Managing Vaccine Misinformation in the Midst of a Pandemic

Virtual Event Series

Webinar online, 15 April 2021

The Mérieux Foundation Vaccine Acceptance Initiative

Report issued May 12, 2021 rev

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Note to the reader

This report condenses discussions according to the themes addressed rather than attempting a chronological account. It addresses points emerging from wide-ranging discussions and does not necessarily imply consensus.

Summaries of presentations and of points made in discussion are presented as the opinions expressed.

Background

The Mérieux Foundation Vaccine Acceptance Virtual Event Series aims to increase multi-sectoral efforts to promote vaccination acceptance and build the resilience of immunization programmes, which are facing particular challenges in the context of the ongoing pandemic of coronavirus disease 2019, or COVID-19.

The erosion in vaccination trust during the pandemic is an increasing threat to public health and a major obstacle to the only route out of the pandemic. Ideas and solutions are needed to tackle it. As a contribution to this goal, the Mérieux Foundation brought together a global audience and a panel of distinguished representatives of the scientific, public health and private sectors in two webinars to discuss issues around the introduction and acceptance of COVID-19 vaccines.

"Managing Vaccine Misinformation in the Midst of a Pandemic"

Webinar Program – condensed version

Session 3 & 4 April 15, 2021

Welcome	**Mérieux Foundation & Session Chair: Dr. Angus Thomson** Senior Social Scientist: Demand for Immunization at UNICEF UNICEF
Keynote Speaker :	**Dr. John Cook** Postdoctoral research fellow, Climate Change Communication Research Hub Monash University, Australia **On: Building public resilience to vaccine misinformation through critical thinking, humor, and gamification** Q&A: 10 min
Lectures Speakers:	**Dr. Joe Smyser** CEO, Public Good Projects, USA **On: Adaptive social listening to inform effective vaccine public engagement strategies** Q&A: 5-10 min
	Ms. Sarah Christie & Dr. Saad Omer Program Manager & Public Health Research specialist / Director- Yale Institute for Global Health Yale Institute for Global Health / Yale School of Public Health, USA **On: The Vaccine Acceptance Interventions Lab: Rapid development and testing of evidence-based vaccine communications** Q&A: 5-10 min
Panel Discussion	(All Speakers + Session chair)
	Closing

Mérieux Foundation Convenor: Valentina Picot, Vaccine Acceptance Initiative Lead
Marianne Gojon-Gerbelot, Vaccine Acceptance Initiative coordinator

Introduction

***Angus Thomson**, Senior Social Scientist: Demand for Immunization at UNICEF*

This was the second in a series of webinars on vaccine acceptance hosted by the Fondation Mérieux as part of an ongoing series of annual conferences (normally hosted in Annecy in France) on the broader topic of vaccine acceptance and uptake. These are the only international annual meetings on this subject, though its importance and relevance has evolved enormously over the last decade and there is now a substantial and increasing body of solid formative research upon which to found interventions to build confidence in vaccines and address hesitancy. There is a pressing need now for more interventions to be designed and tested for efficacy. Many vaccine communications are relatively ineffective, and some can actually backfire.

The focus of this meeting was mis- and disinformation. The COVID-19 pandemic has been accompanied by a tsunami of misinformation, and perhaps particularly around the issue of vaccines. Vaccination has always been a lightning rod for misinformation, since the very first vaccination programmes, but this has increased during the pandemic—a context of simultaneous information overload and dramatic information voids. Anxiety and uncertainty are prevalent and more interventions are needed to address them.

There is also a great deal of disinformation. While misinformation is misleading information, disinformation is misleading information that is deliberately created. Increasingly, the authors of this information work very effectively, applying an understanding of the social and behavioural determinants of peoples decisions to vaccinate in order to redesign and retool misinformation and disseminate it. Spikes in uncertainty and anxiety have understandably occurred linked to extremely rare adverse events associated with vaccines, leading to surges in questions and concerns in the media and online. Accompanying these there has been a massive surge in opportunistic disinformation. The authors of this information know how to create and spread “sticky” disinformation that stays with people and influences decisions; and they know when and how to spread it. The goal for public health to become as good as or better than these people.

Dr Thomson finished his introduction by acknowledging a gap in representation from low- and middle-income countries in the speakers, and expressing the hope that this will not be the case in the next meeting.

Building resilience to vaccine misinformation through critical thinking, humour and gamification

***John Cook**, Monash Climate Change Communication research Hub*

This presentation was based on several different lines of research and reports, one of which was the *Vaccine Misinformation Management Field Guide* https://www.unicef.org/mena/reports/vaccine-misinformation-management-field-guide. This guide takes a holistic look at the different aspects of developing programmes to counter misinformation. This presentation focussed on the fourth phase, the "engage phase" of developing responses to misinformation.

Dr Cook's research focus is a branch of psychological research called inoculation theory, which dates back to the 1950s and which applies the principles of vaccination to knowledge. Over decades psychology researchers have found that, just as exposing people to a weakened form of a virus builds up immunity for the actual virus, exposing people to weakened forms of misinformation can build up resilience to actual misinformation, inoculating people against it and making them less likely to be misled.

There are two key elements to an inoculating message. The first is warning people of the threat of being misled; the second is arguments that explain how the misinformation is wrong. There are two main ways of explaining the latter: fact-based and logic-based approaches. Fact-based corrections demonstrate how misinformation is wrong by explaining the science and the facts behind it; logic-based corrections explain how it misleads by pointing out the logical and rhetorical techniques used to mislead.

