



VACCINATION ACCEPTANCE
RESEARCH NETWORK

S SABIN VACCINE INSTITUTE

VARN2022:

Shaping Global Vaccine Acceptance
with Localized Knowledge

MARCH 1-3, 2022



CONFERENCE REPORT

The inaugural conference was organized by the Sabin Vaccine Institute and the VARN Planning Committee. This conference was open to the public, held virtually and funded by Sabin.

FOREWORD

May 2022

It is a privilege to present to you the findings and insights stemming from the Sabin Vaccine Institute's inaugural Vaccination Acceptance Research Network (VARN) conference: Shaping Global Vaccine Acceptance with Localized Knowledge, held virtually between March 1-3, 2022.

Making vaccines more accessible, enabling innovation and expanding immunization across the globe, particularly in low- and middle-income countries (LMICs), has been the decades-long mission of Sabin. The COVID-19 pandemic has made vaccine hesitancy and vaccine inequity common household terminology. The support and momentum for this knowledge-sharing event underscores the importance of collectively advancing our understanding of vaccine acceptance and demand through the collaborative efforts of researchers, implementers and communities.

Sabin's VARN strives to foster social and behavioral science research collaborations and action-oriented solutions. Our goal is to translate research results and new knowledge for policy-making, program decision-making and healthcare delivery and practice. We were pleased to see the level of engagement from stakeholders across global regions and professional sectors. During the conference we were able to share a wide spectrum of perspectives,

which also enabled the sharing of unique tools, data, system resources, and connections that organizations and individuals can leverage to generate confidence, acceptance, and demand related to vaccines.

The high level of dynamic, multisectoral and cross-disciplinary engagement continues to inform the priorities of our programs and projects. We strive to put people and communities at the center of our work. Through the VARN, we can amplify localized vaccine knowledge and innovation and unlock the potential of vaccines through collaborative partnership.

We hope that all those who participated in VARN2022 found the discussions to be rich and relevant to the work being conducted locally, regionally and globally. We expect the VARN program to continue to connect people, information and opportunities in new ways that both enhance and amplify the work they are doing.

The conference report is a synthesis of the contributions made by over 50 presenters sharing evidence from interventions designed to further understand and break down barriers to vaccine acceptance and demand in over 40 countries. Thank you again to our presenters, moderators, and conference attendees. We'd like to extend a special note of appreciation to Sabin's Vaccine Acceptance & Demand team members and our VARN Conference Planning Committee members:

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ACRONYMS

BeSD	Behavioral and Social Drivers of Vaccination
CAB	Community Accountability Board
CoP	Community of practice
CRA	Community Rapid Assessment
CRM	Community Resiliency Model
CT4I	Community theater for immunization
HPV	Human papillomavirus
LMIC	Low- and middle-income country
PTSD	Post-traumatic stress disorder
RCCE	Collective Service for Risk Communication and Community Engagement
SAGE	Strategic Advisory Group of Experts
TWG	Technical working group
UNICEF	United Nations Children's Fund
US CDC	United States Centers for Disease Control and Prevention
VARN	Vaccination Acceptance Research Network
WHO	World Health Organization

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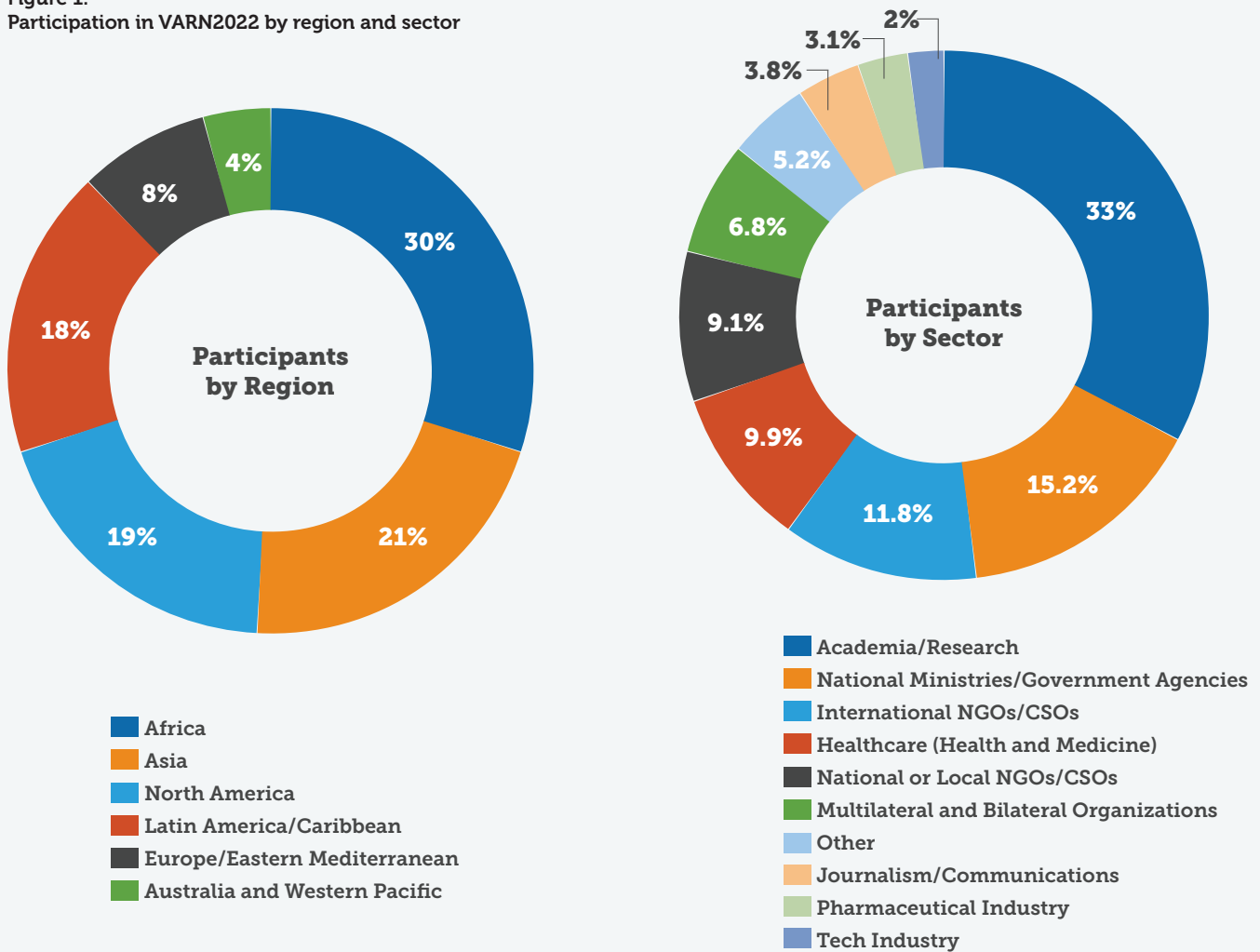
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INTRODUCTION

The inaugural Vaccination Acceptance Research Network (VARN) conference, *Shaping Global Vaccine Acceptance with Localized Knowledge*, was held March 1–3, 2022, as a virtual meeting.

VARN2022 brought together 750+ global experts as registered attendees across 76 countries. Participants represented diverse disciplines including global health and policy, research and academia, and healthcare and health communications (see Figure 1).

Figure 1. Participation in VARN2022 by region and sector



The inaugural meeting promoted collaborative exploration of research results from around the globe and provided a forum to discuss key priorities and opportunities emerging across the ecosystem of vaccination programs, policies, and practice. The keynote address was provided by Robert Kanwagi, MPH, consultant to Gavi, entitled “Demand Generation for COVAX.” The subsequent panel discussion included experts from five global regions. VARN2022 also incorporated 34 oral presentations and 11 poster presentations into its agenda (see Annex 1).

The various presentations and discussions centered around four key themes:

1

**Understanding
Vaccine Hesitancy
and its Drivers**

2

**One Size Does Not
Fit All: Community-
and Context-Specific
Approaches to Increase
Vaccine Acceptance**

3

**Fighting the
Infodemic &
Harnessing Social
Media for Good**

4

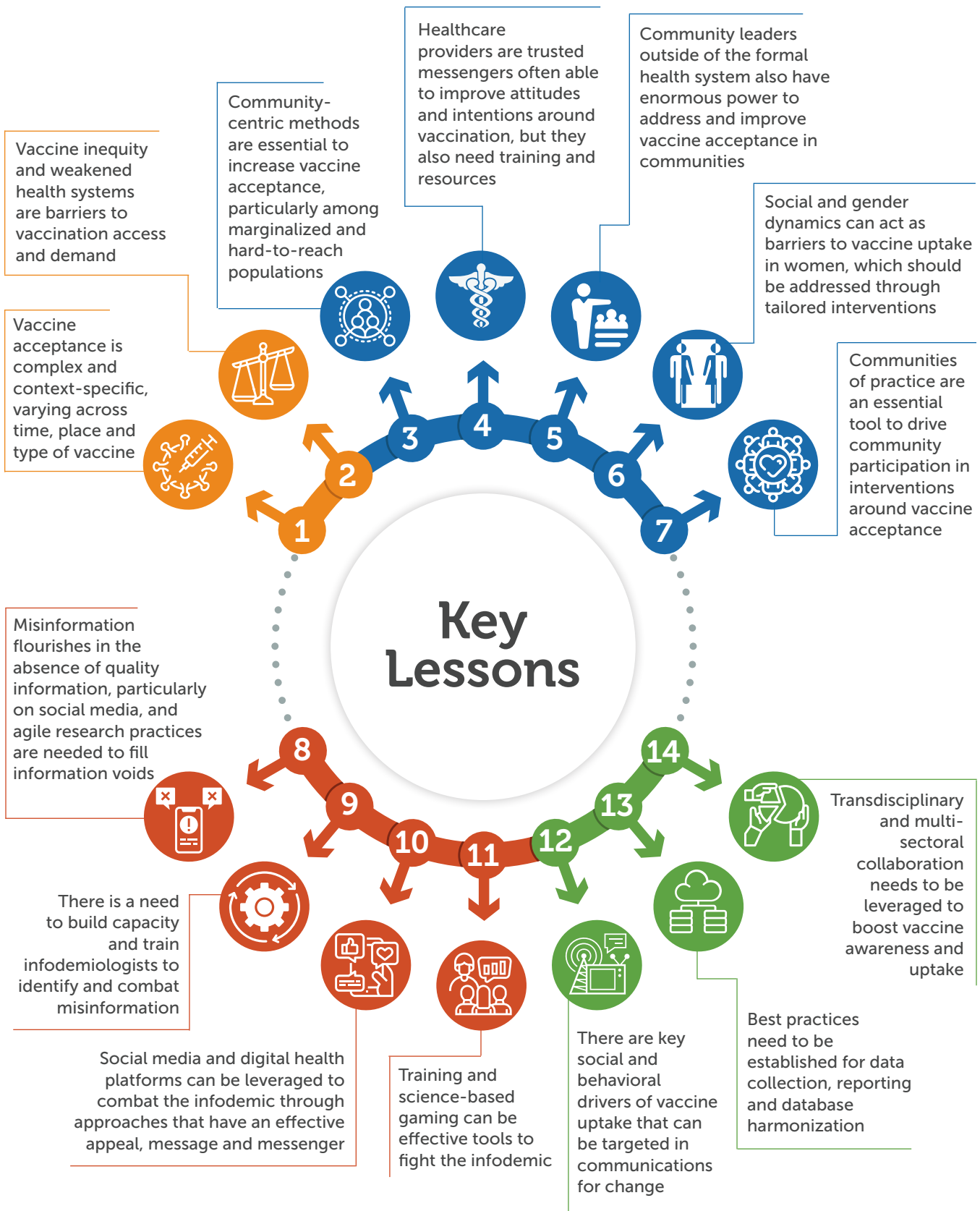
**Frameworks,
Data Integrity &
Evaluation of Best
Practices**

Along with presentations on global-, regional- and local-level vaccine acceptance and demand, the conference also included four concurrent breakout sessions serving as landscaping discussions around similar themes, including supporting communities of practice (CoP) networks and platforms.

