵ Susan van den Hof, Marina A.E. Conyn-van Spaendonck, and Jim E. van Steenbergen, "Measles epidemic in the Netherlands, 1999-2000," *Journal of Infectious Diseases* 186, no. 10 (2002): 1485.

⁶ Nina H. Fefferman and Elena N. Naumova, "Dangers of vaccine refusal near the herd immunity threshold: a modelling study," *Lancet Infectious Diseases* 15 (2015).

⁷ Kate T. Simms et al., "Impact of HPV vaccine hesitancy on cervical cancer in Japan: a modelling study," *Lancet Public Health* 5, no. 4 (2020).

⁸ E.J. Gangarosa et al., "Impact of anti-vaccine movements on pertussis control: the untold story," *Lancet* 351, no. 9099 (1998).

⁹ van den Hof, Conyn-van Spaendonck, and van Steenbergen, "Measles epidemic in the Netherlands, 1999-2000," 1485.

¹⁰ Mark Muscat, "Who gets measles in Europe?," *Journal of Infectious Diseases* 204, Sup. 1 (2011).

¹¹ Barry R. Bloom, Edgar Marcuse, and Seth Mnookin, "Addressing vaccine hesitancy," *Science* 344, no. 6182 (2014).

blamed on vaccination rates having fallen below the herd immunity threshold,¹² while the still-larger 2019 outbreak in American Samoa, which led to 81 reported deaths, appears to have been the consequence of a temporary suspension of the MMR vaccination programme.¹³ In Europe, the first six months of 2018 saw more cases of measles than in any previous 12-month period in the decade, with a total of 39 deaths.¹⁴ Although this increase is partly attributable to travel to and from countries outside Europe with low levels of vaccination,¹⁵ statistical analysis shows that vaccine coverage within Europe itself was the main driver, with countries that had achieved high rates of vaccination avoiding outbreaks even where rates of travel and immigration were also high.¹⁶

All of the above indicates the tremendous danger posed by anti-vaccination campaigners in their attempts to thwart the global response to the COVID-19 pandemic. But it also indicates that vaccine hesitancy is a long-term problem which will still be with us even once that pandemic has been tamed.

Understanding vaccine hesitancy

The culture of vaccine hesitancy

Vaccine hesitancy can be understood 'as a continuum ranging from total acceptance to complete refusal,' and '[v]accine-hesitant individuals may refuse some vaccines, but agree to others' and they may not refuse vaccination outright, instead 'delay[ing] vaccination or accept[ing] vaccination although doubtful about doing so'.¹⁷ A number of causes have been identified, including diminished perception of the necessity of vaccination (ironically caused by the success of vaccination), overestimation of the risks of vaccination and underestimation of the risks of non-vaccination, scepticism and mistrust of traditional sources of information, and the Dunning-Kruger effect, which leads 'people with less knowledge to think that they are better able to evaluate information than the experts in the field themselves'.¹⁸ A further problem may be a general bias towards 'errors of omission' as opposed to 'errors of commission', which is to say that people may feel less averse to the idea of becoming ill due to diseases that would have been prevented by vaccination than they do to the idea of suffering adverse reactions as a result of vaccination itself, independently of any objective assessment of the relative likelihood of these two

¹² Maimuna S. Majumder et al., "Substandard vaccination compliance and the 2015 measles outbreak," *JAMA Pediatrics* 169, no. 5 (2015).

¹³ Kenneth Rochel de Camargo Jr, "Here we go again: the reemergence of anti-vaccine activism on the Internet," *Cadernos de Saúde Pública* 36, Sup. 2 (2020): 2.

¹⁴ Wei-Yee Leong, "Measles cases hit record high in Europe in 2018," *Journal of Travel Medicine* 25, no. 1 (2018).

¹⁵ Anita E. Heywood, "Measles: a re-emerging problem in migrants and travellers," *Journal of Travel Medicine* 25, no. 1 (2018).

¹⁶ Wei-Yee Leong and Annika Beate Wilder-Smith, "Measles resurgence in Europe: migrants and travellers are not the main drivers," *Journal of Epidemiology and Global Health* 9, no. 4 (2019).

¹⁷ Eve Dubé et al., "Mapping vaccine hesitancy—country-specific characteristics of a global phenomenon," *Vaccine* 32 (2014): 6649.

¹⁸ Rochel de Camargo Jr, "Here we go again: the reemergence of anti-vaccine activism on the Internet," 2-3.

outcomes.¹⁹ This may explain the findings of a survey of Italian parents found general vaccine hesitancy to be higher among those who perceive one or more vaccines to be unsafe or to carry a risk of side effects and among those who are uncertain of the effectiveness of vaccines,²⁰ as well as focus group and interview data from Romania which suggests that vaccine averse mothers may view rumoured side-effects of the HPV vaccine as a risk 'far more severe than [that of] developing cancer if not vaccinated.'²¹ However, it is important to acknowledge the role of deliberate human agency in promoting vaccine hesitancy. Organised opposition to vaccination dates back to the 18th century, when religious figures in Britain and America preached against vaccines, and to the mid-19th century, which saw the formation of the Anti-Vaccination League in London.²²

The predictors of vaccine hesitancy

A qualitative study based on interviews with experienced national immunisation managers in 13 selected countries summarises the 21st century situation as follows:

[V]accine hesitancy ... exists worldwide. While some [immunisation managers] considered the impact of vaccine hesitancy on immunisation programmes to be a minor problem in their country, for others it was more serious. Although some [immunisation managers] associated vaccine hesitancy with particular religious or ethnic groups, most agreed that vaccine hesitancy is not limited to specific communities, and exists across all socioeconomic strata of the population. Some [immunisation managers] associated it with highly educated individuals ... Two [immunisation managers] emphasized that health professionals may themselves be vaccine-hesitant.²³

Specific problems raised include risk perceptions (both with regard to vaccines and with regard to the diseases that they prevent), medical trust, lack of knowledge, and the prevalence of misinformation, as well as general issues with the medical systems in the countries in question (for example, a shortage of female medical professionals in contexts where female patients prefer not to be treated by males).²⁴

Many numbers of studies have been carried out to identify the drivers of vaccine hesitancy. A useful review of this literature was carried out by Larson et al, covering research published between 2007-2012 in multiple national contexts.²⁵ Studies carried out in Nigeria, the United States, Burkina Faso, and Bangladesh found contradictory evidence with regard to socioeconomic status, either finding that both high and low income were associated with

¹⁹ Salmon et al., "Vaccine hesitancy: causes, consequences, and a call to action," D67.

²⁰ Francesco Napolitano, Alessia D'Alessandro, and Italo Francesco Angelillo, "Investigating Italian parents' vaccine hesitancy: A cross-sectional survey," *Human Vaccines & Immunotherapeutics* 14, no. 7 (2018).

²¹ Catrinel Craciun and Adriana Baban, "'Who will take the blame?': understanding the reasons why Romanian mothers decline HPV vaccination for their daughters," *Vaccine* 30 (2012): 6790.

²² Azhar Hussain and Sheharyar Hussain, "The anti-vaccination movement: a regression in modern medicine," *Cureus* 10, no. 7 (2018): 2.

²³ Dubé et al., "Mapping vaccine hesitancy—country-specific characteristics of a global phenomenon," 6653.

²⁴ Dubé et al., "Mapping vaccine hesitancy—country-specific characteristics of a global phenomenon," 6652-53.

²⁵ Heidi J. Larson et al., "Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007–2012," *Vaccine* 32 (2014).

vaccine hesitancy or that low income was associated both with vaccine hesitancy and with vaccine acceptance.²⁶ In Nigeria, India, and Bangladesh, exposure to pro-vaccination messaging in the media was associated with vaccine acceptance, but in Taiwan and Canada, exposure to media reports about vaccination appeared to be associated with vaccine hesitancy, perhaps because the stories were often negative.²⁷ Studies in the United States, Canada, the UK, the Netherlands, Taiwan, Nigeria, and the Democratic Republic of Congo found social or professional support for vaccination to be a factor in reducing vaccine hesitancy.²⁸ Health knowledge and belief in scientific medicine were associated with lower vaccine hesitancy in both India and Germany, while studies in Nigeria and the Netherlands found higher vaccine hesitancy to be associated with an understanding of health issues influenced by rumours, alternative medicine, or certain particular spiritual beliefs.²⁹ Higher levels of integration into private or public health services were also associated with greater likelihood of vaccination in Nigeria, India, Burkina Faso, China, Senegal, and the Netherlands, while perceptions of the dangers of vaccine preventable diseases, whether on the part of the patient or on the part of the medical professional, were found to be associated with vaccination in Nigeria, Taiwan, the Democratic Republic of Congo, Canada, the Netherlands, and the United States.³⁰ Studies have found an association between youth and vaccine hesitancy, including among parents with regard to their children.³¹

Direct comparison between multiple national contexts was made possible by the Wellcome Trust's commissioning of nationally representative sample surveys in over 140 separate countries in 2018. These surveys asked respondents whether they considered vaccines to be safe, effective, and important for children to receive. Interestingly, positive views of vaccines were often found to be more common in lower income regions than in higher income regions. In South Asia and Eastern Africa, 85% and 81% strongly agreed that vaccines were safe (respectively) and 84% and 79% strongly agreed that they were effective (respectively), while in Western and Eastern Europe, 36% and 37% strongly agreed that they were safe (respectively) and 44% and 46% strongly agreed that they were effective.³² Of those countries where 95% or more agreed that vaccines were safe, effective, and/or important for children to have, the overwhelming majority were in the global south,³³ while

²⁶ Larson et al., "Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007–2012," 2154.