A paper by Phillip Schmid and Cornelia Betsch entitled *Effective strategies for rebutting science denialism in public discussions* found that both approaches were effective in neutralising the misleading effects of misinformation; but crucially it also argued that explaining the rhetorical techniques of misinformation can also potentially inoculate people against misinformation on other topics that uses the same technique. Dr Cook's own research supported this finding: when inoculating participants against the fake expert strategy used by the tobacco industry, he found that that same rhetorical techniques concerning climate misinformation were no longer effective. Without mentioning climate misinformation, it was possible to inoculate people against it.

Given the powerful generalizability of logic-based approaches to inoculation, there is a need to explore more effective ways to put them into practice. The first step is to build out the vocabulary and the framework for describing the different techniques using this information with a handy acronym: FLICC.

- Fake experts
- Logical fallacies
- Impossible expectations
- Cherry picking
- Conspiracy theories.

Over the last decade Dr Cook has gradually built up a taxonomy of different rhetorical techniques, logical fallacies and traits of conspiratorial thinking – see Fig. 1.

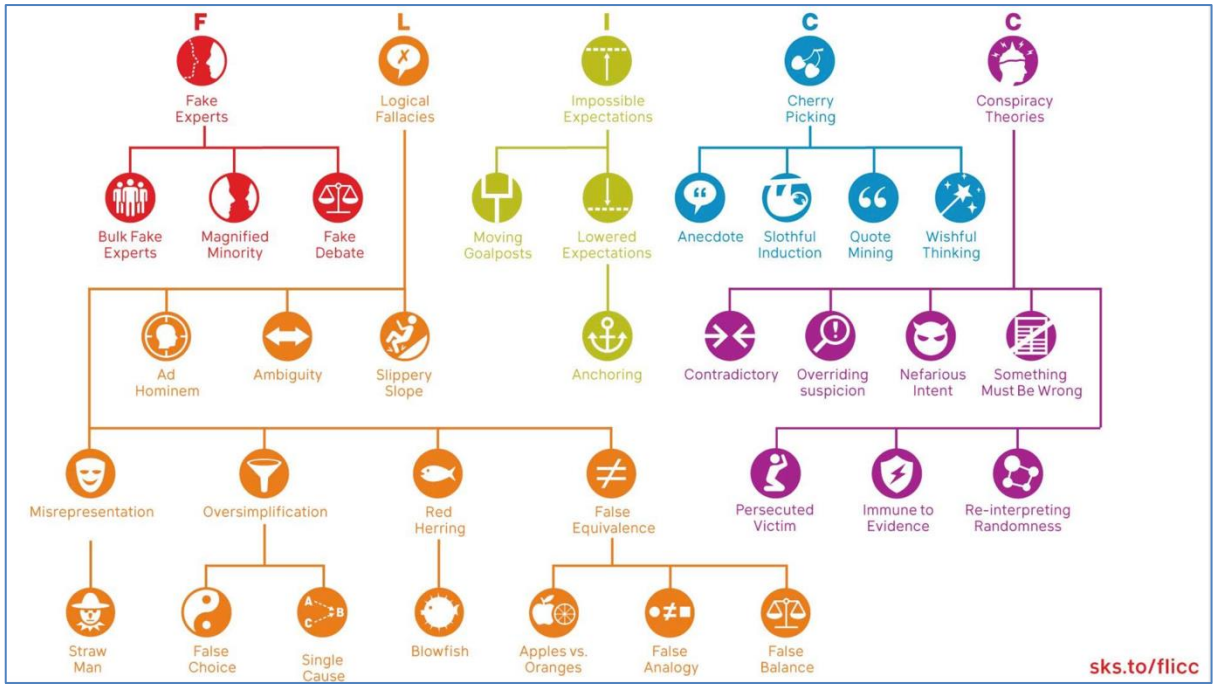

FIG. 1 – techniques of science denial (sks.to/flicc)

The challenge is that in order to achieve effective inoculation against misinformation, people must internalise all of this information. Given the range of different techniques, that is a big communication, education, and psychological challenge.

Guidance to combining the fact- and logic-based approaches in order to respond directly to vaccine misinformation can be found in the *COVID-19 vaccine communication handbook: a practical guide for improving vaccine communication and fighting misinformation*, which is available at https://hackmd.io/@scibehC19vax/home and which addresses misinformation and general communications principles for engaging with the public around COVID-19 vaccination. One section addresses responding to specific myths about vaccines, combining approaches to explain relevant facts to debunk different myths, but also to explain the fallacy that each myth commits. Corrections that incorporate all these elements, explaining facts and incorporating critical thinking into the communication, can be highly effective.

Along with Sojung Kim and Emily Vraga, Dr Cook has also conducted research into different practical ways of employing logic-based corrections to explain fallacies in misinformation most effectively, looking at humorous versus non-humorous approaches to the explanations themselves. While running the experiments, the team used eye tracking equipment to monitor what people were looking at while reading misinformation and associated corrections in tweets. The analysis revealed that humorous correction increased attention to the image portion of the correction tweet, and that this attention directly lowered

misperception by reducing the credibility of the misinformation tweet; but that non-humorous corrections outperformed humorous ones in reducing misperceptions because of their higher credibility ratings. Non-humorous approaches used infographics to point out misinformation; humorous approaches used a technique called parallel argumentation, taking the flawed logic in the misinformation and transplanting it into analogous situations, thereby making the underlying abstract logic more concrete and relatable. Survey data also showed that people were more likely to share, comment on, retweet or like the humorous corrections. While both approaches were effective, the humorous ones were more likely to be shared and seen by more people, or even perhaps to go viral.

