comment

Advocating for vaccination in a climate of science denial

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In many countries, the success of misinformation, alternative facts or fake news is promoting a climate of science denial, where false claims such as vaccination causing autism can spread. Learning lessons from behavioural studies can help advocate for vaccination in the face of vaccine refusers and deniers.

Vaccination has been credited with being one of modern medicine's biggest success stories, reducing morbidity from major human infectious diseases such as diphtheria, measles and polio by over 95% and eradicating smallpox. Despite this, vaccine refusers have repeatedly been associated with outbreaks of preventable diseases and avoidable deaths[1]. (Note that this comment uses vaccine-hesitant individuals, vaccine refusers and vaccine deniers, where the probability of changing one's mind to vaccine acceptance on the basis of new information is high for vaccine-hesitant individuals, low for vaccine refusers and very low or zero for vaccine deniers[2].) Non-medical exemption rates in the United States, for example, have increased over the last decade, with clusters of exemptions ranging from 1–26% of the eligible population in some counties, leaving considerable pockets of susceptible individuals[3]. Vaccine hesitancy has multiple causes[4], but lacking confidence in vaccine safety is one of the most visible factors, as vaccine refusers and deniers can be very vocal in defending their attitudes and spreading misinformation, making personal interaction with medical professionals challenging. However, lessons from behavioural studies (see overview in Table 1) offer healthcare professionals and scientists avenues for supporting successful routine and public communication on vaccine efficacy and safety.

What we say and how we say it

The decision to vaccinate involves risk–benefit balancing. When the disease is perceived as riskier than the vaccine, the decision should be to vaccinate. Risk perception, however, is not necessarily a rational process and perceived risks do not necessarily correspond to objectively given risks — especially as today, thanks to vaccination, most vaccine-preventable diseases are rare and almost forgotten. Fear appeals that use emotional materials to stress the danger of diseases may be tempting. However, research shows that fear can backfire and even lead to less willingness to vaccinate[5]. This provides a challenging context for vaccination advocacy, especially as the typical time used for informing about risks and benefits of vaccination during a vaccination visit is as short as 20 seconds[6]. Thus, it is crucial that the words are chosen mindfully.

A study showed that speaking about the pathogen as the actor makes the disease feel more severe; likewise, agency to the vaccine makes it feel more effective. Participants in that study agreed more with mandatory human papillomavirus vaccination when linguistic agency was with the virus and the vaccine[7]. In addition to emphasizing disease risks, the risk–benefit ratio can also be improved by adding benefit. A qualitative study showed that in only about half of vaccination visits are benefits discussed at all, mostly with emphasis on protection against disease[6]. While the individual benefit is important, most vaccines also entail social benefit due to herd immunity, which is rarely explained in information materials. This is a dramatic missed opportunity, as a recent study showed that explaining the herd immunity concept increases the intention to vaccinate[8]. Stressing the additional social benefit can activate pro-social motives as well as change the cost–benefit ratio in a positive way. Whether these strategies also work for hesitant individuals or vaccine refusers, however, is still unknown.

Dialogue with vaccine refusers

When faced with misinformation — either in the media or in a face-to-face dialogue — debunking the false information is a challenge. Studies showed, for example, that providing adults with 'right or wrong' fact sheets addressing myths strengthened the beliefs in myths over time, instead of debunking them[9]. Only a small number of experiments have demonstrated successful interventions to debunk misinformation[9]. One of the most promising strategies seems to be to emphasize scientific consent, for example, stating that "90% of medical scientists agree that vaccines are safe"[10]. This strategy also has the advantage that it does not repeat the misinformation, since something that is heard or read very often is easily accessible in memory and such information may be interpreted as true. Interrupting this link can be used to debunk misinformation, as research in the political arena suggests. This idea proposes that extreme attitudes result from the illusion that one has a deep understanding of an issue[11]. In a study, participants were asked to explain the causal mechanism behind a policy in a detailed step-by-step manner as opposed to providing any justification[14]. In the group tasked with describing causal mechanisms, perceived understanding was reduced, leading to less extreme views. However, using this strategy in a conversation might seem intrusive and elicit reactance, an emotional reaction to pressure that results in fostering the contrary view. Moreover, there is no research to date showing that challenging misinformation works with vaccine refusers. Despite this, this cognitive debiasing technique should be tested against other conversation techniques, such as motivational interviewing (MI).

MI takes an opposite approach as it is responsive and empathetic and avoids confrontation. This technique relies on asking open questions, affirming, reflecting, summarizing and providing information and advice with permission[12]. It avoids persuading or overwhelming the other person with facts. Instead, it aims to facilitate an individual's reasoning as to why they need vaccination (for examples, see Table 1). A study piloting MI in pharmacies found that

Table 1 | Summary of strategies for advocating for vaccination in a climate of science denial.