These engagements were open to all VARN2022 attendees and were participant-shaped and driven. These discussions served as a precursor to the establishment of VARN technical working groups (TWGs), occurring post-conference, as they provided unique perspectives of participants to set agendas for action-oriented collaboration and future meetings and activities.



The conference generated a number of key lessons:



The insights shared throughout the three-day conference will set the stage for ongoing collaboration and future meetings and activities through VARN with VARN members and local, regional, and global stakeholders. Together, we hope that VARN will provide a forum to stimulate discussions, drive collaboration, and highlight key priorities for either new or continued investment that can positively impact vaccine acceptance and demand and vaccination uptake around the world.

All VARN2022 conference presentation recordings, posters, and other materials will be publicly available in Summer 2022 at www.vaccineacceptance.org.



Vaccine hesitancy remains a critical public health issue, classified as one of the top 10 threats to global health by the World Health Organization (WHO) in 2019.¹ Growing vaccine hesitancy worldwide threatens to reverse progress made in combatting vaccine-preventable diseases like measles and polio. During the COVID-19 pandemic, vaccine acceptance took center stage, with the pandemic highlighting the importance of vaccination as a public health tool – but also growing levels of hesitancy. The first major theme of VARN2022 was understanding what we mean by vaccine hesitancy – or conversely, vaccine acceptance, as a first step to understanding how it can be addressed to improve vaccination rates. The keynote address by Robert Kanwagi, MPH, sought to define vaccine acceptance, why it matters, and its key drivers.

1. Vaccine acceptance is complex and context-specific, varying across time, place and type of vaccine

Vaccine hesitancy is defined as the reluctance or refusal to accept vaccination despite the availability of vaccines.¹ There is a continuum of vaccine acceptance between full acceptance and outright refusal of all vaccines, and the majority of vaccine-

hesitant people will fall somewhere in the middle of that continuum. Factors influencing hesitancy are complex, oftentimes specific to the context and community, and they can vary across time, place, and type of vaccine. Hesitancy is influenced by a number of factors, including confidence (trust in the vaccine, delivery system, and provider), convenience (access to immunization services), complacency (lack of perceived need for/value of vaccines), skepticism (perceptions of vaccines constructed by knowledge and information sharing), and psychological factors, including conspiratorial thinking.^{2,3,4,5,6,7} For this reason, Sabin and key global stakeholders encourage the use of the term vaccine acceptance rather than vaccine hesitancy. Instead of placing blame on an individual who may be hesitant, the continuum of vaccine acceptance gives acknowledgement to the complex structures and environmental factors that influence a person's decision to vaccinate (see Figure 2).

In many regions, the proportion of people who are firm refusers of vaccination is likely to be small. For example, findings from repeated surveys conducted across five waves of the COVID-19 pandemic in Quebec, Canada⁸ identified that the proportion of

Figure 2.
The vaccine acceptance continuum

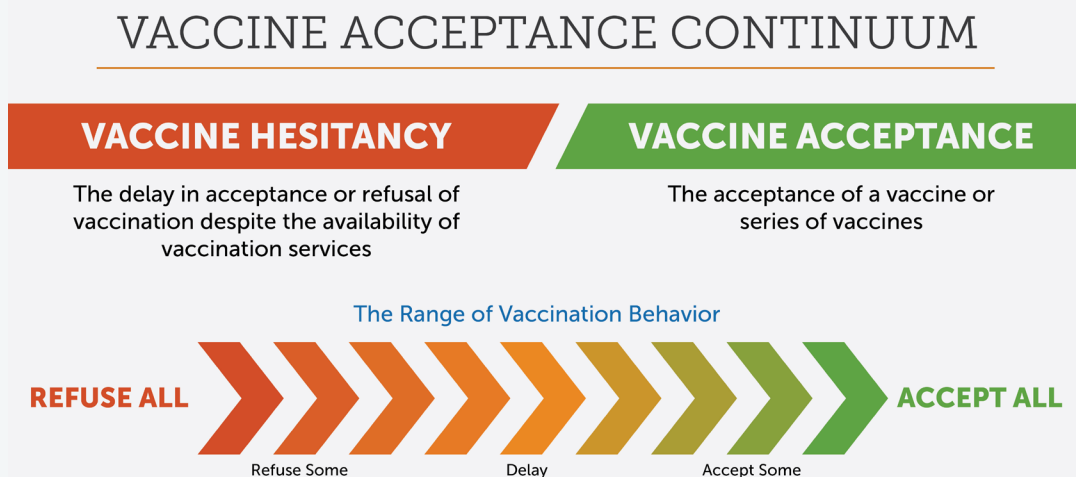
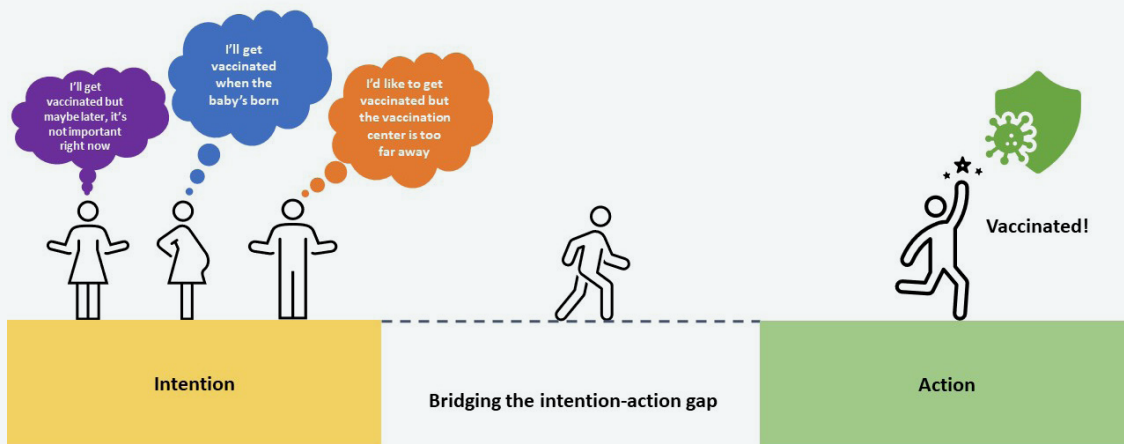


Figure 3.
The intention-action gap around vaccination



Source: Adapted from presentation by Dena Gromet, PhD, "Behaviour Change for Good: Effective Strategies to Boost Vaccination Rates"

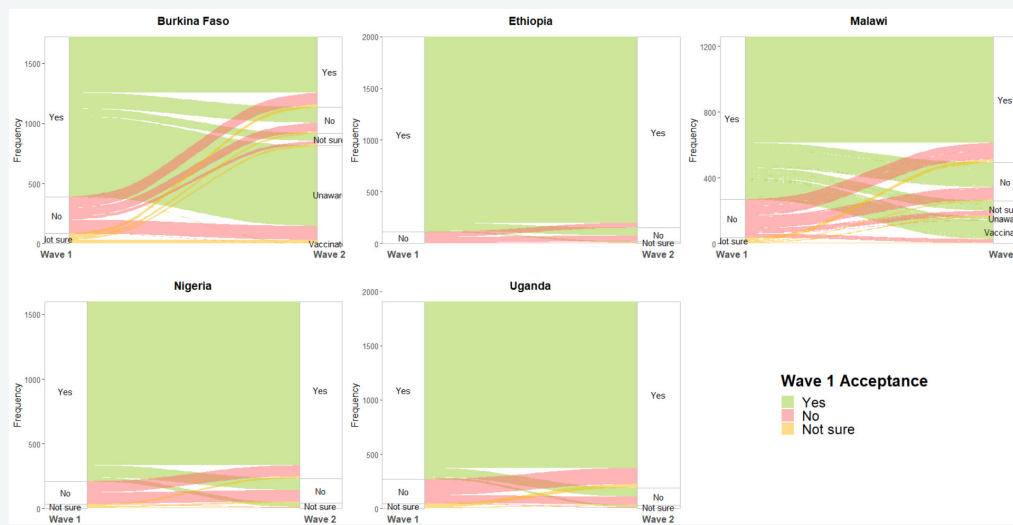
respondents with no intention to be vaccinated remained stable at around 5% of respondents, compared with around 20% overall who were hesitant. However, during the conference, speakers discussed the concept of an "intention-action gap" – where a person's intention to get vaccinated does not automatically translate into getting vaccinated (illustrated in Figure 3).

Reasons underlying low vaccine acceptance are heterogenous, often highly context-specific and dynamic, as an individual's beliefs can vary over time and between different vaccines. In surveys conducted across Burkina Faso, Ethiopia, Malawi, Mali, Nigeria, and Uganda by the World Bank,⁹ common reasons for low COVID-19 vaccine acceptance included concerns about vaccine safety and potential side effects. The same study found that while sociodemographic patterns of vaccine acceptance varied across countries, some patterns emerged, with higher hesitancy in groups with

internet access, and among women, households with greater levels of income, and people living in urban areas.

Interestingly, the study in sub-Saharan Africa also demonstrated how confidence in vaccines can be gained but also lost, indicating that high levels of acceptance should not be taken for granted. Across the countries included in the study, vaccine acceptance was generally high (80% of surveyed people willing to be vaccinated overall), but there were notable variations between countries and over time. Certain countries showed little change in respondents' attitudes over time, with only 7% of respondents switching attitudes in Ethiopia, 14% in Nigeria and 15% Uganda. However, in other settings, there was notable switching of attitudes from acceptance to hesitance (Ethiopia, Burkina Faso, Malawi, and Nigeria), while the opposite was true in Uganda (see Figure 4).

Figure 4.
Change in attitudes towards vaccination over time in Burkina Faso, Ethiopia, Malawi, Nigeria, and Uganda

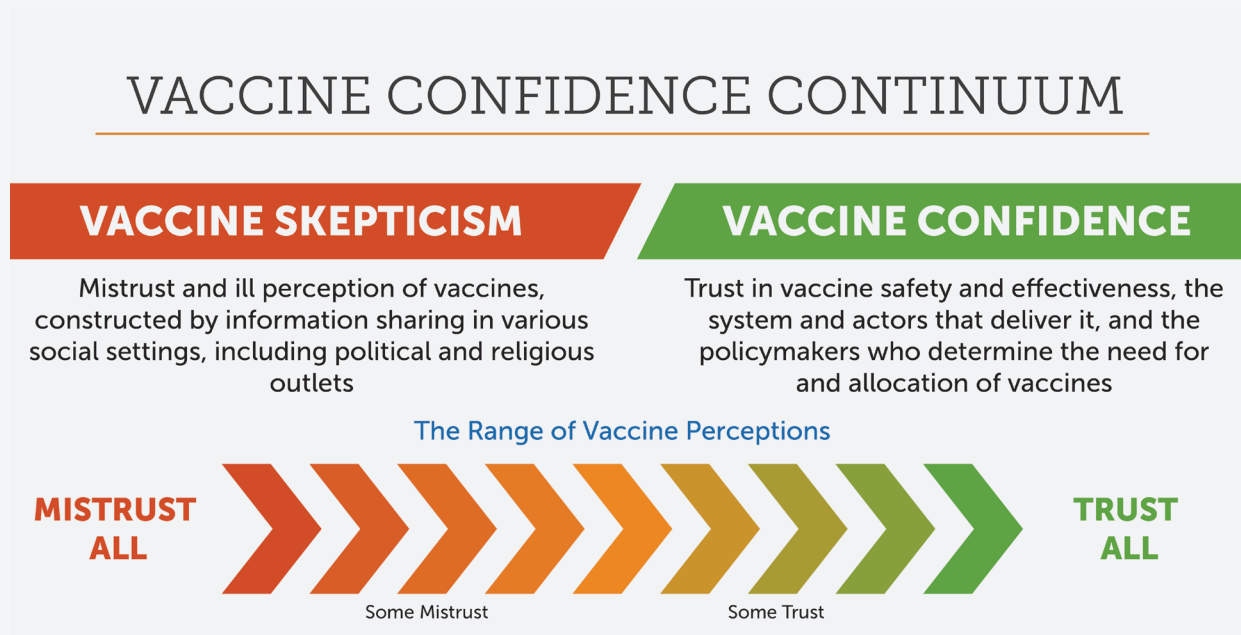


Source: Presentation by Philip Wollburg, MSc, "Attitudes Towards COVID-19 Vaccination in Africa"

Vaccine confidence, a main driver of vaccine acceptance, equates largely to trust in the safety and effectiveness of a specific vaccine or set of vaccines, the system that delivers them (including health services and immunization professionals), and the policymakers who decide on the availability of and need for vaccines.^{10,11} Like vaccine acceptance, vaccine confidence lies on a continuum, with individuals ranging from zero to 100% confident. As trust may be gained and lost, the same can be said for vaccine confidence (see Figure 5).