The landscape of misinformation techniques is huge and growing. The FLICC taxonomy is not comprehensive. This creates a significant communication challenge in gaining people's attention, explaining the necessary information and getting them to internalise it so they can use it in the real world. Dr Cook has been working to resolve this issue and the challenges inherent therein. There are two key challenges: the psychological difficulty of critical thinking, had the difficulty of reaching siloed communities.

In overcoming psychological barriers and inoculating people against misinformation, the goal is to turn them into critical thinkers who slow down, assess arguments and spot rhetorical techniques. This goes against the hardwiring of human brains, which have two main ways of thinking: fast and slow. Fast thinking involves instantaneous reactions to stimuli, making quick decisions in order to navigate daily life. It is effortless and happens, for the most part, without conscious engagement. Slow thinking involves reasoning through difficult problems, trying to assess the logic of an argument. It takes cognitive effort. Because of the difference between these two types of thinking, the vast bulk of our thinking is fast. Slow thinking is hard: we can do it, but we don't often do it. This is a central challenge when trying to inoculate the public against misinformation.

A third type of thinking is "expert heuristics:" the quick responses of experts to difficult problems after much practice. These are the kind of qualified responses that experts can make based on years of work, like a heart surgeon assessing a complicated situation in the middle of surgery and making an instant decision based on deep experience. Repeated practice can help convert slow thinking tasks to fast thinking responses. This dynamic led Dr Cook to a project using gamification to resolve the psychological barriers to inoculating the public. The project is a game called "Cranky Uncle," in which the player's goal is to become a cranky, science-denying uncle. The player is mentored by a Cranky Uncle character who explains the different science denial techniques. The player then implements these techniques themselves, getting crankier and crankier as they play. The techniques in the game are the five techniques of science denial, along with the sub fallacies and techniques that run through that taxonomy. The cranky uncle explains different denial techniques and the game uses cartoon analogies or parallel arguments in cartoon form to make the logical explanations more concrete. The important element is not just introducing and explaining the techniques, but getting players to practise spotting misinformation by showing multiple examples of misinformation and giving them the task of identifying the denial technique. In essence this means getting the player to practice critical thinking, and as they practise it, the game uses

common gameplay elements to incentivize them to move further and further into the game—collecting points, levelling up, competing with friends and so on., As this happens, they are converting the slow thinking task of spotting policies into a quick thinking expert heuristic. The goal of the game is to make critical thinking quicker and easier. Some pilot testing has been done with the Cranky Uncle Game, using a prototype version in the initial testing stages, which found it to be effective in increasing resilience and increasing players' ability to spot different types of misinformation across a range of different topics. Even with the fairly simplistic prototype game, the players gained resilience against misinformation.

The other challenge with inoculating the public against misinformation is reaching siloed communities. Social media and even mainstream media are so fragmented that many people only receive information that conforms to their existing beliefs. The business model of social media platforms is based on clicks and retweets, interactions that generate revenue for the platforms. People are more likely to engage with content that they agree with, and so social media platforms deliver information that fits in their pre-existing beliefs. Getting inoculating messages that deal with damaging myths into specific communities vulnerable to that misinformation is far harder if the social media platform will not deliver that information. This is a big challenge affecting communicators, scientists, educators and all those trying to get important information to those that need it the most.

Developing Cranky Uncle involved talking to scientists about their content. Scientists who teach classes were very enthusiastic about a game that introduced critical thinking to students in an engaging, interactive way. They had been crying out for interactive exercises that engage their students, and the classroom is one of the most effective ways to reach a broad spectrum of the community. Responding to this opportunity, Dr Cook developed a Teacher's Guide to assist educators using the game in classrooms, and started to promote the game to educators on social media. There was good uptake from educators across the USA and in a dozen further countries around the world, in both conservative and liberal areas. A multilingual version of the game is currently in development and volunteers have offered to help translating it. About a dozen different languages are lined up for translation.

Once the first version has been publicly available for several months, the team will consider expansion packs addressing specific issues, potentially including vaccination. Currently the game is about misinformation in general, but adding social elements may be a powerful way to reach more people and help the game engage players at a deeper level.

Finally, while the game is good at inoculating people against misinformation and building resilience, one thing it does not yet do is teach people to have difficult conversations with others who have objections, or who are hesitant about issues like vaccination. The hope is to add another character—maybe a "Cordial Cousin"—to explain different techniques that people can use to have those kinds of difficult conversations.

The game is currently freely available on iPhone, Android and browser platforms. Dr Cook finished by encouraging all present to have a look, and to reach out to him if they have any questions about it.

Discussion

There are other games similar to Cranky Uncle around the world that have been tested in studies, demonstrating that this idea is effective and can be scaled up. The same is true for classroom-based interventions. For example, a cluster randomised trial showed that a critical thinking curriculum in schools in Uganda had a significant impact on students' ability to identify misinformation. In Finland, the country most resistant to misinformation, this approach has been incorporated into the national curriculum for some time. In the USA, other games have been developed to counter fake news, misinformation in elections and covert misinformation, and studies have shown all of these to increase resilience against misinformation. Some of these inspired the approach taken in Cranky Uncle, which is an active form of inoculation: while most types of inoculating messages are passive, games are based on active communication. While it is important to have systems that allow an understanding of the concerns and questions that communities have, one of the most exciting parts of this work is that it shows that people can be inoculated against misinformation in general.