²⁷ Larson et al., "Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007–2012," 2154.

²⁸ Larson et al., "Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007–2012," 2155.

²⁹ Larson et al., "Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007–2012," 2155.

³⁰ Larson et al., "Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007–2012," 2155.

³¹ Anja Repalust et al., "Childhood vaccine refusal and hesitancy intentions in Croatia: insights from a population-based study," *Psychology, Health & Medicine* 22, no. 9 (2017); Rebekah Reuben et al., "Mistrust of the medical profession and higher disgust sensitivity predict parental vaccine hesitancy," *PLoS ONE* 15, no. 9 (2020).

³² Wellcome, *Wellcome global monitor: how does the world feel about science and health?* (London: Wellcome Trust, 2019), 110-11.

³³ Wellcome, *Wellcome global monitor: how does the world feel about science and health?*, 114.

the country with the most negative perception of vaccines – with the greatest percentage disagreeing that vaccines are safe, the second-greatest percentage disagreeing that they are effective, and the third-greatest percentage disagreeing that they are important for children to have – was France.³⁴ As for demographic variables, these appeared to vary in association by region. For example, in Northern America, Central Asia, and most of Europe, perceived vaccine safety was lowest among those with the least science education and highest among those with the most, but in Eastern Europe, Eastern Asia, and Central Africa, the opposite was true.³⁵

This extreme degree of variation suggests that vaccine hesitancy may not be a single phenomenon, even if it looks like one from the point of view of the agency attempting to eradicate disease. Instead, there may be multiple contextually specific tendencies that have quite different structures and causes, and that produce the same effects almost coincidentally. For example, Global Polio Eradication Initiative data suggests that in some developing world contexts, ‘organised resistance’ to vaccination is rare, and, where it occurs, is typically an expression of opposition to those who are perceived to be behind the vaccination programme, sometimes being used in order to leverage unrelated demands.³⁶ However, in the global north, there is – as discussed above – a longstanding tradition of opposition to the practice of vaccination itself, and this appears to have benefited from the ubiquity of digital communications technology, which allows ‘pockets [of contrarian views] to converge and coalesce, gaining the necessary critical mass to become vocal parties in the general discussion.’³⁷ Such pockets of anti-vaccination sentiment have emerged not only on dedicated anti-vaccine websites and discussion boards, but also on widely-used social networking services such as Facebook, where ‘anti-vaccine ... groups have closed their forums to anyone who describes themselves as “pro-vaccine,”’ thus ensuring that they can propagate their messages unopposed.³⁸ In these digital spaces, ‘[g]roup dynamics combine to weed out nonbelievers, and reward new converts with the dopamine hits of likes and positive comments.’³⁹ One large-scale analysis suggests that anti-vaccination clusters of users may soon become dominant on social media thanks to a range of network dynamics, including greater entanglement between them and clusters of undecided users.⁴⁰

First world problems? Anti-vaccination campaigners in the digital sphere

The ideology of social media anti-vaccination groups is often expressed through conspiracy theories. A conspiracy theory is ‘an explanation of politics [which] ... purports to locate and identify the true loci of power ... [among] conspirators ... [who] operate a concealed political

³⁴ Wellcome, *Wellcome global monitor: how does the world feel about science and health?*, 116.

³⁵ Wellcome, *Wellcome global monitor: how does the world feel about science and health?*, 117.

³⁶ Susan Goldstein et al., "Health communication and vaccine hesitancy," *Vaccine* 33 (2015): 4213.

³⁷ Rochel de Camargo Jr, "Here we go again: the reemergence of anti-vaccine activism on the Internet," 3.

³⁸ Olivia Benecke and Sarah Elizabeth DeYoung, "Anti-vaccine decision-making and measles resurgence in the United States," *Global Pediatric Health* 6 (2019): 2.

³⁹ CCDH, *The anti-vaxx playbook* (London and Washington (DC): Center for Countering Digital Hate, 2020), 48.

⁴⁰ Neil F. Johnson et al., "The online competition between pro- and anti-vaccination views," *Nature* 582 (2020): 230-31.

system behind the visible one.⁴¹ It has been found both that ‘conspiracy beliefs can be easily spread via social media platforms and [that] people who have conspiracy beliefs are more likely to get information from social media,⁴² which perhaps explains some of their affinity with anti-vaccination content. A study of anti-vaccination websites in 2004 found 91% attributing medical conditions such as autism to vaccination and 76% alleging cover-ups and conspiracies with regard to vaccine safety.⁴³ From 2007 onwards, a series of content analyses of English-language YouTube content found anti-vaccine videos to received more positive evaluations from platform users than balanced or pro-vaccine videos, with some indication of a shift towards greater volumes of anti-vaccine content over time.⁴⁴ A 2017 survey of the most popular Facebook posts about the Zika virus found that misleading posts were much more popular than accurate ones: the most popular accurate post was a press release from the WHO which had been shared 964 times and viewed 43000 times, but the most popular misleading post – a video which claimed to prove that Zika was a hoax – had been shared 19600 times and viewed 530000 times.⁴⁵ Analysis by one non-profit organisation shows that, during the COVID-19 pandemic, 147 leading anti-vaccination accounts added 10.1 million social media followers in 2020, including 4.3 million each on both Instagram and YouTube.⁴⁶ An academic study of YouTube video recommendations found that ‘even if users are to watch a pro-vaccine video, they have a relatively high chance of being recommended an anti-vaccine video’ and that ‘[a]nti-vaccine videos are much more likely to lead to more anti-vaccine videos’.⁴⁷ Despite multiple announcements of policies to counteract COVID-19 disinformation, it remains so widespread on major digital platforms that some observers have come to the conclusion that ‘social media companies are [either] completely ineffectual at counteracting the volume of dangerous nonsense hosted on their platforms, or [are] so inept as to not recognise it.’⁴⁸

The online flood of disinformation related to infectious diseases, which has now been going on for over two decades, appears to have had a measurable impact on the vaccine-related beliefs and practices of many individuals in technologically advanced countries with easy Internet access. A systematic review found vaccine-related misinformation to be one of the

⁴¹ Michael Barkun, *A culture of conspiracy: apocalyptic visions in contemporary America* (Los Angeles: University of California Press, 2003), 178.

⁴² Andreas Goreis and Oswald D. Kothgassner, "Social media as a vehicle for conspiracy beliefs about COVID-19," *Digital Psychology* 1, no. 2 (2020): 38.

⁴³ Richard K Zimmerman et al., "Vaccine criticism on the World Wide Web," *Journal of Medical Internet Research* 7, no. 2 (2005).

⁴⁴ J. Keelan et al., "YouTube as a source of information on immunisation: a content analysis," *Journal of the American Medical Association* 298 (2007); K.A. Ache and L.S. Wallace, "Human papillomavirus vaccination coverage on YouTube," *American Journal of Preventative Medicine* 35 (2008); Rowena Briones et al., "When vaccines go viral: an analysis of HPV vaccine coverage on YouTube," *Health Communication* 27 (2012).

⁴⁵ Megha Sharma et al., "Zika virus pandemic - analysis of Facebook as a social media health information platform," *American Journal of Infection Control* 45, no. 3 (2017).

⁴⁶ CCDH, *The anti-vaxx playbook*, 9.

⁴⁷ Lu Tang, Kayo Fujimoto, Muhammad (Tuan) Amith, Rachel Cunningham, Rebecca A. Costantini, Felicia York, Grace Xiong, Julie A. Boom, and Cui Tao, "'Down the rabbit hole' of vaccine misinformation on YouTube: network exposure study," *Journal of Medical Internet Research* 23 (1), no. e23262 (2021): 7.