Similarly, low vaccine confidence can be a symptom of deeply rooted mistrust in healthcare systems and national governments. In fact, vaccine acceptance can be seen as a proxy for trust in government and as a result, it was highlighted as important not to hold individuals and communities fully responsible for exhibited hesitancy. Multiple VARN2022 speakers also talked about the effects of systemic racism and discrimination faced by indigenous and other marginalized communities, which have damaged trust in mainstream healthcare and public health.

Figure 5.
The vaccine confidence continuum



The impact of the COVID-19 pandemic on vaccine acceptance was also a topic of discussion. Pre-pandemic, barriers towards vaccine acceptance were primarily seen at an individual level, with certain parents or caregivers expressing hesitancy, for example, or were being driven by faith leaders with negative opinions of vaccines. During the COVID-19 pandemic, however, there has been much greater polarization of opinions based on ideological differences. Challenges to vaccine acceptance have also been seen at the political level, with some key leaders and governments stating outright that COVID-19 does not exist.

However, COVID-19 has also led to some major positive shifts for vaccination, with increased awareness and engagement on issues around vaccination. More attention is also being given to the importance of vaccine equity and that LMICs also need, and should have, the same access to vaccines as high-income countries to combat COVID-19 and new variants.

2. Vaccine inequity and weakened health systems are barriers to vaccination access and demand

Vaccine acceptance is complicated by a myriad of other factors that can affect likelihood of vaccine uptake, most notably access to vaccination. Many communities, particularly marginalized groups, face systemic barriers around accessing healthcare and vaccination. It is therefore important that we recognize the difference between true vaccine hesitancy and/or low vaccine demand and systemic barriers to vaccination, and tailor our solutions accordingly.

For example, prior to the COVID-19 pandemic, it might have been assumed that vaccine acceptance is higher in high-income countries compared with LMICs. In fact, recently reported data has shown that willingness to vaccinate is generally higher in LMICs, with average willingness to take a COVID-19 vaccine at 80.3% in a survey of 10 LMICs compared with 64.6% in the United States and 30.4% in Russia.^{12,13} However, many LMICs have faced systemic issues around vaccine access and roll out, hindered by international supply chain failures. In the keynote address, Robert Kanwagi, MPH, pointed out that COVID-19 has exposed a disconnect between global expertise and realities on the ground.¹⁴

Ensuring uptake of vaccines also hinges on political commitment to fund and plan vaccination campaigns, combined with having strong health systems in place to coordinate and enable the roll-out. As an example, the Democratic Republic of the Congo received 6.2 million doses of COVID-19 vaccines in 2021, but only 2.2 million doses were utilized, despite high willingness for vaccination across the population.¹⁴ In this case, vaccine roll-out was hindered by practical issues, with only four out of 26 provinces having initiated mass vaccination campaigns. A further 10 provinces have yet to implement any mass COVID-19 vaccination campaign. As such, demand generation has been insufficient or low in the country, leading to vaccine wastage.

Overly broad generalizations may also mask situations where the issue is access to vaccination rather than hesitancy. In a presentation on last-mile delivery of COVID-19 vaccines,¹⁵ Ahmed Mushfiq Mobarak, PhD, MA, (Yale University School of Management) noted that in rural areas of Sierra Leone it can take an average of three hours each way to reach the local vaccination center – an overnight trip costing US\$6.50, in a region where people live on US\$1.00 per day (Figure 6).

Figure 6.
Vaccine delivery challenges in Sierra Leone.

In rural areas of Sierra Leone where we are working, it takes (on average) 3 hours to get to a vaccination center each way, and it costs 6.50 USD each trip

Source: Presentation by Ahmed Mushfiq Mobarak, PhD, MA, "Last-Mile Delivery of COVID Vaccines: Field Trials in Sierra Leone, Bangladesh, and India"

In transitioning vaccine hesitancy to confidence, governments should conduct an analytic approach and/or gap analysis to identify weaknesses in their healthcare systems and determine where to focus funding and other resources for vaccination efforts. Ultimately, access to vaccination services greatly depends on functional governments, and non-state actors – particularly those working at the community level. Through community ownership and trust building, a good local vaccination site can be transitioned into a structurally strengthened mass vaccination site.

Learnings and investments in health infrastructure from the COVID-19 pandemic can also be leveraged for future vaccination uptake campaigns and pandemic preparedness. This point was discussed in terms of how to overcome the disruptions to routine immunization programs, as part of the technical working group on Community-Centric Methods to Support Marginalized & Hard-to-Reach Populations. It was suggested that the infrastructure and systems established for COVID-19 vaccines, such as cold chains and physical locations, could be utilized to provide urgent catch-up vaccinations to “zero-dose” children who have not received any routine immunizations.

Further investments in the health workforce, particularly at the primary healthcare and community level, were also recommended to address the high levels of burnout seen among healthcare workers as a result of the pandemic. Presenters also recommended immediate remedial action to counter the surprisingly high levels of COVID-19 vaccine hesitancy seen among healthcare workers in some settings.¹⁵



One Size Does Not Fit All: Community and Context Specific Approaches to Increase Vaccine Acceptance

THEME 2

A central theme to VARN2022 was the concept that there are no “one size fits all” approaches to understanding or improving vaccine acceptance. Instead, context-specific, community-centered strategies are essential to increasing vaccine uptake and sustaining demand. The conference brought together work from diverse settings around appropriate, localized solutions, particularly in low-resource settings. This theme was further explored in two technical working groups: *Community-Centric Methods to Support Marginalized & Hard-to-Reach Populations* and *Supporting Communities of Practice Networks & Platforms*.

3. Community-centric methods are essential to increase vaccine acceptance, particularly among marginalized and hard-to-reach populations

Communities have diverse and unique characteristics that require specific solutions to reduce the barriers they face around vaccine acceptance and access. Presenters shared learnings from work with diverse communities, including residents within urban, peri-urban, and rural settings; marginalized and displaced populations, and zero-dose children. The technical working group on this topic discussed existing community-based initiatives, tools and best practices for designing and implementing community-centric and/or community-based participatory approaches (e.g., human-centered design and community guidance, creation of Community Accountability Boards [CABs]) for increasing vaccination acceptance and uptake in a variety of community settings.

As an example, a presentation by Nadine Ann Skinner, PhD, MPA, (Stanford Center for Health Education, Digital Medic, USA) and Anne Kraemer Diaz, MA, (Maya Health Alliance) highlighted the myriad of issues faced by indigenous Mayans

in Guatemala in terms of accessing vaccination services and the importance of community-centric methods to improve vaccine acceptance in such marginalized communities.¹⁶ Indigenous people of Mayan descent in Guatemala account for over 40% of the national population.¹⁷ Despite this, the indigenous community has been historically underserved by the healthcare system, and many indigenous people do not wish to be treated in the hospital as a result, where caregivers rarely speak their language or respect their dignity. Community healthcare workers serving the local communities in the central highlands of Guatemala report significant vaccine access issues, including long delays due to variable availability of vaccines from the government, lack of information about dosing schedules, and confusion over eligibility criteria. These barriers, combined with fears about side effects from the vaccines, contributed to increased vaccine mistrust in the population.

To understand the root causes of low vaccination within communities, one needs to gain access to the population and fully understand and appreciate the sociocultural factors influencing vaccine acceptance. Access to and knowledge of the community can most successfully be gained through working directly with community members and asking the right questions (e.g., Which populations have zero-dose children and/or unvaccinated adults? Why are they under-vaccinated? What do they need to become vaccinated? What are additional gaps?). Community-based participatory approaches allow for the co-design and evaluation of research data collection methods and the subsequent interventions between an (often external) research/implementation partner and key community members.

Furthermore, developing pragmatic, user-friendly and contextually relevant interventions that are acceptable to the community is essential for success.

Interventions should be as simple as possible to avoid burdening the community and increase the likelihood that changes will be implemented and sustained. Strategies also need to be adaptable over time, so that interventions are long-lasting and vaccine knowledge stays within the community. In this context, empowering local community leaders and stakeholders through capacity building efforts is powerful, as it gives the community the tools and knowledge to continue projects once original external stakeholders disengage.

Health- and vaccine-related messaging also need to be delivered by trusted individuals in the community. Multiple presenters from different global regions spoke about the need to identify and engage with

key community influencers who already have strong relationships with their community. Working with community-level leaders across multiple sectors – religion, education, and healthcare – to connect with various community groups engenders deeper community engagement for long-term success. As an example, Rubina Qasim, MSc, (Institute of Nursing, Dow University of Health Sciences, Pakistan) shared that within an underserved urban population residing in Muslimabad Colony, Landhi Town in Karachi, Pakistan, residents have high trust in informal healthcare workers, whom they call “quacks”, because these lay providers know the local communication style.¹⁸ This same community also received health messaging from masjid imams (religious leaders) during Friday prayer services.

Below are three very different examples of successful community-centric approaches to increase vaccine acceptance and uptake in Guatemala and the two West African countries of Niger and Nigeria.

1. In the previously mentioned indigenous Mayan population in Southern Guatemala, language barriers are a particular barrier to health information.¹⁹ The official language of Guatemala is Spanish or Castilian, with the Castilian monolingual educational system accelerating the disappearance of Mayan languages. As a result, there’s a large unmet need for health messaging in native languages for Indigenous community members. As part of a study conducted by Nadine Ann Skinner, PhD, MPA, (Stanford Center for Health Education, Digital Medic, USA) and Anne Kraemer Diaz, MA, (Maya Health Alliance) several different approaches were attempted to improve local messaging, including the use of image-based messages. The presenters shared that co-designing images with community leaders was key (see Figure 7), so the project could deploy culturally-specific symbols, which conveyed the correct meaning for the audience. Image messaging was also accompanied by radio sequences in local languages or dialects on informal radio stations listened to by Indigenous communities.

Figure 7.
Co-designing messaging with indigenous Mayans in Southern Guatemala.



Source: Presentation from Nadine Anne Kinner, PhD, MPA, and Anne Kraemer Diaz, MA, “Understanding vaccine acceptance in Indigenous populations in the Central Highland of Guatemala”

2. In the Niger Delta region of Nigeria, a community theater for immunization (CT4I) intervention was undertaken to investigate whether community theater can improve demand for vaccination services from caregivers.²⁰ According to a previous survey conducted in the country, 42% of caregivers reported a lack of awareness as the reason for incomplete immunization of their children and 11% reported having no faith in vaccinations. As part of the study, the CT4I interventions included advocacy and stakeholder engagement with health system actors and communities, and the creation of theater storyboards with users, ahead of theater performances at community events, gatherings and meetings (Figure 8). The 29 theater performances put on through the initiative reached over 2400 community members and trained 217 community members as routine immunization champions and theater performers. The intervention had a substantial impact on

Figure 8.
Community theater performances in the Niger Delta region of Nigeria as part of the CT4I initiative.



Source: Presentation by Chijioke Kaduru, MBChB, MPH, "Using Community Theater to Improve Demand for Vaccination Services from November 2019 to May 2021 in the Niger Delta Region of Nigeria."

attitudes and knowledge around vaccination, with 81% of community members reporting that they felt more accepting of vaccines for their children after the theater performance. The CT4I program also resulted in a 26% increase in the number of fully immunized children in communities where performances were conducted. Overall, the use of CT4I in this study demonstrates that caregivers will demand vaccination services as a right if they are engaged through a human-centered process of trust building, education and social support.