Classroom interventions that combine explaining facts with elements of critical thinking explaining the fallacies used to distort facts have been shown to increase science literacy—and, interestingly, to increase students' confidence to talk about the issue. Inoculation research scientists have noted that this "post inoculation talk phenomenon," encouraged by equipping people with counterarguments against potential misinformation, empowers them and builds their confidence to talk about potentially difficult subjects and potentially to spread their inoculated status to others. Potentially, mass immunization programmes against misinformation could also, if done right, equip people to immunize others.

With regard to policy recommendations: while having a game like Cranky Uncle is a good thing, boosted by its translation into further languages, the teacher's guide takes it to a different level of potential. Policymakers should think very seriously about making major investments in managing infodemics. Over the long term, building levels of immunity within a population to misinformation by investing in in the science and expanding on work like this, establishing how it can be implemented at scale, could have huge benefits.

Inoculation is one aspect of a holistic, comprehensive approach to mis- and disinformation, and taking a holistic approach is crucially important. This involves social listening to ensure awareness of the shape and scale of the problem; developing robust responses; then working with social scientists and educators to deploy those responses.

To combat misinformation in communities with low levels of literacy and those that lack access to the internet, it can be important to work with local groups to make generalised content relevant and resonant with local populations. This involves finding good, expert teams in local communities and communication practitioners who understand how to how to reach those communities. It is hard, but the hard work of building teams and relationships and customising responses to different contexts is necessary. If there is to be one positive angle to the current pandemic, it could be that policymakers and funders start to recognise that if we continue to fail to invest in public engagement, communication and inoculating

communities against misinformation to the extent that we invest in vaccine supply and distribution, the world will be stuck in an misinformation cycle forever.

Adaptive social listening to inform effective vaccine public engagement strategies

***Joe Smyser**, Chief Executive Officer PGP (Public Good Projects), Vaccination Demand Observatory*

Impressively, Dr Smyser was presenting at 0300hrs local time.

At present it can feel like every university, marketing agency, PR agency and government has developed a new dashboard out of thin air to address misinformation, a silver bullet to the infodemic. In contrast, this presentation is not about a dashboard, so much as a system of systems: an integrated, community-up methodology to apply the lessons of the pandemic to real world situations in the day-to-day work of public health and immunisation. This effort is called the Vaccination Demand Observatory and has been running in pilot form for a few months.

The Observatory's work has started with countries in which UNICEF has active immunisation programmes, and its mission is deceptively simple. It is a multistakeholder global initiative to identify, track and respond to vaccine hesitancy and misinformation. Single dashboards cannot cope with problems like the infodemic; what is needed is a global network of infodemiologists supporting national immunisation programmes through equitable social listening and partner coordination, involving deep, substantive connexions into networks of communities, ministries, governments and non-governmental quasi-governmental organisations. These individuals and organisations should be working together to build demand for vaccines, manage the ongoing—and worsening—infodemic, and address it in in a way that builds upon existing science of vaccine hesitancy and new vaccine introductions.

The organisations that have come together to create this initiative include UNICEF—which, prior to the pandemic, was the world's largest purchaser of vaccines, and possibly the largest organisation immunising children around the world. UNICEF is running immunisation programmes in over 100 countries. 85% of UNICEF staff are in communities, with deep understanding of the countries and contexts in which they operate, and include behaviour change specialists and community level teams.

Another participating organisation, the Public Good Project (PGP) is a US-based public health nonprofit organisation specialized in large-scale media monitoring programmes, behavioural health interventions and cross-sector initiatives. It runs the United States' largest vaccine misinformation monitoring system, Project VCTR, used by 500 organizations including US and Canadian government agencies.

The final organisation is the Yale Institute of Global Health (YIGH). The director of YIGH, Dr Saad B. Omer, is a leading researcher on vaccine demand whose team has identified key socio-

behavioural drivers of vaccine acceptance and tested behaviour-grounded interventions to increase immunization coverage and acceptance.

The Vaccine Demand Observatory has three major facets to its work. The first is social listening and analytics through a customizable social listening platform, analytical tools and the provision of technical support to enable countries to track and analyze vaccination conversations in digital space and real world. The second is the Vaccine Acceptance Interventions Lab, or VAIL, the task of which is rapid design and testing of messages and narratives for efficacy and safety. The third is a field infodemiologist training programme to build country capabilities, with a focus on developing field infodemic managers.

Outside the specialist media monitoring world, there tends to be conflation of social listening with social media monitoring. "Social listening" in this context applies to all listening and collection of data in order to find signals in noise. Some of that data is in public media and some in social media, but it is wrong to limit listening to social media data alone. The guiding principle of social listening is that it must come from communities first and be built out for communities rather than started at large scale. While there are currently many dashboards collecting public media data and attempting to give directional information to global health authorities, the Observatory is trying instead to build out a system that links up existing sources of data at community level, bring it to country level and then have those countries report up to a global system. A great deal of mis- and disinformation circulates on online social networks, and this is an important part of the programme, but there are also many other types of data that are critically important. In the misinformation and disinformation space these go far beyond online social networks, and can include things like polls, hotlines, community feedback (like the community health surveys done routinely by UNICEF), market research, published research, traditional sources of media data, radio and television broadcasts, print newspapers, and so on. At the moment there is no global system that integrates all of these varieties of data into one place, and those systems that do exist are still focused on top-down rather than community-up approaches. The Observatory is trying to do two things at once: bringing a greater variety of data into the picture in order to get much clearer directional evidence, and ensuring that that data is rooted in communities. This work involves different kinds of data structures, and parts of it can be analysed automatically with artificial intelligence (AI) and machine learning using natural language processing. Other data are more qualitative and require different analytical approaches. Together, this adds up to an ambitious effort.