⁴⁸ David Robert Grimes, "Health disinformation and social media," *EMBO reports* 21, no. e51819 (2020): 4.

most common forms of misinformation online,⁴⁹ and a review of fifteen interview- and focus group-based studies carried out in 2005 found that a majority identified mistrust (in particular, as expressed through conspiracy allegations) as a barrier to uptake of childhood vaccination.⁵⁰ A separate systematic review found that vaccine rejectors tend to acquire information about vaccination from mass media and Internet sources, while those who are more accepting of vaccination tend to cite medical practitioners as a primary source of information.⁵¹ Unsurprisingly, it also found that MMR vaccine acceptors trusted medical experts as well as the safety and effectiveness of vaccines, while MMR vaccine rejectors distrusted experts and expressed fears with regard to possible adverse effects (often citing autism as one such) and, in some communities, instead placed their faith in alternative remedies.⁵² In this connection, it is worth noting that alternative health entrepreneurs have been among the leading disseminators of anti-vaccination content on social media, and that according to one study they may provide as much as 40% of the anti-vaccination movement's social media following.⁵³ Use of alternative medicine was found to predict vaccine hesitancy in Croatia,⁵⁴ although a survey carried out in Spain found that trust in complementary and alternative treatments such as homeopathy and reiki is only weakly associated with vaccine hesitancy, which is much more strongly predicted by distrust in conventional medicine.⁵⁵

A number of experimental studies appear to support the view that online anti-vaccination materials such as vaccine conspiracy theories may be playing a causal role in reducing vaccine coverage in the developed world. Volunteers from an advanced science class at a high school for academically gifted students in the United States were asked first to carry out Google searches for the terms 'vaccine safety' and 'vaccine danger', and then to write down what they had learnt; 59% of the 'facts' reported in this subsequent 'lessons learnt' exercise were found to be inaccurate (this experiment was carried out in 2008, when the great majority of high-ranking search hits for the latter of these terms were for sites featuring inaccurate information).⁵⁶ A German experiment also from the first decade of the century involving a large convenience sample of Internet users found that as little as 10

⁴⁹ Steven Lloyd Wilson and Charles Wiysonge, "Social media and vaccine hesitancy," *BMJ Global Health* (2021).

⁵⁰ Edward Mills et al., "Systematic review of qualitative studies exploring parental beliefs and attitudes toward childhood vaccination identifies common barriers to vaccination," *Journal of Clinical Epidemiology* 58, no. 11 (2005).

⁵¹ Annika Beate Wilder-Smith and Kaveri Qureshi, "Resurgence of measles in Europe: a systematic review on parental attitudes and beliefs of measles vaccine," *Journal of Epidemiology and Global Health* 10, no. 1 (2020): 53-54.

⁵² Wilder-Smith and Qureshi, "Resurgence of measles in Europe: a systematic review on parental attitudes and beliefs of measles vaccine," 54.

⁵³ CCDH, *The anti-vaxx playbook*, 9.

⁵⁴ Repalust et al., "Childhood vaccine refusal and hesitancy intentions in Croatia: insights from a population-based study."

⁵⁵ Matthew J. Hornsey, Josep Lobera, and Celia Díaz-Catalan, "Vaccine hesitancy is strongly associated with distrust of conventional medicine, and only weakly associated with trust in alternative medicine," *Social Science & Medicine* 255 (2020).

⁵⁶ Philip Kortum, Christine Edwards, and Rebecca Richards-Kortum, "The impact of inaccurate Internet health information in a secondary school learning environment," *Journal of Medical Internet Research* 10, no. 2 (2008).

minutes' exposure to 'typical' anti-vaccination websites was sufficient to increase perceived risk of vaccination, decrease perceived risk of non-vaccination, and decrease intention to vaccinate.⁵⁷ Much more recent experiments have made similar findings, with a study involving participants from Britain and the United States finding both that belief in anti-vaccination conspiracy theories is associated with lower vaccination intentions and that exposure to materials expressing such theories acts to reduce vaccine intentions,⁵⁸ and a Chinese study finding that exposure to conspiracy theories about HPV vaccination has a negative effect both on attitudes to HPV vaccination and on intention to receive the HPV vaccine.⁵⁹ An experiment carried out in the Netherlands found that participants tend to choose to expose themselves to messages that confirm their existing beliefs about vaccines, which supports the view that the free choice provided by the Internet (as compared to traditional media) may be making it harder to persuade those with negative views of vaccines to change their minds,⁶⁰ and three surveys carried out in the UK, two of them with large representative samples, found that belief in COVID-19 conspiracy theories was associated with sourcing information about COVID-19 from social media sources (especially YouTube) rather than from traditional broadcast and print media sources.⁶¹ Conspiracy suspicions about COVID-19 have also been found to be far more common among members of minority ethnic communities than among members of white ethnic groups.⁶²

Since the beginning of the COVID-19 pandemic, a number of studies have been carried out to assess hesitancy with regard to an (initially hypothetical) COVID-19 vaccine. These results paint a similar picture to the above. A study in the United Kingdom found that demographic variables had little predictive power with regard to COVID-19 vaccine hesitancy, which was instead mostly explained by lack of belief that vaccination against the disease will 'save lives [and] help the community' or that 'it will be dangerous if many people do not get vaccinated'.⁶³ The same study also found vaccine hesitancy to be predicted by vaccine conspiracy beliefs and by negative perceptions of medical professionals, including those involved in developing vaccines.

A separate study found that COVID-19 conspiracy believers were more likely to engage in certain health-protective behaviours such as mask-wearing before this was recommended by UK health authorities, but also more reluctant to engage in others, particularly

⁵⁷ Cornelia Betsch et al., "The influence of vaccine-critical websites on perceiving vaccination risks," *Journal of Health Psychology* 15, no. 3 (2010).

⁵⁸ Daniel Jolley and Karen M. Douglas, "The effects of anti-vaccine conspiracy theories on vaccination intentions," *PLoS ONE* 9, no. 2 (2014).

⁵⁹ Li Chen et al., "Effects of vaccine-related conspiracy theories on Chinese young adults' perceptions of the HPV vaccine: an experimental study," *Health Communication* Published online first (2020).

⁶⁰ Corine S. Meppelink et al., "'I was right about vaccination': confirmation bias and health literacy in online health information seeking," *Journal of Health Communication* 24, no. 2 (2019).

⁶¹ Daniel Allington et al., "Health-protective behaviour, social media usage and conspiracy belief during the COVID-19 public health emergency," *Psychological Medicine* Published online first (2020).

⁶² Siobhan McAndrew, Daniel Allington, and Bobby Duffy, "Belief in Covid conspiracies linked with vaccine hesitancy: relying on social media for information on the pandemic also appears to play a role," news release, 31 January, 2021, <https://www.kcl.ac.uk/news/belief-in-covid-conspiracies-linked-with-vaccine-hesitancy>.

⁶³ Daniel Freeman et al., "COVID-19 vaccine hesitancy in the UK: the Oxford coronavirus explanations, attitudes, and narratives survey (Oceans) II," *Psychological Medicine* Published online first (2020).

vaccination,⁶⁴ while yet another found COVID-19 vaccination hesitancy in the UK to be predicted by mistrust (including both vaccination conspiracy beliefs and negative views of medical professionals), anger towards society (e.g. agreement with statements such as ‘I think society should be burned to the ground’), and lack of positive experiences with healthcare in the past.⁶⁵ Two recent non-peer reviewed academic studies have backed this up with further UK data. The first of these found vaccine hesitancy to be predicted by lack of trust in conventional medicine, general conspiracy beliefs, and sourcing of information from YouTube.⁶⁶ The second found vaccine hesitancy to be associated with conspiracy suspicions about the coronavirus, and found such suspicions to be heightened among those who source information from social media platforms such as Instagram and YouTube, and still further heightened among those who prefer the DuckDuckGo search engine, as opposed to the market leader, Google (which, unlike DuckDuckGo, has attempted to prioritise reputable sources of vaccine information in search results).⁶⁷ A peer-reviewed multivariate analysis of the same dataset suggests that differences in COVID-19 vaccine hesitancy associated with reliance on various media sources are largely explained by conspiracy beliefs about COVID-19 and attitudes to vaccines in general, which could be taken to imply that any effects associated with media usage are achieved through promulgation of such attitudes and beliefs; interestingly, these beliefs and attitudes appeared to explain the higher vaccine hesitancy observed among members of other than white ethnic groups.⁶⁸

A peer-reviewed analysis of four representative sample surveys found evidence that COVID-19 vaccine hesitancy in the US was associated with female gender, lower levels of education, and having voted for Donald Trump, while COVID-19 vaccine hesitancy in the UK was associated with youth, other than white ethnicity, and reliance on social media for information about COVID-19.⁶⁹ Both in the US and in the UK, the same study found vaccine hesitancy to be associated with lower use of broadcast and print media news for information about COVID-19. A separate peer-reviewed study found that, among people whose media diet is dominated by social media, a ‘conspiracy mentality’ is associated with intention actively to discourage others from being vaccinated, but that among people with different media diets, the tendency is reduced.⁷⁰ This suggests that ‘when people gain a broad perspective, from a range of different media sources, they ... are more likely to

⁶⁴ Marie Juanchich et al., "Are COVID-19 conspiracies a threat to public health? Psychological characteristics and health protective behaviours of believers," *PsyArXiv preprints* (2020).

⁶⁵ Daniel Freeman et al., "COVID-19 vaccine hesitancy in the UK: the Oxford coronavirus explanations, attitudes, and narratives survey (OCEANS) II," *Psychological Medicine* Published online first (2021).

⁶⁶ Will Jennings et al., "Lack of trust and social media echo chambers predict COVID-19 vaccine hesitancy," *medRxiv preprint* (2021).

⁶⁷ McAndrew, Allington, and Duffy, "Belief in Covid conspiracies linked with vaccine hesitancy: relying on social media for information on the pandemic also appears to play a role."