Strategy	Sample sentences	Evidence
Mindful routine communication about vaccination		
Let diseases and vaccines be the active agents	"Human papillomavirus preys on millions of people. Vaccination guards people." (Instead of: "Millions of people contract human papillomavirus. People protect themselves through vaccination."[7])	Experiment: phrases giving potency to the agent (disease, virus) increased the perceived severity of human papillomavirus disease and the assumed effectiveness of the vaccine[7]
Emphasize social benefit of vaccination	"If you get vaccinated, then you can protect others who are not vaccinated."[8]	Experiment: explaining herd immunity increased vaccination intentions[8]
Facing vaccine-hesitant or refusing individuals in a dialogue that involves misinformation		
Emphasize scientific consensus	"90% of medical scientists agree that vaccines are safe."[10]	Experiment: perceived consensus increased support of vaccines[10]
Make people holding misinformation generate mechanistic explanations of their assumption	"Describe all the details you know about [the misinformation], going from the first step to the last, and providing the causal connection between the steps."[11]	Experiment: explaining the mechanisms behind a policy (versus giving reasons) decreased perceived understanding and extremity on the position[11]
Motivational interviewing using questions that are client-centred, semi-directive and aimed at changing behaviour	Patient: I don't see any need to vaccinate. Healthcare provider: So you're wondering what's the benefit of getting a vaccination now when you're feeling fine (reflect back, emphasize the issue)? Patient: Right. Healthcare provider: That's a great question. Would you mind if I gave you some information that's relevant to your question and then you tell me what you think (offer information, ask for permission to give information, invite patient to draw a conclusion, offer time to do so)? (http://go.nature.com/2qWvedO)	Randomized clinical trial[4]: vaccination uptake was higher after motivational interviewing on maternity wards
Facing a vocal vaccine denier in a public debate		
Debunk the content and technique used by the anti-vaccination argument (note, the public is the audience, not the vaccine denier)	Correct content: "The scientific evidence is clear: vaccination is the most effective protective measure[…]"[2] Unmask technique, for example, selectivity: "Ms Y is cherry-picking the scientific evidence, using only fragments that back up her position and ignoring the bulk of solid evidence that disproves it."[2]	Literature review and best practice guidance by WHO; empirical testing needed[2]
Inoculate audience by warnings	"Some politically-motivated groups use misleading tactics to try to convince the public that there is a lot of disagreement among scientists. However, research has found that among scientists there is virtually no disagreement that…"[15]	Experiment: consensus messages with warning that the belief will be threatened lead to no distortion due to misinformation[15]

Note, sample sentences are partially shortened and adapted to the context of vaccination.

the readiness for adult vaccination increased and that pharmacists felt comfortable with the procedure[13]. Moreover, the first results of a Canadian randomized clinical trial demonstrated that MI on maternity wards can increase vaccination intentions by 20% and the chances for a complete vaccination status by 9%, as compared with a control group[12]. Thus, MI has shown promising results in different settings and is recommended in provider-patient settings with hesitant parents.

Unmask denialism techniques
Interaction and debate with vaccine refusers or deniers can take place in front of other people — either because a conversation gains attention and is overheard by other interested listeners, or because it is a public debate in the media. This offers an opportunity to advocate for vaccination. As deniers are unlikely to be swayed[14], such situations should not be used to address the denier, but instead to educate the public about vaccination and to counter misinformation[2]. When acting publicly, vaccine deniers use techniques that are common in the area of science denial: for example, assuming conspiracies, calling on fake experts, selectively and exclusively citing scientific papers that challenge consensus, or having impossible expectations, such as demanding 100% certain results or 0% side-effects[2]. Recent best practice guidance by the World Health Organization (WHO) suggests a two-step approach in which both the misinformation should be corrected, and the technique unmasked[2] (see Table 1). While experimental tests of this combined strategy are still lacking, evidence from other areas suggests that information about misleading tactics of activist groups can indeed inoculate the audience against misinformation[15].

Conclusions
Understanding how to advocate for vaccination in a climate of science denial is a challenging task. First, harnessing data is difficult, as many of the studies

were conducted in lab environments in very specific settings (usually in WEIRD countries — western, educated, industrialized, rich, democratic). Second, the studies often lack replication and explicit testing of effectiveness in vaccine-hesitant or refusing individuals. Thus, crucial future steps are to transfer these strategies into other settings (for example, low- and middle-income countries) to test the strategies' sole and combined effects in controlled lab and applied environments. Nevertheless, the evidence provided here suggests that some strategies deserve further practical and scientific attention:

- Talk about vaccination as active protection for the individual and society.
- Respect potential doubts and offer insights to refute them.
- Ask for explanations of the mechanism behind the proposed misinformation.
- Emphasize scientific consensus where appropriate.
- Unmask techniques of the deniers.

Ultimately, none of the proposed strategies grant success. However, in the face of vaccine hesitancy and continued outbreaks of preventable diseases, the scientific community has an obligation and opportunity to use the best available evidence to improve communication and advocacy for vaccine uptake in the public arena. ❐

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