Serious attempts to identify misinformation and respond to it also require offline sources of data. There are huge holes in our understanding of misinformation and disinformation—and also earnest, honest information seeking. Systems that only show (for example) Twitter data can overlook the fact that not every person in the world uses Twitter; not everyone on Twitter posts on it; and not every Twitter user is representative of the general population. Useful systems must bring different sources of information together in an attempt to perform more holistic analysis.

In March 2020 WHO declared an infodemic; shortly thereafter, they declared a brand new

branch of public health called infodemiology. There is now a need for infodemiologists to practise infodemiology, but no agreed global curriculum, certifications or degree programmes in the field. The Observatory's Field Infodemiologist Training Programme would be one of the first such efforts. It is based on a similar existing model, the field epidemiologists training programme, or FETP, that has been running for several decades. The model used as a basis for the infodemiology programme is managed by the US Centres for Disease Control and Prevention (US CDC) in close partnership with ministries of health and other global and domestic health organisations around the world. It is active in around 80 countries and aims to find the most promising epidemiologists in countries around the world – with a focus on low and middle income countries – and give them CDC-level training so they can go on to provide the best possible expertise in their home country. The infodemiology course and curriculum are modelled on the US CDC FETP programme, adapted for the specific nuances of the new field of infodemiology. The programme involves 12 months of three-month modules in which outside experts provide training to students who remain in their home countries and institutions (though the formal curriculum has not yet been published, WHO has released some guidance on what a good curriculum should look like). Students who apply successfully to the programme will receive a stipend to cover their costs and incentivise them over the course of the year so they can go on to work full time as an in-country infodemiologist, whether in UNICEF, a government agency or another organisation. They will be selected on the basis of their personal qualities and their potential to contribute to this new field.

It was probably WHO that used this term first, but the ideal students are "unicorns." Field infodemiology is not only a new field of public health, but also a new field of communications, productivity and creativity in data science. It would be wrong therefore to limit intake to—for example—epidemiologists. Finding unicorns is more about acknowledging and identifying fields well placed to contribute useful expertise, then looking at the calibre of the individual candidates, whether they be communicators, epidemiologists, data scientists or people with expertise in community organising or community health. The course will accommodate a diverse group, and the training curriculum will reflect that. The goal is to bring all these people to the same baseline level of understanding. Elements of it will be redundant for some people, but all of it together will be new for everyone.

The planned overall structure of this global system will be centred on an administrative headquarters for the Vaccine Demand Observatory, which will include the field infodemiology training programme, the Vaccine Acceptance Interventions Lab and a creative studio tasked with providing additional capacity to country teams making health communication messages. The point of the headquarters is not to run the system for the whole world, but rather to be a focus for providing technical assistance, capacity and data sharing to regional and country offices, sited where they are most needed. Each such office will be responsible for the ongoing monitoring of vaccine communications, structured collection of data, and intervention decisions around how they respond to spikes and misinformation, including "message deployment" to partner organisations, stakeholders and community members. An imagined example of how this might work is as follows: an alert notice is picked up by a country infodemic manager supported by the global monitoring system working in partnership, and sharing data, with the country office. This alert is sent to the lab, which very rapidly generates

strategic communications, guidance and communications templates that are run through testing—just as marketers and advertisers do in real time—comparing messages against each other to see which perform better in a real world environment. The resulting guidance and assistance goes back out to national partners, including the UNICEF Country Office and community-based organisations, and to global partners.

A pilot has been established and has run for a few months. UNICEF has held a series of misinformation webinars with partners that have generated a great deal of interest in the science and the vision of the observatory. The vaccine misinformation management field guide is available in multiple languages. Example polio-specific programmes are ongoing in Liberia, Congo Brazzaville, Burkina Faso and Cote d'Ivoire, and the Observatory is providing ongoing technical assistance to UNICEF country offices and ministry and community partners. A dashboard is also operational and access can be requested now.

A similar system and approach was created domestically in the USA in 2019, and was up and running before the pandemic hit. Before 2019 very few people were interested in vaccine hesitancy or misinformation. When the pandemic arrived and WHO started talking about misinformation, interest surged. The system has evolved since 2019, and a lot has been learnt through constant communication with users. Three main lessons have emerged.

Firstly, while a system might look good, and produce great data visualisations, if the field infodemiologist in a city is not extracting value from it, it is pointless. Whether a public health professional is in Freetown, Liberia or Santa Barbara, California, they are likely to have very little time. Public health workers tend to have 10 effective jobs simultaneously, of which infodemiology is just one. The Observatory systems have therefore been designed so that a user with five minutes or less can quickly understand what they need to do and receive guidance on what to do about it. While the early versions of these systems allowed a lot of data examination and manipulation, very few people were interested in doing that: they tended to need one pertinent piece of information or guidance for immediate execution. Interactive dashboards are in fact more useful for reporters, who explore data more than public health people because they are tracking information to its source and seeking stories. It is important to cater to both use cases.