⁶⁸ Daniel Allington, Siobhan McAndrew, Vivienne Moxham-Hall, and Bobby Duffy. "Coronavirus conspiracy suspicions, general vaccine attitudes, trust, and coronavirus information source as predictors of vaccine hesitancy among UK residents during the COVID-19 pandemic," *Psychological Medicine* (in press, 2021).

⁶⁹ Daniel Allington, Siobhan McAndrew, Vivienne Moxham-Hall, and Bobby Duffy, "Media usage predicts intention to be vaccinated against SARS-CoV-2 in the US and the UK," *Vaccine*. Published online first (2021).

⁷⁰ Andrew Chadwick et al., "Online social endorsement and COVID-19 vaccine hesitancy in the UK," *Social Media and Society* (in press, 2021).

positively endorse vaccination'.⁷¹ Being cross-sectional, these studies cannot provide evidence of causality. Such evidence was, however, provided by a very large experimental study which found that exposing British and American participants to online misinformation on the subject of COVID-19 and vaccination led to a substantial fall in the proportion of participants who would 'definitely' be vaccinated against the coronavirus.⁷²

A study in France found attitudes towards vaccination and specific intention to be vaccinated against COVID-19 both to be negatively associated both with COVID-19 conspiracy beliefs and with support for chloroquine as a treatment for COVID-19 (which appears to be regarded as an 'alternative' remedy in part because of its promoters' appeals to conspiracy narratives).⁷³ Interestingly, vaccination attitudes and COVID-19 vaccine intentions were also predicted by general conspiracy mentality, measured using non-medical questionnaire items, indicating that the problem may not be specific conspiracy theories but a broader conspiratorial outlook. A longitudinal study in the United States found COVID-19 vaccination conspiracy beliefs to predict COVID-19 vaccine hesitancy (as well as reluctance to engage in other health-protective behaviours such as mask-wearing), with belief in a link between the MMR vaccine and autism acting as a mediator.⁷⁴ In the same study, vaccine hesitancy was also found to be associated with youth, minority ethnic group membership, and use of social media and conservative media rather than mainstream television news as a source of information.

Not all studies have focused primarily on ideas and beliefs, however. For example, an Israeli study found acceptance of a COVID-19 vaccine to be predicted by economic insecurity and having lost one's job during the pandemic, as well as by having already undergone vaccination against influenza, and by perceiving oneself to be at high risk from COVID-19.⁷⁵ This appears to suggest that if people can see that they have a clear personal stake in the success of a vaccination campaign, and especially if they have personally benefited from vaccination in the past, they are unlikely to reject vaccination. Such findings should remind us that acceptance or rejection of vaccination is not purely a matter of acceptance or rejection of beliefs about the benefits and risks. Indeed, it can be a matter of social identity:

To refuse vaccine-preventable diseases – to engage in or endorse vaccination – is to proclaim one's social communion with the mainstream. Similarly, to refuse a vaccination is to proclaim one's affiliation with significant others from beyond the mainstream. Like getting a gang tattoo, slipping on a wedding ring, or binge-

⁷¹Andrew Chadwick et al., "Online social endorsement and COVID-19 vaccine hesitancy in the UK".

⁷²Sahil Loomba et al., "Measuring the impact of COVID-19 vaccine misinformation on vaccination intent in the UK and USA," *Nature Human Behaviour* (2021).

⁷³ Paul Bertin, Kenzo Nera, and Sylvain Delouvé, "Conspiracy beliefs, rejection of vaccination, and support for hydroxychloroquine: a conceptual replication-extension in the COVID-19 pandemic context," *Frontiers in Psychology* 11, no. 565128 (2020).

⁷⁴ Daniel Romer and Kathleen Hall Jamieson, "Conspiracy theories as barriers to controlling the spread of COVID-19 in the U.S.," *Social Science & Medicine* 263, no. 113356 (2020).

⁷⁵ Amiel A. Dror et al., "Vaccine hesitancy: the next challenge in the fight against COVID-19," *European Journal of Epidemiology* 35 (2020).

watching a popular streamed TV show, vaccine refusal entails an act of identification – of opting in – of proclaiming ‘I belong’ and ‘I share your values.’⁷⁶

Such a view of vaccine hesitancy would appear to be supported by a systematic review of studies of parental attitudes with regard to the MMR vaccination in Europe, which found both acceptors and rejectors to cite judgement or fear of judgement from their peers as a reason for their stance.⁷⁷ If vaccine confidence and hesitancy is primarily a matter of social identity rather than empirical belief, the solution is perhaps simply to make the community of vaccine acceptors as attractive and easy to see oneself as belonging to as possible – a point to which the following section will return.

Solutions to the problem of vaccine hesitancy

A systematic review of both peer reviewed studies and grey literature published from 2007-2013 with regard to interventions designed to reduce vaccine hesitancy:

The most effective interventions employed multiple strategies. The interventions with the largest observed increases (>25%) in vaccine uptake were those that (not in order of importance): (1) directly targeted unvaccinated or under-vaccinated populations; (2) aimed to increase vaccination knowledge and awareness; (3) improved convenience and access to vaccination; (4) targeted specific populations ... ; (5) mandated vaccinations or sanction against non-vaccination; and (6) engaged religious or other influential leaders to promote vaccination.⁷⁸

However, a second systematic review covering a wider period found little good evidence, except with regard to reducing options for exemptions to mandatory vaccination and making such exemptions more difficult to obtain on a purely procedural level.⁷⁹ As a solution, this is not to be dismissed lightly: in practice, allowing non-medical exemptions to vaccination policies in the early years educational sector has been found to reduce vaccination rates quite substantially, and disallowing them has been found to raise those rates.⁸⁰ Moreover, one qualitative study found that some individuals interpret non-compulsoriness as a signal that vaccinations are unnecessary.⁸¹ Several European countries have responded to recent outbreaks of measles by introducing forms of coercion,⁸² and

⁷⁶ Elisa J. Sobó, "Theorising (vaccine) refusal: through the looking glass," *Cultural Anthropology* 31, no. 3 (2016): 348.

⁷⁷ Wilder-Smith and Qureshi, "Resurgence of measles in Europe: a systematic review on parental attitudes and beliefs of measles vaccine," 53.

⁷⁸ Caitlin Jarrett et al., "Strategies for addressing vaccine hesitancy – a systematic review," *Vaccine* 33 (2015): 4184.

⁷⁹ Alina Sadaf et al., "A systematic review of interventions for reducing parental vaccine refusal and vaccine hesitancy," *Vaccine* 31 (2013): 4297.

⁸⁰ Jacqueline K. Olive et al., "The state of the antivaccine movement in the United States: A focused examination of nonmedical exemptions in states and counties," *PLoS Medicine* 15, no. 6.

⁸¹ Marta Fadda, Miriam Depping, and Peter J. Schulz, "Addressing issues of vaccination literacy and psychological empowerment in the measles-mumps-rubella (MMR) vaccination decision-making: a qualitative study," *BMC Public Health* 15, no. 836 (2015).

⁸² BMJ, "Europe steps up action against vaccine hesitancy as measles outbreaks continue," *British Medical Journal* 359, no. j4803 (2017).

results appear to have been positive. France saw increases in coverage for all vaccinations covered by the new law, including an increase of coverage for meningococcal C from 39.3% to 75.7%, and a concomitant fall in the number of meningococcal infections for children under one year old; interestingly, the number of HPV vaccinations also rose even though this was not affected by the new law.⁸³ Italy saw less dramatic increases from a higher starting point and, interestingly, a fall in the proportion of vaccine hesitant parents from 15.5% to 11.5%.⁸⁴ What this shows is that – at least when combined with careful marketing (as it was in both France and Italy) – compulsory vaccination does not necessarily result in a backlash; indeed the opposite, sometimes even leading to increased uptake of non-compulsory vaccinations.

Education has also been proposed as a solution to the problem of vaccine hesitancy. It has been found both that participants who were more knowledgeable about the news media were less likely to endorse conspiracy theories,⁸⁵ and that information literacy – operationalised as the ability to identify verified, reliable information and to distinguish it from statements of opinion – predicts correct identification of ‘fake news’.⁸⁶ Moreover, a survey of a representative sample of Polish Internet users found that endorsement of COVID-19 conspiracy theories was higher among younger and less highly educated respondents, as well as among those with lower health literacy.⁸⁷ On the other hand, educational solutions can only work in the long-term, and it is hard to see how they could be of benefit to adults who have left the educational system and lack the opportunity or the inclination to return. Such adults typically remain in communication with medical professionals, however, and there has been considerable research interest in the potential of the latter group to reduce vaccine hesitancy – or even to bolster it (there is evidence from the US suggesting that some may not be recommending HPV vaccine to all eligible individuals due to concern that it may promote unprotected sexual activity, and a survey of general practitioners in France found that some are hesitant to recommend vaccinations, especially if they lack confidence in the health authorities or are unconvinced of the effectiveness or safety of vaccines, though lack confidence in explaining the issues was also a factor).⁸⁸ A systematic review found as follows:

⁸³ Daniel Lévy-Bruhl et al., "Assessment of the impact of the extension of vaccination mandates on vaccine coverage after 1 year, France, 2019," *Eurosurveillance* 24, no. 26 (2019).