3. In Niger, West Africa, a "Vaccination Calendar Baby-Wrap" was used to increase the mother's knowledge of the pediatric vaccination schedule and increase vaccination coverage.²¹ Previous research in the country had found that 59% of mothers surveyed had incorrect knowledge about the pediatric vaccination schedule and number of necessary appointments.²² To improve vaccination coverage, this project worked with local artists, mothers and healthcare workers to design a baby wrap with information on the pediatric vaccination schedule, depicted using a series of motifs and a symbolic calendar that mothers with low literacy can utilize to track time between appointments (Figure 9). Perceptions of the baby-wrap were overwhelmingly positive, and the baby wraps were well used by mothers in the project. While complete comprehension of the baby wrap symbols was low (56%), mothers were able to identify that the pattern was associated with vaccination and reported that it served as a general reminder to bring their baby back to the clinic for additional vaccinations.

Figure 9.
The "Vaccination Calendar Baby-Wrap" and its symbols.



Vaccination Calendar Baby-Wrap, final digital design for factory-printed cloth. Designer: Eliza Squibb, co-investigator on the Vaccination Calendar Baby-Wrap research project



Zeinabou wearing the printed baby-wrap with her son Abdoul Malek in Niamey, Niger. Photo by Issa Oumarou Yacouba



Taweygna "Mother of Twins" wearing the printed baby-wrap with her son and daughter in Niamey, Niger. Photo by Eliza Squibb

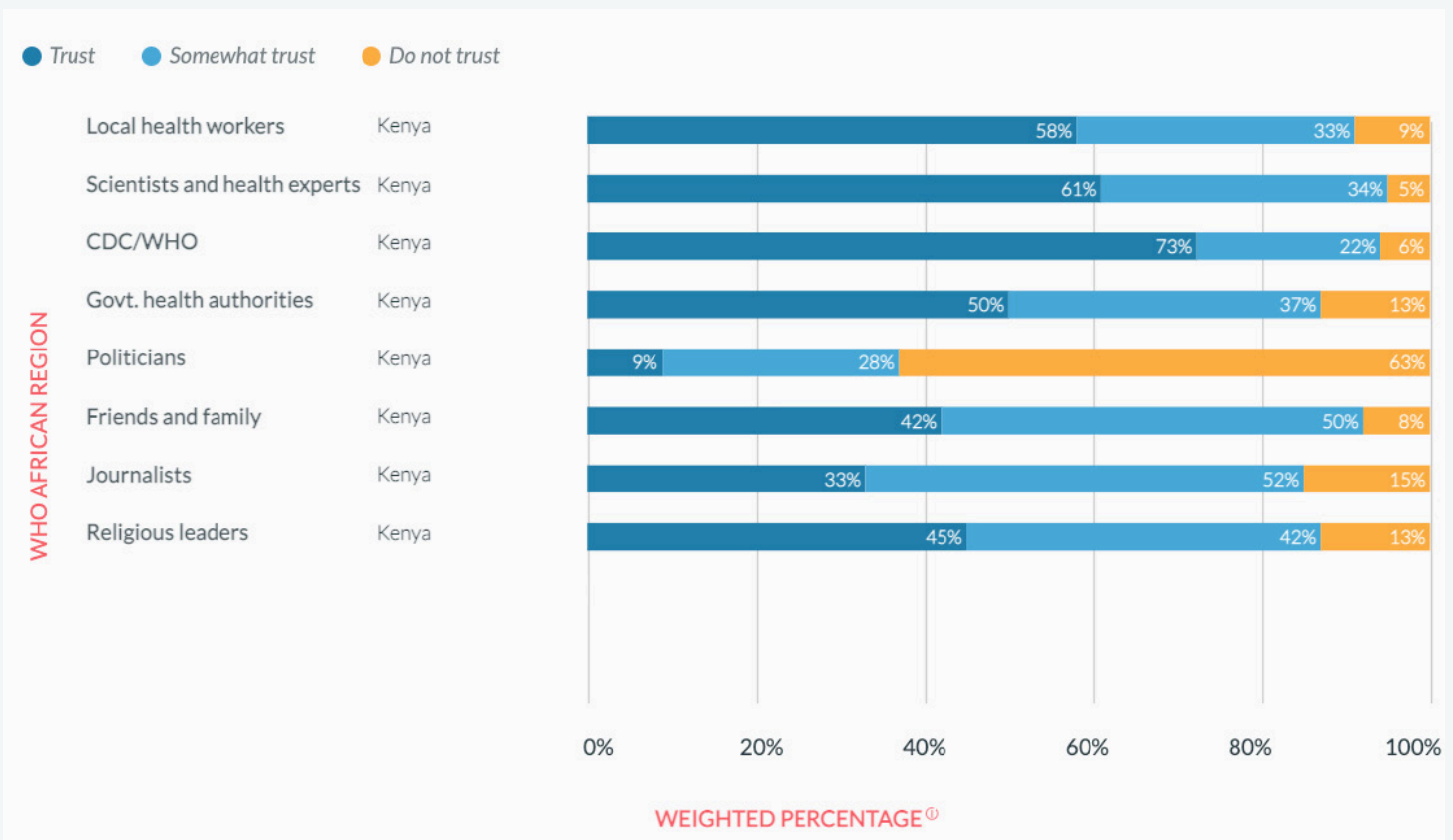
Source: Presentation by Eliza Squibb, BFA, "The Vaccination Calendar Baby-Wrap: Carrying Infants to Vaccines in Niger, West Africa."

4. Healthcare providers are trusted messengers often able to improve attitudes and intentions around vaccination, but they also need training and resources

Healthcare providers are generally seen as trusted messengers who have the power to improve attitudes and perceptions around vaccine acceptance and uptake. In fact, local health workers are consistently rated as one of the most trusted

sources for COVID-19 (Figure 10)²³ and other health-related information. However, a key issue is that healthcare workers in lower-resource settings rarely receive routine training or educational resources on best practices for responding to misinformation,²³ which increases their vulnerability to misinformation. This is particularly true for informal healthcare workers or traditional healers, who in some communities are more trusted than formally trained and certified health practitioners.

Figure 10.
Proportion of population that trusts different sources in Kenya



Source: COVID Behaviors Dashboard, referenced in presentation by Alexandra Michel, MPH.²³ Available at: <https://covidbehaviors.org/>.

Misinformed and/or vaccine hesitant health workers can prove detrimental to vaccination campaigns and potentially initiate a change in vaccination attitudes from positive to negative. As mentioned by presenters Benson Wamalwa, PhD, MSc, and Caroline Aura, PhD, (University of Nairobi, Kenya), within a study conducted in Trans-Nzoia County, Kenya, vaccine acceptance among community health workers was only 26% – substantially lower than among the general population.²⁴ The beliefs and actions of healthcare workers countered the notion that COVID-19 vaccines were safe and effective and that public health facilities remained secure to visit during the COVID-19 pandemic. There was a reported and widely publicized incidence of health worker panic, including refusal to handle and care for sick patients with symptoms of COVID-19 in hotspot areas.

Similarly, a presentation on why pregnant and breastfeeding women in rural India who want the COVID 19 vaccine are not getting vaccinated highlighted mixed messaging from healthcare workers as a factor behind low vaccination rates among this population.²⁵ Only one-third of the women surveyed had received the COVID-19 vaccine, despite all of them being connected to the health system.

Consequently, there is an urgent need to better train health workers on health and vaccine literacy points, particularly to ensure consistent messaging around vaccine eligibility and to assuage any safety concerns that groups like pregnant women may have. Health workers also need to be equipped with the tools to fight misinformation and address their own concerns as well as the informational needs present in their community. Specific tools and approaches to help healthcare workers are discussed in Themes 3 and 4.

5. Non-traditional actors also have enormous power to address and improve vaccine acceptance in the community

Keynote speaker Robert Kanwagi, MPH, noted that, historically, governments have tended to take

over immunization or vaccination campaigns and become predominant actors without consulting with community leaders. However, there was agreement that increasing vaccine acceptance in the community will be most successful through a multi-pronged approach, including multi-sectoral and transdisciplinary partnerships, and leveraging the relationships and knowledge of non-traditional actors in addition to health workers.

Presenters spoke about the importance of working with community influencers outside of the formal healthcare system, due to the erosion of trust in vaccines and vaccination being closely related to broader structural challenges and the deeply rooted community mistrust in political and healthcare systems. Earning the trust of community-level change-makers, such as faith leaders, schoolteachers, civil society activists, traditional healers, and even youth, and empowering them with knowledge on vaccine benefits may create strong vaccine champions with greater community reach.^{26,27,28}

In one example shared at the conference, a single speech on vaccination from a religious leader led to 95% of vaccine-hesitant individuals in a community becoming willing to accept the COVID-19 vaccine.²⁹ Similarly, a presentation by Corrina Moucheraud, ScD, MPH, (University of California Los Angeles Fielding School of Public Health, USA) on barriers towards human papillomavirus (HPV) vaccine acceptance in Malawi emphasized the importance of deploying diverse, trusted messengers, with messages that resonate, highlighting the benefit of vaccination.³⁰

As discussed in Theme 3, social media influencers also often have the largest platforms and can speak directly to large cross sections of the population (e.g., younger people) who may be less likely to see official health messaging.³¹ Overall, it is key to identify community influencers who can serve as peer educators within their own communities.

6. Social and gender inequity can act as barriers to vaccine uptake in women, which should be addressed through tailored interventions

Social norms and gender inequity can lead to women facing specific barriers around vaccine access for themselves and potentially for their children. Research shared at the conference reported higher levels of vaccine hesitancy among women across sub-Saharan Africa and India, for diverse reasons relating to a lack of information, fear of negative effect on reproductive health/fertility and low autonomy to seek information and vaccination services.^{32,33,34,35,36} For example, women may have less autonomy in households, potentially needing permission from their husbands or family members to leave home, which makes it difficult for women to advocate for vaccination or seek information.^{37,38} In a study of pregnant and breastfeeding women in India, there was a notable lack of access to trusted information, with 96% of women reporting that they did not know where to get accurate information on COVID-19.³⁸ Issues with access to information are covered further in Theme 3.

Overcoming the additional barriers faced by women first requires recognition of the issue. Widespread public health education campaigns about COVID-19 vaccination specifically targeted to women would be helpful, alongside health worker education to ensure they can address concerns that patients may have about vaccine safety during pregnancy and breastfeeding. However, it's important that local values, traditions and cultural practices are kept in mind when designing interventions to empower women, to ensure that approaches are feasible and well received by the community.

Rubina Qasim, MSc, (Institute of Nursing, Dow University of Health Sciences, Pakistan) shared the positive impact of a project that worked with the local community to co-design and test socio-behavioral interventions to counter COVID-19 related misinformation in Landhi town, Karachi, Pakistan. Male and female community members were interviewed privately by study team members of the same sex, and women were approached to co-design solutions for their community alongside

female researchers. A female respondent in the project said: *"In our society females are given less priority in decisions. The thing we like about this study was our active involvement from day one and respecting our culture, autonomy and giving us opportunity to decide and act along with other stakeholders and researchers. This was the reason why this approach is greatly needed in the community."*

Furthermore, with men often being enablers or blockers to vaccination behavior of the entire household, vaccination demand creation interventions may also strategically target men and fathers.^{39,40} Understanding that in many cultures gender norms are such that women are the primary child caretakers and men hold a significant power over household decision-making, a study conducted in Nigeria, Uganda and Guinea, investigated what would motivate fathers to give approval for the uptake of early childhood vaccinations.⁴⁰ The study reported that linking vaccination with the health and financial success of the family and ensuring that vaccine information is disseminated by trusted community influencers will likely have a positive impact on men allowing the completion of their children's immunization schedules. Additional strategies regarding messaging appeals can be found in Theme 3.

7. Communities of practice are an essential tool to drive community participation in interventions around vaccine acceptance

Communities of practice (COPs) are groups of people that come together to fulfil a shared purpose around a community issue. COPs are often used for disseminating information and expertise and to facilitate peer-to-peer learning, to advance a field of practice and translate knowledge into effective action. They can be an essential tool for elevating concerns and reactions from community members across the vaccination ecosystem, including to policy and program decision-makers. As such, COPs play a key role in enabling community-centric

approaches in program design and facilitating a bottom-up and top-down feedback loop.

The role of COPs in vaccine acceptance and demand was explored in a technical working group, which sought to understand the existing landscape of COPs/networks and determine how best to implement an informative, dynamic, and needs-based cycle of reactive change. Sabin's Boost community was a shared example of a COP – a global community of immunization professionals allowing for professional connection, learning, and leading through the sharing of curated resources and live, virtual events for leadership, management and immunization competencies.