The second lesson has been the importance of providing a resource library in which all of the necessary information is accessible for those who want it, but crucially without burdening the typical end user by educating them too much while they're trying to do their jobs. The average public health practitioner only wants enough information to do their job.

The third lesson has been that—whether we like it or not—politics is a huge part of the work of managing mis- and disinformation. Much of the public health world was perhaps naive to believe that the pandemic and public health protocols would be outside the political sphere, and that the importance of the work of public health would be obvious enough for it to remain uninterrupted and unpoliticised. In reality, what politicians do and say related to public health is intimately involved with misinformation and disinformation, and with what the public sees, believes and understands.

The Vaccine Acceptance Interventions Lab: Rapid development and testing of evidence-based vaccine communications

***Sarah Christie**, Program Manager & Public Health Research Specialist, Yale Institute for Global Health*

The Vaccine Acceptance Interventions Lab is an ongoing partnership working toward rapid development and testing of evidence-based vaccine communication. Vaccine hesitancy is an extremely complex matter of human behaviour: strong campaign performance online and in communities does not immediately induce behaviour change offline. Vaccine acceptance messaging that is highly specialised to context and culture presents many opportunities to do things right. There are just as many opportunities to get things wrong if messages are improperly or insufficiently contextualised and localised. Best practice understands that what is being said is as important as how it is said and who is saying it.

Different levers can be targeted for messaging. Examination of these different levers entails looking at attitudes, cognitive biases, trust, social norms and moral values, activating shared value systems to convey effective messaging. Vaccine acceptance is based on trust in information and in the system that offers and provides vaccinations. In reality, acceptance lies on a continuum from active demand to total refusal. This is a crucial point: there is a great deal of opportunity to make changes and most people are reachable within this continuum. Only a very small percentage would refuse all vaccines, and there is a great deal of ambivalence within the continuum. The goal is to work with people wherever they are in terms of vaccine acceptance.

Digital communication is one way to shape vaccine demand, but it is not only social media that influences demand, but also the community context and the movement of information from all sources including but not limited to radio, traditional press, word of mouth and community dialogues. People access information in multiple forums, and modern, resilient health systems need infrastructure and tools to listen to, understand and engage with their communities so they can understand prevailing sentiments and how to address them. The process of developing effective messaging involves developing a nuanced understanding of country information ecosystems, including how they are being altered by the COVID-19 infodemic; applying this understanding to develop compelling pro-vaccine messages, campaigns, and inoculation strategies; pre-test messaging systematically with targeted audiences for efficacy and safety; and then building in-country, sustainable capacity for vaccine behaviour change communications. Responding rapidly, when faced with real time problems in urgent need of solutions, requires the use of approaches that are already common in other sectors—retail marketing, for instance – but not yet applied to the public heath landscape. These are not only one-off tests but also iterative tests of small modifications to previous content, tweaking minor aspects of the message to see what traction it gets and follow its journey. Very rapid testing modifications can be made, swapping out messages, messengers, creative approaches and different levers for potency. On the social media platform, the messages can go head to head against each other, demonstrating which have the most impact.

The pandemic has not only presented challenges around the COVID-19 vaccines, but it has also made people concerned about going to facilities for routine immunizations and therefore led to a fall in child immunisation coverage as well. Trust in vaccination has really changed. A wealth of information is already available to guide responses to this issue, and an increasing amount of experience and expertise – not least that of UNICEF, Facebook, YIGH and the PGP – means there is now a major opportunity to respond to mis- and disinformation and develop impactful messages based on evidence and detailed insight. The goal of the Lab is to leverage the strength of all these actors and combine the respective approaches of academia, countries, regional offices, UNICEF headquarters and the private sector into something very powerful, using strategic communications at country and community level to improve vaccine demand and address hesitancy.

The lab is working with a number of partners, including national authorities in the Philippines, Kenya, Ukraine, Pakistan and India, to build sustainable national capacity to convert intelligence into impactful messages for strategic communication. This is being done by analysing public Facebook posts to generate insights into vaccine confidence and identify levers for effective messaging; using these insights and technical expertise to create targeted content for distribution via Facebook; testing and scaling messages that improve public trust in vaccines; measuring change in intent to vaccinate and coverage; and leveraging social listening to develop, design and deploy meaningful health communication. This is the Brand Lift approach to studies, which relies on experimental design to understand which digital campaigns resonate most. Ultimately it has to be a country-driven approach, led by the issues the country considers the most pressing in terms of vaccine acceptance, and grounded in behavioural science.

The YIGH suggests 10 evidence based strategies to develop effective vaccine messaging:

1. **Don't assume vaccine hesitancy**: people are on a continuum and most usually have some level of interest in vaccinating. This can be amplified in target communities.
2. **Anticipate cognitive shortcuts**: people's quick thoughts will move quickly towards their biases. These shortcuts must be anticipated.
3. **Tell stories**: storytelling is more impactful than statistics, especially when talking about emotional issues such as getting children vaccinated or accepting our own vaccination. These decisions are not only public health oriented, but they are also emotional decisions driven by thoughts, feelings and values.
4. **Build trust and use credible communicators**: people are more likely to understand and accept messages from people they deem credible and trustworthy. Communicators should have expertise, trustworthiness and similarity. These might include peers, influencers, parents, community health workers or religious leaders.
5. **Connect with people's values:** For example, liberty is a value that some feel is threatened when people are told to vaccinate; but this value can be leveraged if vaccination can be framed as improving liberty, changing the "right to protect your child from vaccines" to the "right to protect your child *by* vaccinating." The same can be done with the purity/degradation perception, changing the need to keep children clear of vaccines to the need to keep children clear of disease.