⁸⁴ Fortunato D’Ancona et al., "The law on compulsory vaccination in Italy: an update 2 years after the introduction," *Eurosurveillance* 24, no. 26 (2019).

⁸⁵ Stephanie Craft, Seth Ashley, and Adam Maksl, "News media literacy and conspiracy theory endorsement," *Communication and the Public* 2, no. 4 (2017).

⁸⁶ S. Mo Jones-Jang, Tara Mortensen, and Jingjing Liu, "Does media literacy help identification of fake news? Information literacy helps, but other literacies don’t," *American Behavioural Scientist* Published online first, DOI: <https://doi.org/10.1177/0002764219869406> (2019).

⁸⁷ Mariusz Duplaga, "The determinants of conspiracy beliefs related to the COVID-19 pandemic in a nationally representative sample of Internet users," *International Journal of Environmental Research and Public Health* 17 (2020).

⁸⁸ Manika Suryadevaraa et al., "Pediatric provider vaccine hesitancy: an under-recognized obstacle to immunizing children," *Vaccine* 33 (2015).; Pierre Verger et al., "Vaccine hesitancy among general practitioners and its determinants during controversies: a national cross-sectional survey in France," *EBioMedicine* 2 (2015).

Overall, knowledge about particular vaccines, their efficacy and safety, helped to build [healthcare providers'] own confidence in vaccines and their willingness to recommend them to others. Knowledge alone, though, is not enough, as indicated in the study that also identified the importance of societal endorsement and support from colleagues.⁸⁹

Providing medical professionals with the support to recommend vaccination effectively might thus have a direct impact on vaccination coverage. But, as the above quotation emphasises, it is important not to mistake this for a matter of information provision. A separate systematic review cautions as follows:

Although [the public perception that there is a lack of adequate information about all vaccines] is partly linked to quality of the communication and information system, it is also largely influenced by mistrust. This is reflected by the fact that some studies found that participants were still describing concerns that MMR might cause autism although they knew that experts and scientists had not found any evidence for this association. Providing information is not, by itself, sufficient to change people's behaviour.⁹⁰

This point alone should be enough to lead us to question the view that it is necessary 'to encourage active intellectual discussion between believers in conspiracy theories and those who have labelled them as conspiracy theorists – often scientists, politicians, or other professionals.'⁹¹ As scholars of the phenomenon have recognised, 'conspiracy theories ... consist of a warped explanatory logic that is not amenable to rational debate.'⁹² If scientists, politicians, and other respected figures attempt to debate conspiracy theorists, this gives the latter the unwarranted appearance of equivalence with the former; moreover, their well-documented ability to discount evidence and their propensity to combine 'lofty incredulity about the official accounts' with 'tolerant credulity towards the arguments of anyone challenging [those accounts]'⁹³ makes it easy for them to maintain the illusion of having held their own in an argument even when their position has been shown (from a strictly rational point of view) to hold no merit whatsoever. Indeed, purveyors of misinformation such as conspiracy theorists and anti-vaccination campaigners explicitly recognise this, and attempt to exploit it as one of the best routes to the expansion of their audience:

Leading anti-vaxxers have claimed that they welcome mainstream media scrutiny and fact-checks as a way of exposing new audiences to their ideas. In an interview

⁸⁹ Pauline Paterson et al., "Vaccine hesitancy and healthcare providers," *Vaccine* 34 (2016): 6703.

⁹⁰ Emilie Karafillakis and Heidi J. Larson, "The benefit of the doubt or doubts over benefits? A systematic literature review of perceived risks of vaccines in European populations," *Vaccine* 35, no. 4840-4850 (2017): 4847.

⁹¹ Kim Mortimer, "Understanding conspiracy online: social media and the spread of suspicious thinking," *Dalhousie Journal of Interdisciplinary Management* 13 (2017): 12.

⁹² Jovan Byford, *Conspiracy theories: a critical introduction* (Basingstoke: Palgrave Macmillan, 2011), 155.

⁹³ David Aaronovitch, *Voodoo histories: how conspiracy theory has shaped modern history* (London: Vintage Books, 2010), 231.

with Ty and Charlene Bollinger, the operators of The Truth About Vaccines network of social media accounts, the anti-vaccine film producer Del Bigtree claimed:

‘I read the headlines: “Del Bigtree anti-vaxxer putting everybody at risk,” and I know that that attack on me, and that article, that I just had a hundred people said ‘Who is Del Bigtree? What is the HighWire? What’s this show about?’ And we just gained a hundred people, and they just lost a hundred. ...’

Similarly, Robert F. Kennedy appeared to welcome scrutiny of his role in spreading conspiracy theories about Bill Gates from the New York Times, deliberately referring to the newspaper’s reporting in a post on the subject that reiterated the same conspiracies. This suggests that anti-vaxxers may deliberately indulge in provocative conspiracy theories in order to attract media attention.⁹⁴

Debating dedicated anti-vaccine campaigners is therefore likely to be counterproductive: it directly supports their own strategy for expanding their audience, when the most direct way of opposing that strategy would be to remove them from mainstream platforms without publicly acknowledging their existence. (This is less controversial than it might seem: no platform feels the need to justify the removal of scammers, for example.) Moreover, debating individual vaccine hesitators may be inadvisable for the different reason that it can lead them to entrench their positions, especially if a general climate of disapproval acts to isolate them within ‘increasingly vulnerable communities of like-minded individuals.’⁹⁵ This seems particularly likely, given that vaccine acceptors have been found to judge the vaccine hesitant very harshly, seeing them as ‘(i) stupid or irrational, (ii) overly emotional, (iii) crazy, paranoid or conspiratorial, and (iv) selfish, egotistical or privileged.’⁹⁶ Rather than adopting this implicit deficit model by attempting to shame vaccine hesitators or to reason them out of their convictions, the aim should perhaps be to respond to them on an emotional level, accepting them as people without validating their false beliefs, and communicating a confidently positive view of vaccination without getting bogged down in debate. This would seem particularly import when dealing with people who are reluctant to vaccinate individuals who are dependent on them. For example, focus group data suggests that it is a sense of parental responsibility that leads some mothers to the view that they ‘cannot take the risk’ of allowing their daughters to be vaccinated against HPV.⁹⁷ If people believe that they are acting in the best interests of their children or elderly parents by protecting them from what they see as the risks of vaccination – risks which they see the vaccine confident as having failed to grasp, or irresponsibly ignored – then stigmatising them as stupid or selfish is unlikely to have a positive effect. Moreover, even if their assessment of the relative risks of vaccination and non-vaccination is objectively mistaken, attempting to demonstrate

⁹⁴ CCDH, *The anti-vaxx playbook*, 38.

⁹⁵ Mark Dredze et al., "Understanding vaccine refusal: why we need social media now," *American Journal of Preventative Medicine* 50, no. 4 (2016).

⁹⁶ Tomas Rozbroj, Anthony Lyons, and Jayne Lucke, "The mad leading the blind: perceptions of the vaccine-refusal movement among Australians who support vaccination," *Vaccine* 37 (2019): 5989.

⁹⁷ Craciun and Baban, "Who will take the blame?", 6790.

this to them may also be counter-productive: it is a rare person indeed who feels reassured by the loss of an argument.

Bearing all these things in mind, it seems reasonable to assume that '[i]nstead of offering contrary information, empathetic listening and careful language will be far more effective when interacting with people experiencing conspiracy ideation.'⁹⁸ In this light, the following advice for paediatricians would seem well-judged:

Listening to parents and being available to answer questions makes a difference. ... Discussing aspects of the vaccines at each paediatric visit is an excellent starting point. It is necessary to provide the information and ensure that it has been correctly understood; hearing and accepting doubts without judging their relevance. Discussing the benefits of vaccines, keeping an open mind to relay knowledge, and accepting cultural and intellectual differences are very important.⁹⁹

On the other hand, the same author's recommendation that '[a]sking parents what they know or think about vaccines can be an interesting introduction'¹⁰⁰ should perhaps be treated with caution: one observational study of provider-parent vaccination discussions (which intentionally over-sampled discussions with vaccine-hesitant parents) found that where providers began the discussion with a participatory initiation, this was associated with much higher odds of parental resistance to provider recommendations than if they began with the assumption that vaccination would take place.¹⁰¹ The implication would appear to be that merely to place vaccination in question invites hesitancy and rejection, whereas treating it as the ordinary and expectable course of affairs invites acceptance. This is unsurprising: if the aim is to make patients or those responsible for them feel reassured, then legitimating potentially mistaken beliefs by beginning with an elicitation of opinion may be no better than starting an argument. Presenting vaccination as uncontroversial, the default option, and part of the normal course of events offers fewer opportunities for hesitancy to arise.