As COPs are for the people and by the people, it is essential that voices are elevated from the ground up when COPs are established. COPs should have a human-centered design, and it is important to bring diverse voices to the table. COPs can be a strong community management strategy, providing a continuous feedback loop and enabling translation of knowledge into influence and policy. Ensuring member engagement, encouraging feedback from members and continuously evaluating both what the members can gain from the group and what the group can provide to the broader community are essential for a healthy COP. However, care should also be taken to avoid being narrowly focused when engaging with COPs: the COP needs to include broad representation of the people it serves, and

members need to feel that their contributions are valued and will impact interventions. When starting a COP, establishing trust is vital for maintaining impactful and long-term collaboration.

A challenge around COPs is that donors are often focused on numbers (i.e., the measurable impact of interventions). Hence, it is important to work with donors to ensure that they understand the value that COPs contribute to the community beyond the numbers. Other challenges include ensuring that the COP adds value, and defining what differentiates it from other COPs, as new COPs are frequently established. To that end, forming a long-term plan is important, as is deciding if or when to form subgroups, merge with other COPs working in parallel, and establishing a transition plan to end the COP if the group loses energy or members decide the group is no longer necessary.

There was also discussion around global COPs, which can help us understand different cultures, contexts and languages and recognize that different COPs will have different needs (e.g., in terms of IT, platforms, time input) in order to be sustainable. Global COPs help facilitate global knowledge sharing and collaboration but may need a different design to enable communication over different time zones and geographies (e.g., online and offline working methods) and this is something requiring further exploration.



We are currently living in what we are calling an “infodemic” era, that is, a time when public health issues are accompanied by overwhelming amounts of false or misleading information. Another major theme of the conference was looking at tools to fight the infodemic, how to build capacity for online users to identify misinformation, and how social media can be harnessed for good. The topic was also discussed as part of a technical working group “Fighting the Infodemic and Harnessing Social Media for Good”, which looked at approaches that examine, evaluate, and deploy social and digital media strategies to improve confidence in vaccines and vaccination.

“We’re not just fighting an epidemic; we’re fighting an infodemic. Fake news spreads faster and more easily than this coronavirus and is just as dangerous.”

Tedros Adhanom Ghebreyesus, WHO Director-General

8. Misinformation flourishes in the absence of quality information, particularly on social media, and agile research practices are needed to fill information voids

There are high rates of vaccine-related misinformation circulating globally, which disproportionately affect marginalized populations who often have poorer trust and exposure to official health information sources.^{41,42,43} Common myths and misinformation around COVID-19 and vaccines span safety issues (e.g., vaccines cause infertility in one or both sexes,^{44,45} vaccines are unsafe,⁴² cause deaths⁴⁴), government conspiracies (COVID-19 is a government hoax,⁴⁶ tracking microchips are implanted during vaccination⁴⁴) and religious concerns (vaccines are against the will of God/cause you to become marked by the devil^{44,47}). VARN2022

research presentations with communities in Pakistan,⁴² Guatemala⁴⁴ and Uganda⁴⁸ all found high levels of misinformation around vaccines, which shows the infodemic affects vaccine acceptance across global regions.

The infodemic has also diminished people’s trust in traditional sources of information, in particular the government/public health officials and healthcare workers, as discussed in the first key learning of Theme 1. Freddy Kitutu, PhD, MPH, MA, (School of Health Sciences, Makerere University, Uganda) reported research that 17–29% of those surveyed in Buikwe District, Uganda believed some conspiracy theory around government involvement in the COVID-19 pandemic and/or that information is being withheld from the population on a systemic level.⁴⁸

Social media was highlighted as a particular driver of misinformation. There are now an estimated 4.62 billion social media users⁴⁹ and under certain circumstances, false information spreads more quickly than true information over social media, particularly during times of uncertainty and threat.^{50,51} Automated “bot” accounts are a particular problem as they can maliciously amplify topics and spread disinformation. On Twitter alone, there are thought to be hundreds of millions of bot accounts.⁵² There was discussion of how social media platforms are not being held responsible for the content that is being posted, and consequently there is a need for stakeholders in public health to put more pressure on social media platforms to filter promoted content.

Structural issues in research and policy can also contribute to the infodemic, as the timeframe required for ethical approvals of research protocols and to subsequently conduct and publish research findings is substantial. This lengthy process creates information voids, which can quickly give rise to “bad actors” answering public informational needs in the interim. The scale of the internet and social media

– with growing digitization among lower-income settings – means that misinformation can spread rapidly during these information voids, by actors with large platforms who can rapidly amplify harmful or misleading messages.

Furthermore, attitudes and perceptions regarding vaccinations within different communities are not static and can vary quickly. By the time research findings and recommendations are published, they could already be stale and/or irrelevant. There is therefore a need to balance scientific rigor with faster outputs to ensure findings are available to the public in efficient and accessible formats before misinformation becomes stable and attitudes and perceptions shift. Supporting this aim will require faster implementation of evidence-based interventions, use of research frameworks and providing people with practical tools to combat misinformation (discussed further in Theme 4).

An example of a rapid evaluation approach developed by the United Nations Children’s Fund (UNICEF) was shared at the conference. UNICEF’s Community Rapid Assessment (CRA) is a real-time evaluative approach to inform COVID-19 programming, enhance learning/evidence-generation and provide social and behavioral insights.⁵³ The CRA has been implemented in Eastern and Southern Africa and Southern Asia. The CRA is a survey with a standard module design, which also includes space for country adaptations. Each CRA contains around 20 questions on average and can be conducted over 20 minutes through an interactive voice response system. The CRA facilitates rapid data collection for authorities, development partners and health workers to encourage health behaviors and facilitate decision-making. Findings from application of the CRA in Eastern and Southern Africa between June 2020 and June 2021 found that the approach enabled UNICEF to provide rapid insights to support the pandemic response.

There is also a need for agile research practices to keep up with the new information age and allow the rapid sharing of insights. Recognizing that people like to watch engaging, well-made content online – for example TikTok videos – leveraging these approaches will be important to combat

misinformation in online spaces.

9. There is a need to build capacity and train infodemiologists to identify and combat misinformation

Building capacity for people to spot and combat misinformation is central to tackling the infodemic. This can be achieved through both the dissemination of tools to combat misinformation broadly and training so called “infodemiologists” – health information experts who can recognize and combat misinformation. Infodemiologists act as liaisons between different stakeholders in public health communication and the community to impact the overall information environment. In online settings, these experts can take the role of moderators, shaping conversations that may be veering outside of community norms (for example, on a large Facebook group where false information is being widely discussed). Infodemiologists can also work as translators, reframing discussions to promote engagement and understanding instead of divisiveness, and as role models – providing empathetic, non-judgmental listening to community issues. As such, the required skill sets of an infodemiologist may be broad and a range of stakeholders can be called to action – health workers, community leaders, field epidemiologists – but importantly they need to be trusted by the community, have strong communication skills and be willing to act as liaisons.

Countries are establishing capacities for infodemic management. In a survey conducted by WHO,⁵⁴ 87% of countries report that they are tracking and addressing the infodemic and health misinformation and 67% have a designated team for this purpose. However, only 56% of countries have infodemic management capacities in the Ministry of Health.

WHO has a dedicated infodemic management team which has been working to develop tools, training and support to meet the needs of field infodemiologists and provide evidence-informed policies and systems to prevent harm from infodemics. In collaboration with partners, WHO has developed an infodemic management training toolbox, which includes several different approaches to support capacity building, health

system strengthening and developing communities of practice. The toolbox includes a self-paced, open online training “Infodemic Management 101” as well as offline, “train the trainers” workshops and technical capacity building at the country level (Figure 11)

Figure 11.
Capture of Simulation Module from the
WHO Infodemic Manager Training.



Source: Presentation by Tina Purnat, MS, “WHO Preparedness and Prevention of Infodemic Harms: Infodemic Management Training Programme and Inoculation Innovations”

The WHO infodemic manager training is a unique training program, co-sponsored by the US Centers for Disease Control and Prevention (US CDC), UNICEF and the Collective Service for Risk Communication and Community Engagement (RCCE), focused on training experts from a variety of backgrounds, to learn and practice on emerging topics, strategy development, and policy implications in infodemic management. The training includes a number of interactive sessions and small group work to simulate a deployment to a country, with the team tasked with responding to fictitious scenarios that play out in real time. So far, over 750 infodemic managers have been trained through the project across 132 countries – including colleagues in health, academia and civil society organizations – who are supporting each other in communities of practice after the training has been completed.

Based on the success so far, a fourth training is planned for June 2022 to train deployers to add capacity at the country level and address critical country needs. The training is sponsored by Gavi and will leverage the combined expertise of partners –

the US CDC, UNICEF and the Vaccination Demand Hub. WHO is willingly sharing the framework and tools to anyone interested and able to support the initiative. Similar initiatives will be important in empowering infodemiologists working in the field through harmonized tools and learnings.

It is important to note that anyone willing to invest the time to address the issue, should be tapped as a resource, particularly in settings where there may be fewer people with past experience of countering misinformation. In LMICs, community-level experts will be particularly important, to reach people who may be underserved by official health infrastructure. Presenters at the conference shared how community influencers – e.g., religious leaders, informal healthcare workers – are often a primary source of information around vaccination.^{55,56} As such, community influencers have the power to identify misinformation circulating in a community, and work to develop and disseminate counter-messaging that they know will have a positive influence on their community.

10. Social media and digital health platforms can be leveraged to combat the infodemic through approaches that have the right appeal, message and messenger

Social media is a major driver of misinformation but should also be viewed as a powerful tool to help combat the infodemic. A number of presentations at the conference shared research on key attributes of health communications that resonate with audiences and encourage vaccine uptake. As vaccine acceptance varies by context, population and time, public health messaging must be persuasive and tailored with the right informational message, with the most successful appeal, and shared by the most influential messenger using the best method of delivery for the setting. Identifying the right message and messenger requires understanding of the causes of vaccine hesitancy and the sociocultural environment (as discussed in Theme 1). Given the range of methods available today – from old-fashioned pamphlets to websites and micro-targeted social media content – it is also critical to understand which formats will reach and resonate best with the target population.

A presentation by Daniel Erchick, PhD, MPH, (Johns Hopkins Bloomberg School of Public Health, USA) provided insights into which message appeals are most persuasive to nudge vaccine-hesitant individuals to accept a vaccine.⁵⁷ A scoping review identified that common appeals were mostly health outcome-focused, but other common approaches were a gain/loss framing or adverse events focused. A subsequent online survey conducted in India found that the majority of respondents preferred messages delivered by healthcare providers using health outcome messaging. Dena Gromet, PhD, (University of Pennsylvania Behavior Change for Good Initiative, USA) also shared findings from two mega-studies on effective “nudge” strategies to boost flu vaccination rates that could be applied to COVID-19 vaccines.⁵⁸ It was found that two reminder messages encouraging people to go for their flu shots using the wording that it was either “reserved for you” or “waiting for you” boosted vaccination at doctor or pharmacy visits substantially, at nearly zero cost.

Other research, shared at the conference by Rajiv Rimal, PhD, MA, (Johns Hopkins Bloomberg School of Public Health, USA)⁵⁹ and in a poster presentation,⁶⁰ looked at how different YouTube videos on COVID-19 vaccines could promote COVID-19 vaccination in Odisha, India. Overall, the videos were found to be an effective tool to communicate information on vaccination in an entertaining manner, using relatable characters and high production values. Specifically, the video using a “humorous appeal” appeared to be the best strategy to reduce skepticism. However, humorous messaging in a chatbot was found to test poorly, as it was perceived as “mocking” and “condescending” – potentially because humor is harder to convey authentically in a chatbot versus a short video.⁶¹ Instead, empathy-led chatbot messages were the best rated by test participants. The importance of empathy was highlighted across the conference as critical to connect with people and build trust so that health messages resonate.

Social listening, the process of identifying what is being discussed within a community, was also pinpointed as an important tool to combat misinformation both online and offline. Social

listening is essential in understanding people’s concerns, questions and information gaps that need addressing in a timely manner to avoid having the space filled with misinformation.