6. **Remind people why we vaccinate**: the public perception of vaccination is a victim of its own success. The lack of disease in many of our communities is hard to understand when we do not the consequences of disease. Reminding people why we vaccinate in these contexts is about promoting self-efficacy and response-efficacy, framing vaccines as something real and doable that works.
7. **Reinforce social norms**: the fact that our friends and families are getting vaccinated, or that the people we care about want us vaccinated, can be powerful enablers.
8. **Understand that myth busting can backfire**: poorly calibrated messages can have reverse outcomes.
9. **Communicate vaccination as an aspiration, not an act**: people should be met at their point on the continuum of hesitancy. Vaccination should be conveyed as an aspiration, not a top down demand.
10. **Vocal vaccine deniers**: the most vocal vaccine deniers are unlikely to be moved. The job is more to engage the audience around them rather than the deniers themselves.

At this point, the driving goal of the Lab is to build the evidence base for how to harness online sentiment to influence offline behaviour, in combination with local insights. The private sector is doing good work to build better and stronger health systems, and cascading some of this intelligence and sharing knowledge into the public health sector. The task now is to establish whether and how it works. Lab activities include projects in the Philippines, India, Pakistan, Ukraine and Kenya to examine the information ecosystem and establish the most pressing vaccination priorities, then to hold test campaigns in each country to understand what works best, what really drives demand, and what reduces hesitancy in communities—not only for COVID-19 vaccinations but also for routine immunization. Once the impact of those tests is understood, a randomised structured test can be done on the most promising messages to see whether they have an influence on generating intent to vaccinate and demand for vaccination services, using coverage indicators. Finally, this work can be disseminated with the help of colleagues in country offices, to make it accessible as a guide or toolkit for other health communication initiatives. The anticipated impact of all this are to generate innovative research, stressing the importance of "crossing the aisle" to work with new partners and bring out the best in the different sectors; to inform country-level vaccination campaigns and improve lives, making messages and campaigns evidence-based, context driven and relevant; and to generate new partnership models and collaborations that have an impact beyond the individual actors.

The audience for digital messaging is not representative of everyone who accesses information in these countries; but many people do turn to social media platforms for information when they need it. Science tells us that a message for one person is not necessarily going to work for the next person; but perhaps going through these processes to generate effective messages could work for communities.

It may be possible also to target messaging to particular communities that are important from a public health perspective, or to particularly meaningful segments within broader audiences. The ability to perform detailed audience segmentation is on the horizon, and will offer different possibilities for communication, including targeting audiences with bespoke

messages based on where they are on the hesitancy spectrum.

Discussion

A short period of open discussion touched on a number of themes.

There are differences between work in communities or contexts where a lot of people are online and those where fewer people who can access online information, or communities that have broadband access or heavy social media use versus communities that that do not. The work of the PGP has shown that when misinformation circulates through online networks, those conspiracy theories, myths and misunderstandings are also present in areas with less internet penetration. But there are also home-grown versions of misinformation in those communities that are not necessarily linked to the larger systems. The larger pieces of misinformation get into communities with restricted online access, but the home grown misinformation in smaller offline networks does not necessarily find its way up into the larger networks. This highlights one important principle, which is to gather offline information as much as possible—and there is a lot of it out there—and consolidate its insights into central systems so that infodemiologists can view the broader conversations within their countries and communities.

Tests have shown that standard vaccine communications can have a backfire effect, particularly among audiences that already have a level of high hesitancy or concern about vaccines. This can also happen in the school context. For example, in the days preceding the meeting there was an adverse reaction to the Cranky Uncle game in a school where some parents took against it because they felt the content was politically charged. This raises a tension between what is perceived as political and what is socially relevant; to some extent this question is insoluble, but it must be addressed in the way that messages and games are framed and worded. The power of logic-based critical thinking approaches is particularly valuable in this context, in that to an extent they transcend single issues, making it possible to inoculate against certain techniques using innocuous subjects. In the context of Cranky Uncle, it might be possible to remove the parts of the game that appear politically charged and replace them with sections using generic topics, but still to achieve the same effects, without the adverse reactions.

Because vaccine communications can cause their own adverse events, it may be necessary to test them not only for efficacy, but also for safety, just as is done with vaccines. Research to date suggests that these adverse reactions are seen in people who are already hesitant. It is therefore necessary to try to understand hesitancy levels versus general acceptance, parsing the differential impact of the content that people are exposed to based on their pre-existing positions. There are a number of dashboards that look at baselines for hesitancy, track hesitancy levels and acceptance of the roll out, and provide a degree of intelligence around where different countries are in terms of hesitancy benchmarked on a global scale. It is important that countries hold regular surveys to keep this information robust, in depth and up to date, both for general populations and for specific vulnerable communities. The country

readiness and demand workstream of the ACT-Accelerator, the COVAX initiative, has a number of relevant tools in the public domain, including model and standardised surveys for both general public and health workers.