It is therefore with justice that some scholars have argued that the best way to address vaccine hesitancy is simply to focus on 'reinforcing public perception of immunisation as a social norm.'¹⁰² Examples of campaigns which take this approach include Pakistan's enlistment of Islamic scholars to argue that, as a form of preventative medicine, vaccination is supported by Sharia law,¹⁰³ and Italy's grassroots IoVaccino (iVaccine) campaign, which encourages the sharing of selfies with a positive vaccination message:¹⁰⁴ a reminder of the

⁹⁸ Stephanie Beene and Katie Greer, "A call to action for librarians: countering conspiracy theories in the age of QAnon," *Journal of Academic Librarianship* 47, no. 1 (2021): 5.

⁹⁹ Regina Célia de Menezes Succi, "Vaccine refusal - what we need to know," *Jornal de Pediatria* 94, no. 6 (2017): 579.

¹⁰⁰ de Menezes Succi, "Vaccine refusal - what we need to know," 579.

¹⁰¹ Douglas J. Opel et al., "The architecture of provider-parent vaccine discussions at health supervision visits," *Pediatrics* 132, no. 6 (2013): 1040-41.

¹⁰² Goldstein et al., "Health communication and vaccine hesitancy," 4213.

¹⁰³ Yusra Habib Khan et al., "Threat of COVID-19 vaccine hesitancy in Pakistan: the need for measures to neutralize misleading narratives," *American Journal of Tropical Medicine and Hygiene* 103, no. 2 (2020): 604.

¹⁰⁴ R. Rosselli, M. Martini, and N.L. Bragazzi, "The old and the new: vaccine hesitancy in the era of the Web 2.0: challenges and opportunities," *Journal of Preventive Medicine and Hygiene* 57 (2016): E48.

important point that, while it remains necessary to counter the negative emotions that some groups associate with vaccination, it is also necessary to associate vaccination with positive emotions such as hope, and to emphasise pro-social and altruistic motivations for being vaccinated, emphasising family connections and the positive effect that vaccination will have on the wider community.¹⁰⁵

This is in contrast to much current official communication on vaccination in the global north: for example, most of the information supplied to American parents whose children are eligible for vaccination concerns risks and negative vaccine reactions, with little information on the benefits of vaccination.¹⁰⁶ It has also been observed that anti-vaccination groups on social media 'offer a wide range of potentially attractive narratives that blend topics such as safety concerns, conspiracy theories and alternative health and medicine, and also now the cause and cure of the COVID-19 virus,' while the views expressed by grassroots pro-vaccination groups tend to be 'far more monothematic,'¹⁰⁷ potentially limiting the audiences which they are able to reach and persuade.

NGOs and state agencies can address this problem through social marketing: that is, the application of 'commercial marketing concepts and techniques' in order to 'facilitat[e] the acceptance, rejection, modification, abandonment, or maintenance of particular [socially beneficial] behaviours by groups of individuals, often referred to as the target audience'.¹⁰⁸ Here, this means encouraging acceptance of specific vaccinations within specific sub-populations. Just as a commercial marketing campaign begins with a research process aimed at generating insights as to how a specific audience might be persuaded to buy a particular product, a vaccine social marketing campaign would ideally begin by empirically studying the specific barriers to vaccine uptake within a specific group or community and identifying communicative means by which those barriers can be overcome. This is the approach outlined in the WHO Regional Office for Europe Guide to Tailoring Immunisation Programmes (TIP), which was successfully employed in Bulgaria, Sweden, and the UK to develop vaccination campaigns for the Roma, Somali, Anthroposophist, and Orthodox Jewish populations.¹⁰⁹ An exemplary case of a campaign along those broad lines is seen in Denmark, where a fall in HPV vaccine coverage apparently caused by negative media stories, social media discussion, and activism from parents' groups was successfully reversed with a carefully targeted social media campaign:

The health authority invested in surveys of parents to find out who in Danish families made decisions about vaccinations, what questions they were asking, and where they sought advice. The resulting Facebook campaign, 'Stop HPV, Stop Cervical

¹⁰⁵ Wen-Ying Sylvia Chou and Alexandra Budenz, "Considering emotion in COVID-19 vaccine communication: addressing vaccine hesitancy and fostering vaccine confidence," *Health Communication* 35, no. 14 (2020): 1720.

¹⁰⁶ Benecke and DeYoung, "Anti-vaccine decision-making and measles resurgence in the United States," 3.

¹⁰⁷ Johnson et al., "The online competition between pro- and anti-vaccination views," 231.

¹⁰⁸ Sonya Grier and Carol A. Bryant, "Social marketing in public health", *Annual Review of Public Health* 26 (2005): 321.

¹⁰⁹ Robb Butler, Noni E. MacDonald, and SAGE Working Group on Vaccine Hesitancy, "Diagnosing the determinants of vaccine hesitancy in specific subgroups: the Guide to Tailoring Immunization Programmes (TIP)," *Vaccine* 33 (2015).

Cancer,' is designed to target vaccine hesitant mothers and is made up of personal stories of women with cervical cancer.¹¹⁰

Here it is important to note that the campaign involved marketing a specific vaccine to a specific group, and moreover, doing so through the use of emotional appeals and on the basis of empirical research on those whose opinion can make the difference between vaccination and failure to vaccinate. The sheer diversity of issues collected beneath the umbrella term of 'vaccine hesitancy' – a theme recurring throughout this report – suggests that such a level of targeting, tailoring, or fine tuning will always be necessary. To put it another way, the success of the Danish campaign and others like it should remind health authorities and NGOs everywhere that the solution to the global problem of vaccine hesitancy is most likely to be found in universal attention to the local and the particular.

¹¹⁰ BMJ, "Europe steps up action against vaccine hesitancy as measles outbreaks continue."

Bibliography

- Aaronovitch, David. *Voodoo Histories: How Conspiracy Theory Has Shaped Modern History*. London: Vintage Books, 2010.
- Ache, K.A., and L.S. Wallace. "Human Papillomavirus Vaccination Coverage on Youtube." *American Journal of Preventative Medicine* 35 (2008): 389-92.
- Allington, Daniel, Bobby Duffy, Simon Wessely, Nayana Dhavan, and James Rubin. "Health-Protective Behaviour, Social Media Usage and Conspiracy Belief During the Covid-19 Public Health Emergency." *Psychological Medicine* Published online first (2020).
- Allington, Daniel, Siobhan McAndrew, Vivienne Louisa Moxham-Hall, and Bobby Duffy. "Media Usage Predicts Intention to Be Vaccinated against SARS-CoV-2 in the US and the UK." *Vaccine* (2021).
- Allington, Daniel, Siobhan McAndrew, Vivienne Louisa Moxham-Hall, and Bobby Duffy. "Coronavirus conspiracy suspicions, general vaccine attitudes, trust, and coronavirus information source as predictors of vaccine hesitancy among UK residents during the COVID-19 pandemic." *Psychological Medicine*. In press (2021).
- Barkun, Michael. *A Culture of Conspiracy: Apocalyptic Visions in Contemporary America*. Los Angeles: University of California Press, 2003.
- Beene, Stephanie, and Katie Greer. "A Call to Action for Librarians: Countering Conspiracy Theories in the Age of Qanon." *Journal of Academic Librarianship* 47, no. 1 (2021): 102292.
- Benecke, Olivia, and Sarah Elizabeth DeYoung. "Anti-Vaccine Decision-Making and Measles Resurgence in the United States." *Global Pediatric Health* 6 (2019): 1-5.
- Bertin, Paul, Kenzo Nera, and Sylvain Delouvée. "Conspiracy Beliefs, Rejection of Vaccination, and Support for Hydroxychloroquine: A Conceptual Replication-Extension in the Covid-19 Pandemic Context." *Frontiers in Psychology* 11, no. 565128 (2020).
- Betsch, Cornelia, Frank Renkewitz, Tilmann Betsch, and Corina Ulshöfer. "The Influence of Vaccine-Critical Websites on Perceiving Vaccination Risks." *Journal of Health Psychology* 15, no. 3 (2010): 446-55.
- Bloom, Barry R., Edgar Marcuse, and Seth Mnookin. "Addressing Vaccine Hesitancy." *Science* 344, no. 6182 (2014): 339.
- BMJ. "Europe Steps up Action against Vaccine Hesitancy as Measles Outbreaks Continue." *British Medical Journal* 359, no. j4803 (2017).
- Briones, Rowena, Xiaoli Nan, Kelly Madden, and Leah Waks. "When Vaccines Go Viral: An Analysis of HPV Vaccine Coverage on YouTube." *Health Communication* 27 (2012): 478-85.
- Butler, Robb, Noni E. MacDonald, and SAGE Working Group on Vaccine Hesitancy. "Diagnosing the Determinants of Vaccine Hesitancy in Specificsubgroups: The Guide to Tailoring Immunization Programmes (TIP)." *Vaccine* 33 (2015): 4176-79.