Social listening within social media and other online platforms has become a key strategy for harnessing useful information to inform global health campaigns, including the structuring of health communications. Through the extraction and analysis of social media platform aggregate data, social listening strategies allow for a data-driven understanding of public conversations and related attitudes, perceptions and beliefs by topic popularity, stratified not only by population socio-demographics but geospatially, allowing for cultural and community context. Social listening is important as it generates necessary data that can be turned into insights to inform the type of interventions best suited for a particular problem in a particular community of focus.

For example, if a particular message and messaging appeal is identified, and it is known that the majority of the community owns smartphones with access to applications like Facebook, a communications campaign to disseminate the messaging using Facebook advertisement credits may be successful.⁶² Conversely, if the community is not present on Facebook, but rather commonly circulates video clips on WhatsApp, evidence has shown that disseminating a short video of community influencers promoting vaccination would be advantageous.⁶³

Another presentation by Abdul Momin Kazi, MBBS, MPH, (Aga Khan University Department of Pediatrics and Child Health, Pakistan) looked at the role of digital media in the dissemination and communication of COVID-19 information in Pakistan.⁶⁴ The study identified the significant role of mHealth, social media and electronic media in information sharing around the COVID-19 pandemic and COVID-19 vaccination among healthcare providers and caregivers in the country. As such, Dr. Kazi recommended designing low-cost digital health solutions, such as mobile phone-based caller tunes, text and automated call-based messages to overcome barriers to COVID-19 vaccination.

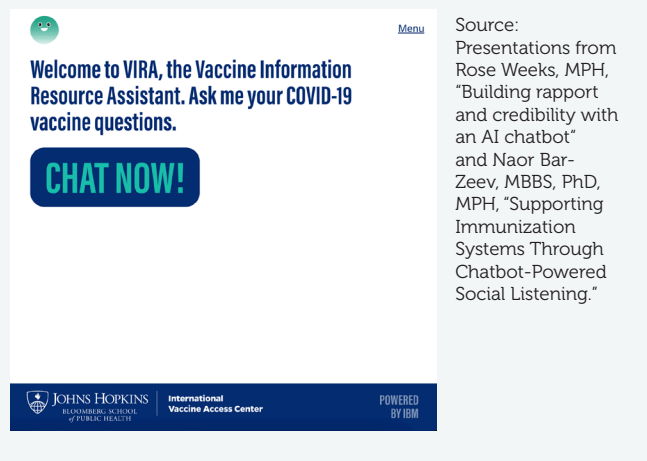
Dr. Kazi also recommended investment in personalized training for healthcare providers and frontline healthcare workers using digital health tools and interventions to increase vaccine awareness and advocacy in the community.

While social media and digital health strategies are far reaching and widely successful, it was also pointed out that a framework is needed around the ethical considerations for social listening and subsequent targeted interventions, to avoid the perception of unethical influence from public health in online spaces.

11. Training and science-based gaming can be effective tools to fight the infodemic

Across the conference, presenters shared specific applications, courses and games that have been developed to fight the infodemic. These interventions aim to engage and encourage users to identify misinformation, develop interpersonal communication skills to support conversations around COVID-19 vaccination, and provide tips and training to combat misinformation in real life.

Figure 12.
VIRA chatbot interface



The first of these is an artificial intelligence chatbot, developed by Johns Hopkins University, to provide trustworthy information on COVID-19 vaccines.⁶¹ The chatbot, named VIRA, is adaptive and listens to users' questions and provides immediate answers (Figure 12). The chatbot can be accessed on

[Vaxchat.org](https://vaxchat.org) via embedded code or WhatsApp. The chatbot is targeted at vaccine advocates, who can either use the chatbot for reference or share it with community members, and unvaccinated individuals, who can use the chatbot to ask questions and query misinformation that they may have encountered.

The use of short, online games is another strategy that holds promise to combat misinformation by allowing people to practice critical thinking. John Cook, PhD, (Monash University Climate Change Communication Research Hub, Australia) presented the "Cranky Uncle" game (<https://crankyuncle.com>), which aims to combat misinformation using inoculation theory.⁶⁵ In the case of misinformation, inoculation theory refers to the concept that exposing people to a weakened form of misinformation builds up their immunity ("mental antibodies"), so that when they encounter actual misinformation, they are less likely to be misled. The free game, accessible by smart phone, uses a "cranky uncle" cartoon figure who mentors players throughout the game and explains techniques used by science denialists, using humorous examples in analogous situations (Figure 13). The first version of the game was launched in December 2020, followed by a multi-language version in January 2022. A newer version is expected to launch in mid-2022 and will be a standalone version focused on vaccine misinformation.

Figure 13.
Snapshot of the Cranky Uncle game



Source: Presentation by John Cook, PhD, "Using Gamification to Combat Misinformation: Cranky Uncle, Vaccine Module."

Other games to teach people about online misinformation include Bad News and Go Viral!, both developed by the Social Decision-Making Laboratory at the University of Cambridge.⁶⁶ Both games leverage social psychology to teach users how to identify misinformation in around five minutes. The games are based on pre-bunking theory, which is a component of inoculation theory. This approach works by exposing people to weakened examples of false information strategies, so they can subsequently identify and refute false information techniques when encountered in real life. However, the need to translate strategies offline was discussed, as certain segments of society (for example, the elderly) are less likely to be online.

Johns Hopkins University has also developed a project to provide frontline health workers with training to identify and respond to misinformation in their communities, based on Go Viral! and Bad News.⁶⁷ The training is grounded in behavioral theories, including inoculation and pre-bunking, and incorporates evidence-based strategies for effective communication with vaccine-hesitant

individuals. Training comprises three core modules: misinformation basics, discussing misinformation with others, and debunking misinformation online, and takes about one hour to complete. The training is available for free on Coursera⁶⁷, and those who complete the training can earn a certificate of completion through the Johns Hopkins School of Public Health.

In addition, Johns Hopkins University has developed a free course on how to talk to peers about vaccines, focusing on using empathy to build trust.⁶⁸

Overall, it is important to have tools that are accessible and designed for the general population, as well as those designed to address the information and training needs of specific populations (e.g., healthcare workers). The importance of ensuring that games and trainings are also adapted for different cultures was discussed at the conference (for example, translating tools into different languages, and using images that are representative of the target population).



Increasing vaccine confidence and acceptance requires tools to understand the specific determinants of related barriers in different populations, which can then inform tailored strategies, alongside monitoring and evaluation to assess the impact and sustainability of the interventions. This theme of the conference looked at the frameworks that have been developed to support these efforts and outlines the current “best” practices and the importance of standardization, where appropriate, for data integrity.

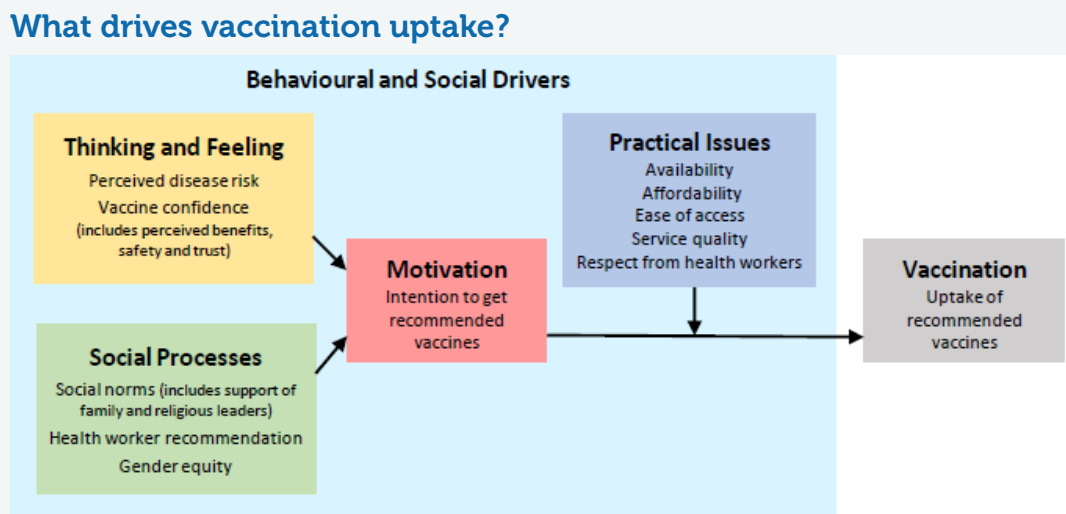
12. There are key social and behavioral drivers of vaccine uptake that can be targeted in communications for change

Establishing effective frameworks is critical when aiming to understand drivers of vaccine acceptance in different populations and develop appropriate, impactful solutions. Lisa Menning, MSc, (WHO Headquarters Department of Immunization, Vaccines, and Biologicals) shared the work conducted by WHO to understand the behavioral and social drivers of vaccine uptake and the tools developed to support programs in measuring and addressing these factors.⁶⁹ In 2018, the WHO working

group “Measuring Behavioural and Social Drivers (BeSD) of Vaccination” was established with core partners around the world to oversee this initiative.

Recognizing that the causes of low vaccine uptake are poorly measured, the working group sought to develop an evidence-based framework that could be utilized to measure and address hesitancy in ways that are tailored to the local setting. The BeSD framework constitutes four key domains which can be used to evaluate and understand reasons for under-vaccination (Figure 14). The four key domains, which largely follow the domains of the Increasing Vaccination Model,⁷⁰ are 1) Thinking and feeling, 2) Social processes, 3) Motivation (or hesitancy), and 4) Practical factors. The “Thinking and feeling” domain covers perceived disease risk and vaccine confidence, while the “Social processes” domain covers social norms around vaccination, health worker recommendation and gender equity. Factors included in these domains feed into the “Motivation” domain (i.e., the intention to get recommended vaccines). The final domain, “Practical issues,” looks at issues of vaccine availability, affordability, ease of access, as well as service quality and respect from health workers.

Figure 14. The WHO Behavioural and Social Drivers (BeSD) Framework.



Source: World Health Organization. Available at: <https://www.who.int/teams/immunization-vaccines-and-biologicals/essential-programme-on-immunization/demand>

The WHO working group subsequently developed and validated a set of tools to support programs and partners in measuring and addressing reasons for vaccine hesitancy, and for the systemic monitoring and evaluation of data over time. The tools include quantitative surveys, qualitative interview guides, and practical implementation guidance to support partners with planning data collection, data analysis, and use, as part of program activities. The tools were initially developed for childhood vaccination and COVID-19 vaccination, with a focus on keeping the guidance as actionable as possible. The development process was comprehensive and included field testing, validation of the tools, and feedback from implementers. The tools contain a number of priority indicators that correspond to each of the four domains, which can be used for routine monitoring and tracking trends over time. The resources also include promising interventions shown to increase vaccine uptake by domain.

The WHO's Strategic Advisory Group of Experts (SAGE) has subsequently recommended that programs systematically gather and use data on behavioral and social drivers of vaccine uptake as part of their routine program activities. The final tools and guidance are on the WHO website.⁷¹

“SAGE recommended the systematic gathering and use of data on BeSD to assess the reasons for low uptake, periodic monitoring of trends.”⁷²

A presentation by Helena Ballester Bon, MA, (UNICEF Eastern and Southern Africa Regional Office, Social and Behavior Change Section) demonstrated the application of the BeSD framework in assessing COVID-19 vaccination in Eastern and Southern Africa.⁷³ Insights included that there was dissonance between confidence in the benefits of vaccination and trust in the vaccines. For example, although most respondents thought the vaccine was very important for health, less than 30% would “trust it very much.” In addition, descriptive social and workplace norms around vaccination were not well established, with respondents underestimating the number of their peers who would take the vaccine if recommended. Factors under the social processes

domain were found to be the best predictors of motivation to vaccinate. The findings helped to inform recommended actions, which included reinforcing trust-building interventions, publicizing pro-vaccination social and work norms, and facilitating vaccine access.

13. Best practices need to be established for data collection, reporting and database harmonization

To understand both the barriers and drivers of vaccine acceptance in a community, we need to be able to collect quality data on immunization rates and vaccine access, and have standardized methods for measuring personal beliefs, perceptions, and cultural sentiments. However, challenges around how data are collected, reported and harmonized can compromise our understanding of, and solutions for, vaccine hesitancy. The need for best practices to ensure data integrity was a topic touched upon in conference presentations and panel discussions, and further unpacked during the technical working group “Data Integrity & the Evaluation of Best Practices.” Numerous key themes emerged.