The sources of disinformation, as opposed to misinformation, are easy to identify. Many of the leaders of the global anti-vaccine movement are happy to be identified. They work visibly, at all hours on all continents, to spread disinformation and engender misinformation, actively undermining immunisation programmes and vaccine confidence. In contrast, a number of admirable groups, such as the Centre for Countering Digital Hate, work very hard to expose those malign individuals and organisations and their motives for doing what they do.

On a different level there are also state sponsored disinformation campaigns that require a greater degree of technical proficiency to identify. There are well-documented Russian and Chinese campaigns going on at the moment to – among other things – undermine confidence in Western-made vaccines. In some ways, these are more sophisticated than the work of the anti-vaccination groups, and they are important and critical to track because they have extraordinary influence. Even when people are confident about vaccines, we know from research that reach and frequency matter; if people are hit with a bad message over and over and over and over again for long periods of time, no matter how confident they were at the beginning, their confidence will be eroded.

On the other hand, a lot of misinformation is just mistakes: people looking for information and misinterpreting it or finding the wrong thing. While the more extreme examples remain important, we are in the middle of a pandemic before which the general public knew very little about vaccines—indeed, a lot of people in public health knew very little about vaccines. All of us are learning as we go, the finish line keeps moving, and new evidence and guidance is emerging every week. Even for public health professionals this can be difficult: the huge scale of this event is new. In this context, while inoculation theory and tracking of deliberate misinformation are critical, so is the work to understand gaps in public understanding. It is important to find out which of people's questions are not being answered, and how to answer them better.

A huge number of previously hidden "experts" have emerged in his pandemic, including economists and politicians and the like very keen to discuss vaccines and immunology and epidemiology. The importance of trusted messengers—or, more accurately, trustworthy messengers—cannot be overstated. This is important not only because people get their truths from those they deem trustworthy, credible and expert, and these sources are a resource to be identified and used; but also because sometimes trusted people say the wrong things.

Away from high profile figures with the potential to be heard by whole populations, the PGP is also working through "micro influencers" in communities. For the last decade or so, the PGP has been reaching out to "average everyday people"—not health experts, but those with a little bit more influence in their social networks than others—and, following a vetting process based on their reach, recruiting them in order to reach particular priority populations. One good outcome of the pandemic has been a widespread willingness to help: it is much easier

now to get to get people excited about spreading good public health messages than it used to be. At the moment the PGP is managing about a thousand such people across the USA, talking about all kinds of COVID-19 related public health protocols and vaccine-related messaging across a range of different communities. This process has been shown to work both in peer reviewed studies and by CDC survey instruments that measure effectiveness. It is approached like a public health intervention rather than a media campaign, and it has been shown that vaccine hesitancy falls and immunisation rates go up when these measures are implemented.

Just as important as influencers are the community organisations. Working with both is "where the magic happens." One PGP initiative funded by the Rockefeller Foundation involves 100 community organisations across priority towns in the USA. All of these organisations are saying the same things at the same time, and the ways in which they say it to the people who trust them are very powerful—probably a lot more so than any messaging by their state health Department.

The existence of all these different initiatives highlights the importance of consistency in messaging. When people hear different things from trusted sources, it becomes very confusing, and when misinformation comes from high ranking or authoritative public figures or leaders it is difficult to manage. Highlighting the illogic used by these people and the tactics they use to spread bad information can help inoculate audiences, as can highlighting the motives behind their handling of misinformation. Disinformation is a big industry, and some of the people creating and spreading disinformation make a lot of money from it. The source-based approach to inoculation or correction involves explaining how a source of misinformation is not credible, but unfortunately there is a dearth of research into this approach. One limitation of this approach, similarly to the fact-based approach, is that it only implies in a narrow context; you can apply to targeted sources but it does not generalise in the same way that the logic-based approach does. On the other hand, a strength of this approach lies in its human psychology: humans are social animals and social messages resonate well. More studies are needed in this area, and therefore more funding. Some work is taking place to study inoculation in the climate context that compares logic-based approached to source-based approached and examine how they interact.

Governments and public health agencies are understandably overwhelmed at the moment. To end the meeting, the speakers were each asked to volunteer a single piece of advice that governments could take and use tomorrow.

Firstly, governments would benefit greatly from improving their understanding of the data and intelligence they already have. A huge amount of rich insight can be generated from the data produced by their everyday work. Harnessing that intelligence into a strategy that resonates, leveraging it to craft quick messages based on a data-derived understanding of how to communicate with specific communities, can be hugely effective.

Secondly, investment in critical thinking in education should build a capacity to address misinformation and misconceptions. This is a powerful educational opportunity, not only in

terms of improving critical thinking and resilience against misinformation, but also for what education researchers called misconception-based learning. Addressing misconceptions about science is one of the most powerful ways of teaching science. The dream goal would be to generate enough investment for inoculation and critical thinking to be taught ubiquitously throughout education systems to the extent that science denial is eradicated, or at least reduced to a socially irrelevant level —just as vaccination campaigns are attempting to do with polio.

Thirdly, we have to realise that what governments say matters. Even if the government does not have the money to put behind the statements they make, they can signal to the public and private sectors to act. Governments, and particularly public health authorities, must formally acknowledge that misinformation is a public health issue that needs to be formally addressed by public health. This would go long way, and the study and the resourcing of this approach would generate a growing understanding that the messenger matters as much as the message. This is an intervention that could have very positive ripple effect across both the public and private sectors.