- Byford, Jovan. *Conspiracy Theories: A Critical Introduction*. Basingstoke: Palgrave Macmillan, 2011.
- CCDH. *The Anti-Vaxx Playbook*. London and Washington (DC): Center for Countering Digital Hate, 2020.
- Chadwick, Andrew, Johannes Kaiser, Cristian Vaccari, Daniel Freeman, Sinéad Lambe, Bao S. Loe, Samantha Vanderslott, Stephan Lewandowsky, Meghan Conroy, Andrew R. N. Ross, Stefania Innocenti, Andrew J. Pollard, Felicity Waite, Michael Larkin, Laina Rosebrock, Lucy Jenner, Helen McShane, Alberto Giubilini, Ariana Petit, and Ly-Mee Yu. "Online social endorsement and COVID-19 vaccine hesitancy in the UK," *Social Media and Society* (in press, 2021).
- Chen, Li, Yafei Zhang, Rachel Young, Xianwei Wu, and Ge Zhu. "Effects of Vaccine-Related Conspiracy Theories on Chinese Young Adults' Perceptions of the HPV Vaccine: An Experimental Study." *Health Communication* Published online first (2020).
- Chou, Wen-Ying Sylvia, and Alexandra Budenz. "Considering Emotion in Covid-19 Vaccine Communication: Addressing Vaccine Hesitancy and Fostering Vaccine Confidence." *Health Communication* 35, no. 14 (2020): 1718-22.
- Craciun, Catrinel, and Adriana Baban. "'Who Will Take the Blame?': Understanding the Reasons Why Romanian Mothers Decline HPV Vaccination for Their Daughters." *Vaccine* 30 (2012): 6789-93.
- Craft, Stephanie, Seth Ashley, and Adam Maksl. "News Media Literacy and Conspiracy Theory Endorsement." *Communication and the Public* 2, no. 4 (2017): 388-401.
- D'Ancona, Fortunato, Claudio D'Amario, Francesco Maraglino, Giovanni Rezza, and Stefania Iannazzo. "The Law on Compulsory Vaccination in Italy: An Update 2 Years after the Introduction." *Eurosurveillance* 24, no. 26 (2019).
- de Menezes Succi, Regina Célia. "Vaccine Refusal - What We Need to Know." *Jornal de Pediatria* 94, no. 6 (2017): 574-81.
- Dredze, Mark, David A. Broniatowski, Michael C. Smith, and Karen M. Hilyard. "Understanding Vaccine Refusal: Why We Need Social Media Now." *American Journal of Preventative Medicine* 50, no. 4 (2016): 550-52.
- Dror, Amiel A., Netanel Eisenbach, Shahar Taiber, Nicole G. Morozov, Matti Mizrahi, Asaf Zigran, Samer Srouji, and Eyal Sela. "Vaccine Hesitancy: The Next Challenge in the Fight against Covid-19." *European Journal of Epidemiology* 35 (2020): 775-79.
- Dubé, Eve, Dominique Gagnon, Emily Nickels, Stanley Jeram, and Melanie Schuster. "Mapping Vaccine Hesitancy—Country-Specific Characteristics of a Global Phenomenon." *Vaccine* 32 (2014): 6649-54.
- Duplaga, Mariusz. "The Determinants of Conspiracy Beliefs Related to the Covid-19 Pandemic in a Nationally Representative Sample of Internet Users." *International Journal of Environmental Research and Public Health* 17 (2020): 7818.

- Fadda, Marta, Miriam Depping, and Peter J. Schulz. "Addressing Issues of Vaccination Literacy and Psychological Empowerment in the Measles-Mumps-Rubella (MMR) Vaccination Decision-Making: A Qualitative Study." *BMC Public Health* 15, no. 836 (2015): 1-13.
- Fefferman, Nina H., and Elena N. Naumova. "Dangers of Vaccine Refusal near the Herd Immunity Threshold: A Modelling Study." *Lancet Infectious Diseases* 15 (2015): 922-26.
- Freeman, Daniel, Bao S. Loe, Andrew Chadwick, Cristian Vaccari, Felicity Waite, Laina Rosebrock, Lucy Jenner, *et al.* "Covid-19 Vaccine Hesitancy in the UK: The Oxford Coronavirus Explanations, Attitudes, and Narratives Survey (Oceans) li." *Psychological Medicine* Published online first (2021): 1-15.
- Gangarosa, E.J., A.M. Galazka, C.R. Wolfe, L.M. Phillips, E. Miller, RT Chen, and R.E. Gangarosa. "Impact of Anti-Vaccine Movements on Pertussis Control: The Untold Story." *Lancet* 351, no. 9099 (1998): 356-61.
- Goldstein, Susan, Noni E. MacDonald, Sherine Guiguis, and SAGE Working Group on Vaccine Hesitancy. "Health Communication and Vaccine Hesitancy." *Vaccine* 33 (2015): 4212-14.
- Goreis, Andreas, and Oswald D. Kothgassner. "Social Media as a Vehicle for Conspiracy Beliefs About Covid-19." *Digital Psychology* 1, no. 2 (2020): 36-39.
- Grier, Sonya and Carol A. Bryant. "Social marketing in Public Health". *Annual Review of Public Health* 26 (2005).
- Grimes, David Robert. "Health Disinformation and Social Media." *EMBO reports* 21, no. e51819 (2020).
- Heywood, Anita E. "Measles: A Re-Emerging Problem in Migrants and Travellers." *Journal of Travel Medicine* 25, no. 1 (2018): tay118, .
- Hornsey, Matthew J., Josep Lobera, and Celia Díaz-Catalan. "Vaccine Hesitancy Is Strongly Associated with Distrust of Conventional Medicine, and Only Weakly Associated with Trust in Alternative Medicine." *Social Science & Medicine* 255 (2020): 113019.
- Hussain, Azhar, and Sheharyar Hussain. "The Anti-Vaccination Movement: A Regression in Modern Medicine." *Cureus* 10, no. 7 (2018): e2919.
- Jarrett, Caitlin, Rose Wilson, Maureen O'Leary, Elisabeth Eckersberger, Heidi J. Larson, and SAGE Working Group on Vaccine Hesitancy. "Strategies for Addressing Vaccine Hesitancy – a Systematic Review." *Vaccine* 33 (2015): 4180-90.
- Jennings, Will, Gerry Stoker, Hannah Willis, Viktor Valgardsson, Jen Gaskell, Daniel Devine, Lawrence McKay, and Melinda C. Mills. "Lack of Trust and Social Media Echo Chambers Predict Covid-19 Vaccine Hesitancy." *medRxiv preprint* (2021).
- Johnson, Neil F., Nicolas Velásquez, Nicholas Johnson Restrepo, Rhys Leahy, Nicholas Gabriel, Sara El Oud, Minzhang Zheng, *et al.* "The Online Competition between Pro- and Anti-Vaccination Views." *Nature* 582 (2020): 230-33.

- Jolley, Daniel, and Karen M. Douglas. "The Effects of Anti-Vaccine Conspiracy Theories on Vaccination Intentions." *PLoS ONE* 9, no. 2 (2014): 1-9.
- Jones-Jang, S. Mo, Tara Mortensen, and Jingjing Liu. "Does Media Literacy Help Identification of Fake News? Information Literacy Helps, but Other Literacies Don't." *American Behavioural Scientist* Published online first, DOI: <https://doi.org/10.1177/0002764219869406> (2019).
- Juanchich, Marie, Miroslav Sirota, Daniel Jolles, and Lilith A. Whiley. "Are Covid-19 Conspiracies a Threat to Public Health? Psychological Characteristics and Health Protective Behaviours of Believers." *PsyArXiv preprints* (2020).
- Karafillakis, Emilie, and Heidi J. Larson. "The Benefit of the Doubt or Doubts over Benefits? A Systematic Literature Review of Perceived Risks of Vaccines in European Populations." *Vaccine* 35, no. 4840-4850 (2017).
- Keelan, J., V. Pavri-Garcia, G. Tomlinson, and K. Wilson. "YouTube as a Source of Information on Immunisation: A Content Analysis." *Journal of the American Medical Association* 298 (2007): 2482-84.
- Khan, Yusra Habib, Tauqeer Hussain Mallhi, Nasser Hadal Alotaibi, Abdulaziz Ibrahim Alzarea, Abdullah Salah Alanazi, Nida Tanveer, and Furqan Khurshid Hashmi. "Threat of Covid-19 Vaccine Hesitancy in Pakistan: The Need for Measures to Neutralize Misleading Narratives." *American Journal of Tropical Medicine and Hygiene* 103, no. 2 (2020): 603-04.
- Kortum, Philip, Christine Edwards, and Rebecca Richards-Kortum. "The Impact of Inaccurate Internet Health Information in a Secondary School Learning Environment." *Journal of Medical Internet Research* 10, no. 2 (2008): e17.
- Larson, Heidi J., Caitlin Jarrett, Elisabeth Eckersberger, David M.D. Smith, and Pauline Paterson. "Understanding Vaccine Hesitancy around Vaccines and Vaccination from a Global Perspective: A Systematic Review of Published Literature, 2007–2012." *Vaccine* 32 (2014): 2150-59.
- Leong, Wei-Yee. "Measles Cases Hit Record High in Europe in 2018." *Journal of Travel Medicine* 25, no. 1 (2018): tay080 (1-2).
- Leong, Wei-Yee, and Annika Beate Wilder-Smith. "Measles Resurgence in Europe: Migrants and Travellers Are Not the Main Drivers." *Journal of Epidemiology and Global Health* 9, no. 4 (2019): 294-99.
- Lévy-Bruhl, Daniel, Laure Fonteneau, Sophie Vaux, Anne-Sophie Barret, Denise Antona, Isabelle Bonmarin, Didier Che, Sylvie Quelet, and Bruno Coignard¹. "Assessment of the Impact of the Extension of Vaccination Mandates on Vaccine Coverage after 1 Year, France, 2019." *Eurosurveillance* 24, no. 26 (2019).
- Loomba, Sahil, Alexandre de Figueiredo, Simon J. Piatek, Kristen de Graaf, and Heidi J. Larson. 2021. "Measuring the Impact of COVID-19 Vaccine Misinformation on Vaccination Intent in the UK and USA." *Nature Human Behaviour* (2021).