First, there's a need to improve data quality and confidence in the data collection process, with consideration of different biases that may affect our collection methods. For example, is there oversampling of certain populations, which could affect the overall generalizability of the research findings? Are people likely to be truthful when asked about vaccination? The second point is particularly important as social and cultural norms can affect how people answer surveys and lead to underreporting or over-reporting or may introduce biases. For example, the effect of stigma around having a certain disease, or gender dynamics, may influence an individual's agency in truthfully answering a healthcare survey. Building data at the national level can miss a lot of these nuances, highlighting the importance of collecting data at the local level, using tools tailored for the specific setting (for example, developing surveys specifically targeted at women, with consideration of how best to reach them in the community). Pooling data from different datasets to create a richer picture of communities was also suggested as helpful, particularly for

emergency response situations. Machine learning (i.e., software that can automatically improve by learning from data) was noted as being potentially useful for this purpose. An example of utilizing machine learning combined with survey and satellite data to tailor mass vaccination campaigns is discussed in key learning 14.

WHO is working to support programs in the collection and use of data in routine planning, implementation, and evaluation practices. As part of this initiative, WHO is developing a number of tools to help facilitate better data collection, such as templates to convert findings into charts and briefing notes on evidence-based interventions which have been shown to increase vaccine uptake.

Secondly, careful consideration of privacy and confidentiality is needed when dealing with issues of vaccine hesitancy. As discussed by Claire Thomas, BSc, (Minority Rights Group International),⁷⁴ surveys should ideally include information on ethnicity, language, and religion to inform locally and culturally sensitive strategies to increase vaccine uptake. However, there may be some settings where it is not appropriate to disaggregate data (for example when working with minority groups where identification could put them in danger). As such, it is essential that privacy concerns are taken into account and that databases are de-identified.

There was agreement that the lack of database harmonization is a particular challenge. An example was given that during the pandemic, COVID-19 vaccination records were held by each vaccine manufacturer, meaning that in some situations it was not possible to track people who had heterologous boosters. Administrative constraints in government were also highlighted as a barrier to obtaining strong data. For example, there can be issues around high staff turnover in government agencies, potentially causing loss of institutional knowledge, alongside a lack of training or standard operating procedures to ensure standardized processes. Government agencies may also be affected by resource issues, such as a lack of memory or bandwidth on government computers, which can make it challenging to process the large amounts of data that may be needed for research studies.

It was also pointed out that there is a failure to document approaches that really work, so that they can be promoted and supported. Global alliances like VARN, which bring together key players in this field, are therefore particularly important to support best practices and pooling of resources, for the greatest impact on vaccine acceptance.

14. Transdisciplinary and multi-sectoral collaboration needs to be leveraged to boost vaccine awareness and uptake

It became clear during the conference that tackling vaccine hesitancy and the infodemic requires a multi-disciplinary and multi-sectoral collaborative approach. Moving forward, we need to leverage stakeholder skillsets from disciplines such as public health, social and behavioral science, journalism, and medical anthropology, and the joint focus of academic research, civil society, as well as the public and private sectors, among others. The causes of vaccine hesitancy and the infodemic are many and varied, hence, our solutions need to be as well. Transdisciplinary collaborations like VARN will be vital in such future efforts.

A number of presentations across the conference looked at lessons learned from other health challenges and disciplines that could be applied to vaccine hesitancy. Janan Dietrich, PhD, (Bio-Behavioural Research Division Perinatal HIV Research Unit, South Africa) discussed how lessons learned from HIV candidate vaccine acceptance could be translated to COVID-19 vaccine acceptance among youth in South Africa.⁷⁵ Her work in the field of HIV highlights the vital role of community engagement in vaccine development, testing and rollout, and the importance of engaging key stakeholders and influencers, including parents and youth.

Susanne B. Montgomery, PhD, MPH, MS, (Loma Linda University School of Behavioral Health, USA) discussed how the community resiliency model (CRM) can be translated to combat vaccine hesitancy in Sierra Leone and beyond.⁷⁶ CRM is a set of six easily learned self-care skills to help people handle life stressors and bring the nervous system back into balance after a stressful life event. The model is based on resiliency development theory and

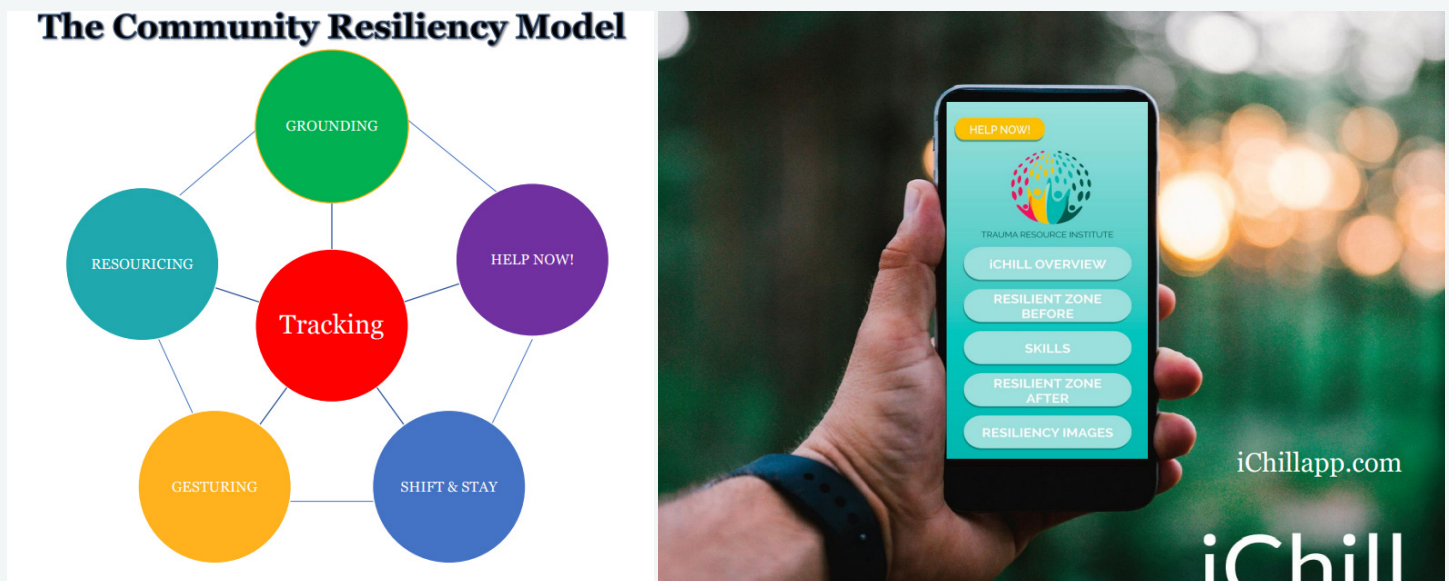
provides education on resilience development and the neurobiology of stress and trauma. In Sierra Leone, CRM was used to train people in stress and resiliency during the 2015 Ebola outbreak. The project was well received, and the intervention was found to increase resiliency and result in clinical changes in participants' measures of post-traumatic stress disorder (PTSD), depression and anxiety – with benefits there a year later. With the health workforce suffering PTSD from Ebola⁷⁷ and complacent during the COVID-19 pandemic, CRM may increase vaccine acceptance within this key population. The Trauma Resource Institute has developed a free smartphone app called iCHILL, which guides users through the use of the CRM in either English or Spanish (Figure 15).

Looking at learnings outside of public health, Rupali Limaye, PhD, MPH, MA, (Johns Hopkins Bloomberg School of Public Health, USA) presented a review of strategies used to combat climate change denialism that could be applied to vaccine-hesitant individuals or refusers.⁷⁹ Pre-bunking (pre-emptively debunking) was highlighted as a promising approach, alongside heuristics – the technique of using mental shortcuts that help people facilitate problem solving and probability judgments by reducing the cognitive load. Consensus messaging – i.e., communicating the scientific consensus – is another approach, although it was noted that the scientific consensus on politicized issues does not always neutralize the effect of people's political worldviews.

“Resiliency is an individual’s and community’s ability to identify and use individual and collective strengths in living fully with compassion in the present moment, and to thrive while managing the activities of daily living.”

Elaine Miller-Karas, 2020⁷⁸

Figure 15. The six skills of the community resiliency model and the iChill app








Source: <http://www.ichillapp.com> and <https://www.newcomersaccesscenter.org/wp-content/uploads/2020/10/Community-Resiliency-Model-NAC-.pdf>

There was also discussion about how private sector techniques can be leveraged for public health initiatives. It was pointed out that many social, behavioral and market research approaches have been long-used in the commercial sector to understand and micro-target customers. Sunny Sharma, MSc, (Ipsos MORI) described the use of attitudinal segmentation to support public health initiatives in sub-Saharan Africa.⁸⁰ Attitudinal segmentation is a practice borrowed from the commercial sector, which clusters people together with similar attitudes and behaviors. This allows public health programs to focus and tailor the most impactful messaging to those who need them the most and has shown promise in the initiatives in sub-Saharan Africa (Figure 16).

Kenneth Davis, MA, (Fraym) also discussed the use of geomapping data analytics to assist governments in tailoring mass vaccination campaigns.⁸¹ Fraym is a small technology company that uses survey and satellite data with machine learning to produce spatially precise, granular information on people in countries all around the world, to support governments, multilateral organizations, non-governmental organizations, and partners. The approach provides neighborhood and community-level data, even in rural and remote areas, enabling a holistic view of the profiles of vaccine-hesitant people, to understand underlying drivers (Figure 17).

Figure 16. Attitudinal segmentation applied to COVID-19 vaccines

Meet the segments

	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5
% of population	24%	25%	12%	19%	20%
					
Summary	Convinced of COVID threat and vaccine benefits. Would be quick adopters driven by social responsibility to protect their community.	Convinced of COVID threat, but scepticism around vaccine safety and efficacy inhibits perceived benefit and quick uptake.	Strongly hesitant of COVID threat and a COVID vaccine. Mistrust in the vaccine's purpose and advocates means they will be slow to vaccine adoption, if at all.	Convinced of COVID threat and merits of a vaccine, but inhibited by practical barriers. Cost-benefit analysis of the process could cause uptake delay.	Not convinced of the threat of COVID as a disease and lack motivation to seek a vaccine, but few barriers to uptake. Could be moved by social norms and strong messaging.
Likelihood to take a COVID-19 vaccine	Highly likely (98% willing)	Neither likely nor unlikely (55% willing)	Highly unlikely (0% willing)	Highly Likely (98% willing)	Fairly likely (76% willing)
Speed of uptake	As soon as possible	Wait at least 6-12 months	Never	As soon as possible	Wait at least 6-12 months
Perceived ease of getting the vaccine	Very easy	Fairly easy	Fairly easy	Not easy/not at all easy	Fairly easy
COVID disease perceptions	High perceived risk and severity	High perceived risk and severity	Low perceived risk and severity	High perceived risk and severity	Low perceived risk and severity
3 C's	Convenience, Confidence	Confidence	Confidence, Complacency	Convenience, Complacency	Complacency

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Source: Presentation from Sunny Sharma, MSc, "Using Attitudinal Segmentation to Support Public Health Initiatives in sub-Saharan Africa: Case Studies in Kenya, Nigeria and Zambia"

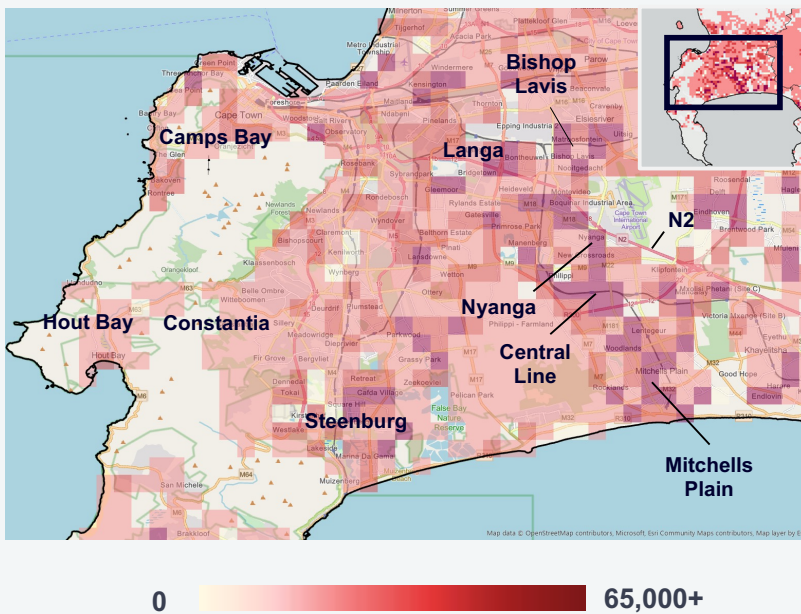
Figure 17.
Use of geomapping data analytics and machine learning to map vaccine hesitancy

VACCINE HESITANCY

Identification and Targeting

Fraym’s hyper-local data uncovers neighborhood-level patterns that are critical for identification and targeting. In the greater Cape Town area, vaccine hesitancy is largely tied to socioeconomic status.