- MacDonald, Noni E., and SAGE Working Group on Vaccine Hesitancy. "Vaccine Hesitancy: Definition, Scope and Determinants." *Vaccine* 33 (2015): 4161-64.
- Majumder, Maimuna S., Emily L. Cohn, Sumiko R. Mekaru, Jane E. Huston, and John S. Brownstein. "Substandard Vaccination Compliance and the 2015 Measles Outbreak." *JAMA Pediatrics* 169, no. 5 (2015): 494-95.
- McAndrew, Siobhan, Daniel Allington, and Bobby Duffy. "Belief in Covid Conspiracies Linked with Vaccine Hesitancy: Relying on Social Media for Information on the Pandemic Also Appears to Play a Role." Press release, 31 January, 2021, <https://www.kcl.ac.uk/news/belief-in-covid-conspiracies-linked-with-vaccine-hesitancy>.
- McIntosh, E. David G. , Jan Janda, Jochen H. H. Ehrich, Massimo Pettoello-Mantovani, and Eli Somekh. "Vaccine Hesitancy and Refusal." *European Paediatric Association Pages* 175 (2016): P248-49.E1.
- Meppelink, Corine S., Edith G. Smit, Marieke L. Fransen, and Nicola Diviani. "'I Was Right About Vaccination': Confirmation Bias and Health Literacy in Online Health Information Seeking." *Journal of Health Communication* 24, no. 2 (2019): 129-40.
- Mills, Edward, Alejandro R. Jadad, Cory Ross, and Kumanan Wilson. "Systematic Review of Qualitative Studies Exploring Parental Beliefs and Attitudes toward Childhood Vaccination Identifies Common Barriers to Vaccination." *Journal of Clinical Epidemiology* 58, no. 11 (2005): 1081-88.
- Mortimer, Kim. "Understanding Conspiracy Online: Social Media and the Spread of Suspicious Thinking." *Dalhousie Journal of Interdisciplinary Management* 13 (2017): 1-16.
- Muscat, Mark. "Who Gets Measles in Europe?". *Journal of Infectious Diseases* 204, Sup. 1 (2011): S353-S65.
- Napolitano, Francesco, Alessia D'Alessandro, and Italo Francesco Angelillo. "Investigating Italian Parents' Vaccine Hesitancy: A Cross-Sectional Survey." *Human Vaccines & Immunotherapeutics* 14, no. 7 (2018): 1558-65.
- Olive, Jacqueline K., Peter J. Hotez, Ashish Damania, and Melissa S. Nolan. "The State of the Antivaccine Movement in the United States: A Focused Examination of Nonmedical Exemptions in States and Counties." *PLoS Medicine* 15, no. 6: e1002578.
- Opel, Douglas J. , John Heritage, James A. Taylor, Rita Mangione-Smith, Halle Showalter Salas, Victoria DeVere, Chuan Zhou, and Jeffrey D. Robinson. "The Architecture of Provider-Parent Vaccine Discussions at Health Supervision Visits." *Pediatrics* 132, no. 6 (2013): 1037-46.
- Paterson, Pauline, François Meurice, Lawrence R. Stanberry, Steffen Glissman, Susan L. Rosenthal, and Heidi J. Larson. "Vaccine Hesitancy and Healthcare Providers." *Vaccine* 34 (2016): 6700-06.

- Repalust, Anja, Sandra Šević, Stanko Rihtar, and Aleksandar Štulhofer. "Childhood Vaccine Refusal and Hesitancy Intentions in Croatia: Insights from a Population-Based Study." *Psychology, Health & Medicine* 22, no. 9 (2017): 1045-55.
- Reuben, Rebekah, Devon Aitken, Jonathan L. Freedman, and Gillian Einstein. "Mistrust of the Medical Profession and Higher Disgust Sensitivity Predict Parental Vaccine Hesitancy." *PLoS ONE* 15, no. 9 (2020): e0237755.
- Rochel de Camargo Jr, Kenneth. "Here We Go Again: The Reemergence of Anti-Vaccine Activism on the Internet." *Cadernos de Saúde Pública* 36, Sup. 2 (2020): e00037620.
- Romer, Daniel, and Kathleen Hall Jamieson. "Conspiracy Theories as Barriers to Controlling the Spread of Covid-19 in the US". *Social Science & Medicine* 263, no. 113356 (2020).
- Rosselli, R., M. Martini, and N.L. Bragazzi. "The Old and the New: Vaccine Hesitancy in the Era of the Web 2.0: Challenges and Opportunities." *Journal of Preventive Medicine and Hygiene* 57 (2016): E47-E50.
- Rozbroj, Tomas, Anthony Lyons, and Jayne Lucke. "The Mad Leading the Blind: Perceptions of the Vaccine-Refusal Movement among Australians Who Support Vaccination." *Vaccine* 37 (2019): 5986-93.
- Sadaf, Alina, Jennifer L. Richards, Jason M. Glanz, Daniel A. Salmon, and Saad B. Omer. "A Systematic Review of Interventions for Reducing Parental Vaccine Refusal and Vaccine Hesitancy." *Vaccine* 31 (2013): 4293-304.
- Salmon, Daniel A., Matthew Z. Dudley, Jason M. Glanz, and Saad B. Omer. "Vaccine Hesitancy: Causes, Consequences, and a Call to Action." *Vaccine* 33 (2015): D66-D71.
- Sharma, Megha, Kapil Yadav, Nikita Yadav, and Keith C. Ferdinand. "Zika Virus Pandemic - Analysis of Facebook as a Social Media Health Information Platform." *American Journal of Infection Control* 45, no. 3 (2017): 301-02.
- Simms, Kate T., Sharon J.B. Hanley, Megan A. Smith, Adam Keane, and Karen Canfell. "Impact of HPV Vaccine Hesitancy on Cervical Cancer in Japan: A Modelling Study." *Lancet Public Health* 5, no. 4 (2020): E223-E24.
- Sobo, Elisa J. "Theorising (Vaccine) Refusal: Through the Looking Glass." *Cultural Anthropology* 31, no. 3 (2016): 342-50.
- Suryadevaraa, Manika, Andrew Handela, Cynthia A. Bonvillea, Donald A. Cibulab, and Joseph B. Domachowske. "Pediatric Provider Vaccine Hesitancy: An under-Recognized Obstacle to Immunizing Children." *Vaccine* 33 (2015): 6629-34.
- Tang, Lu, Kayo Fujimoto, Muhammad (Tuan) Amith, Rachel Cunningham, Rebecca A. Costantini, Felicia York, Grace Xiong, Julie A. Boom, and Cui Tao, "'Down the rabbit hole' of vaccine misinformation on YouTube: network exposure study," *Journal of Medical Internet Research* 23 (1), no. e23262 (2021).
- van den Hof, Susan, Marina A.E. Conyn-van Spaendonck, and Jim E. van Steenbergen. "Measles Epidemic in the Netherlands, 1999-2000." *Journal of Infectious Diseases* 186, no. 10 (2002): 1483-86.

- Verger, Pierre, Lisa Fressard, Fanny Collange, Arnaud Gautier, Christine Jestin, Odile Launay, Jocelyn Raude, Céline Pulcini, and Patrick Peretti-Watel. "Vaccine Hesitancy among General Practitioners and its Determinants During Controversies: A National Cross-Sectional Survey in France." *EBioMedicine* 2 (2015): 891-97.
- Wellcome. *Wellcome Global Monitor: How Does the World Feel About Science and Health?* London: Wellcome Trust, 2019.
- WHO, "Ten Threats to Global Health in 2019," *World Health Organisation*, 2019, <https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019>.
- Wilder-Smith, Annika Beate, and Kaveri Qureshi. "Resurgence of Measles in Europe: A Systematic Review on Parental Attitudes and Beliefs of Measles Vaccine." *Journal of Epidemiology and Global Health* 10, no. 1 (2020): 46-58.
- Wilson, Steven Lloyd, and Charles Wiysonge. "Social Media and Vaccine Hesitancy." *BMJ Global Health* (2021): e004206.
- Zimmerman, Richard K, Robert M Wolfe, Dwight E Fox, Jake R Fox, Mary Patricia Nowalk, Judith A Troy, and Lisa K Sharp. "Vaccine Criticism on the World Wide Web." *Journal of Medical Internet Research* 7, no. 2 (2005): e17.