Cape Town: Number of Somewhat Hesitant Adults¹



- 1** In Cape Town, concentrations of somewhat hesitant adults are highest along the N2 highway and Cape Flats townships.
- 2** Primarily black, low-income neighborhoods such as **Khayelitsha, Mitchells Plain, Nyanga, Langa, Bishop Lavis, and Steenburg** have the highest concentrations of somewhat hesitant adults.
- 3** Wealthier areas such as **Camps Bay, Hout Bay, and Constantia** have much lower concentrations of somewhat hesitant adults.

Note 1: Fraym defines the ‘somewhat hesitant’ as those South Africans over the age of 18 years who do not know if they will get a COVID-19 vaccination if or when one becomes available.

Source: Fraym nationally representative online panel of 8,028 South African adults conducted April 9-23, 2021.

Source: Presentation by Kenneth Davis, MA, “Using Geomapping Data Analytics to Assist Governments in Tailoring Mass Vaccination Campaigns”

Recognizing the diverse and complex causes of vaccine hesitancy, it’s clear that transdisciplinary, multi-sectoral research is needed to guide the various vaccine acceptance strategies moving forward. In particular, social and behavioral sciences

can bridge the gaps between various disciplines but there needs to be pathways in place to ensure evidence can inform decision-making in a timely manner.

LOOKING AHEAD

VARN2022: Shaping Global Vaccine Acceptance with Localized Knowledge has provided a wealth of insight into the drivers of and strategies to increase vaccine acceptance relating to COVID-19 and other life-course vaccinations and child routine immunization globally. We hope that the discussions held during VARN2022 will enhance the work being undertaken and foster collaboration to bring about meaningful changes around vaccination practices and policy. It is clear that we need a human-centered approach to address vaccine hesitancy, one which places people and their communities at the center and delivers tailored solutions to drive confidence in vaccines.

The discussions at VARN2022 also highlighted the importance of engaging multi-sectoral and transdisciplinary perspectives, tools and systems in our work. The introductory and exploratory

discussions held within the four concurrent technical working group sessions have allowed for the identification of key priorities to guide future vaccination acceptance research agendas, actions, and implementation.

In looking ahead, we can confidently share that the insights gathered at VARN2022 will set the stage for the development of a roadmap for research, policy making, and program decision-making in the future, including the formal creation of TWGs, to assist in the optimization of vaccine acceptance, demand, uptake, and health outcomes.



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- Presentation by Philip Wollburg, MSc, Data Production and Methods Unit, World Bank: Attitudes Towards COVID-19 Vaccination in sub-Saharan Africa.
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- Presentation by Ahmed Mushfiq Mobarak, PhD, MA, Yale University School of Management, USA: Last-Mile Delivery of COVID vaccines: Field Trials in Sierra Leone, Bangladesh, and India.
- Keynote Address – Robert Kanwagi, MPH, Consultant for Gavi, the Vaccine Alliance – Demand Generation For COVAX: Understanding Vaccine Acceptance: Why It Matters, How It's Differentiated and Key Drivers.
- Presentation by Benson Wamalwa, PhD, MSc, and Caroline Aura, PhD, University of Nairobi, Kenya: A Community-led Virtual Intervention to Mitigate COVID-19 Misinformation and Increase COVID-19 Vaccine Acceptance in Kenya.
- Presentation by Nadine Skinner, PhD, MPA, Stanford Center for Health Education, Digital Medic, USA and Anne Kraemer Diaz, MA, Maya Health Alliance: Understanding Vaccine Acceptance in Indigenous Populations in Southern Guatemala.
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- Presentation by Rubina Qasim, MSc, Institute of Nursing, Dow University of Health Sciences, Pakistan: Using a Co-Design Approach in Designing and Testing Socio-Behavioural Interventions To Counter COVID-19 Related Misinformation and Its Impact on Potential COVID-19 Vaccination in Karachi, Pakistan.
- Presentation by Nadine Skinner, PhD, MPA, Stanford Center for Health Education, Digital Medic, USA and Anne Kraemer Diaz, MA, Maya Health Alliance: Understanding Vaccine Acceptance in Indigenous Populations in Southern Guatemala.
- Poster presentation by Chijoke Kaduru et al. Using Community Theatre to Improve Demand for Vaccination Services from November 2019 to May 2021 in the Niger Delta Region of Nigeria.
- Poster presentation by Eliza C. Squibb, Mika Kondo Kunieda. The Vaccination Calendar Baby-Wrap: A human-centered textile design to engage mothers in timely completion of childhood vaccinations in Niger, West Africa.
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- Presentation by Benson Wamalwa, PhD, MSc, and Caroline Aura, PhD, University of Nairobi, Kenya: A Community-led Virtual Intervention to Mitigate COVID-19 Misinformation and Increase COVID-19 Vaccine Acceptance in Kenya.
- Presentation by Nadia Diamond-Smith, PhD, MSc, Department of Epidemiology and Biostatistics and Institute for Global Health Sciences at the University of California San Francisco, USA and Preetika Sharma, PhD, Postgraduate Institute of Medical Education and Research: Why are Pregnant and Breastfeeding Women in Rural India Who Want the COVID-19 Vaccine Not Getting Vaccinated?
- Presentation by Rubina Qasim, MSc, Institute of Nursing, Dow University of Health Sciences, Pakistan: Using a Co-Design Approach in Designing and Testing Socio-Behavioural Interventions To Counter COVID-19 Related Misinformation and Its Impact on Potential COVID-19 Vaccination in Karachi, Pakistan.
- Presentation by Baldeep Dhaliwal, MSPH, Johns Hopkins Bloomberg School of Public Health: Community-Centric Methods to Support Marginalized & Hard-to-Reach Populations.
- Presentation by Janan Dietrich, PhD, Bio-Behavioural Research Division Perinatal HIV Research Unit, South Africa: Translating lessons of HIV vaccine acceptance to COVID-19 vaccines among youth in South Africa.
- Comment by Ashima Gulati, B.A., LLB (Hons.), in Moderated Discussion of VARN2022 session: Cross Pollination and Translational Research: Moving Findings into Policy & Practice. March 2, 2022.
- Presentation by Corrina Moucheraud, ScD, MPH, University of California Los Angeles Fielding School of Public Health, USA: Barriers Towards HPV Vaccine Acceptance in Malawi.
- Presentation by Alexandra Michel, MPH, Johns Hopkins Bloomberg School of Public Health, USA: How Does Training Focused on Equipping Individuals with Skills To Identify and Reject Vaccine Misinformation Affect Vaccine Information Seeking?
- Presentation by Helena Ballester Bon, MA, UNICEF Eastern and Southern Africa Regional Office, Social and Behavior Change Section: Measuring BeSD of COVID-19 Vaccination, UNICEF Application of Globally Standardized Data Collection Tools in Eastern and Southern Africa.
- Presentation by Philip Wollburg, MSc, Data Production and Methods Unit, World Bank: Attitudes Towards COVID-19 Vaccination in sub-Saharan Africa.
- Presentation by Ashima Gulati, B.A., LLB (Hons.), and Avani Airan, B.A., LLB (Hons.), #HumHongeKaamayaab, India: Vaccination Uptake in Marginalised Communities in India: An Analysis of Government and Civil Society Interventions to Address the Gender and Economic Divide in Accessing Free COVID-19 Vaccines.
- Poster presentation by Miyola Fernandes et al. Factors leading to vaccine hesitancy in women and using social media to promote vaccine uptake—a community-based project in Rajasthan, India.
- Presentation by Corrina Moucheraud, ScD, MPH, University of California Los Angeles Fielding School of Public Health, USA: Barriers Towards HPV Vaccine Acceptance in Malawi.
- Presentation by Ruth Carlitz, PhD, Tulane University, Department of Political Science, USA and Thespina Yamanis, PhD, MPH, American University, School of International Service, USA: Challenges to and Opportunities for Rolling Out the COVID-19 Vaccine in Tanzania.
- Presentation by Nadia Diamond-Smith, PhD, MSc, Department of Epidemiology and Biostatistics and Institute for Global Health Sciences at the University of California San Francisco, USA and Preetika Sharma, PhD, Postgraduate Institute of Medical Education and Research: Why are Pregnant and Breastfeeding Women in Rural India Who Want the COVID-19 Vaccine Not Getting Vaccinated?
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- Poster presentation by James Bell et al. The Role of Fathers in Uptake of Early Childhood Vaccination in Nigeria, Uganda, and Guinea.
- Presentation by Daniel Erchick, PhD, MPH, Johns Hopkins Bloomberg School of Public Health, USA: What Message Appeals Are Most Persuasive To Nudge Vaccine-Hesitant Individuals To Accept A Vaccine? Pilot Message Testing in Kenya, India, Ukraine, Nepal.
- Presentation by Rubina Qasim, MSc, Institute of Nursing, Dow University of Health Sciences, Pakistan: Using a Co-Design Approach in Designing and Testing Socio-Behavioural Interventions To Counter COVID-19 Related Misinformation and Its Impact on Potential COVID-19 Vaccination in Karachi, Pakistan.
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54. Presentation by Tina Purnat, MS, World Health Organization Department of Epidemic and Pandemic Preparedness and Prevention: WHO Preparedness and Prevention of Infodemic Harms: Infodemic Management Training Programme and Inoculation Innovations.
55. Presentation by Rubina Qasim, MSc, Institute of Nursing, Dow University of Health Sciences, Pakistan: Fighting the Infodemic & Harnessing Social Media for Good.
56. Presentation by Baldeep Dhaliwal, MSPH, Johns Hopkins Bloomberg School of Public Health: Community-Centric Methods to Support Marginalized & Hard-to-Reach Populations.
57. Presentation by Daniel Erchick, PhD, MPH, Johns Hopkins Bloomberg School of Public Health, USA: What Message Appeals Are Most Persuasive To Nudge Vaccine-Hesitant Individuals To Accept A Vaccine? Pilot Message Testing in Kenya, India, Ukraine, Nepal.
58. Presentation by Dena Gromet, PhD, University of Pennsylvania Behavior Change for Good Initiative: Behaviour Change for Good: Effective Strategies to Boost Vaccination Rates.
59. Presentation by Rajiv Rimal, PhD, MA, Johns Hopkins Bloomberg School of Public Health, USA: Promoting the Second Dose of the Covid-19 Vaccine in Odisha, India: The Role of Humor, Collectivistic Appeal, and Gender.
60. Poster presentation by Neil Alperstein et al. Social Network Analysis of Covid-19 Vaccine Videos in Odisha, India on YouTube: Mapping the Comment Network and Analyzing Comment Sentiment.
61. Presentation by Rose Weeks, MPH, Johns Hopkins Bloomberg School of Public Health, USA: Building Rapport and Credibility with an AI Chatbot.
62. Discussed in the "Fighting the Infodemic & Harnessing Social Media for Good" Technical Working Group.
63. Presentation by Baldeep Dhaliwal, MSPH, Johns Hopkins Bloomberg School of Public Health, USA: Establishing an Understanding of Community-Level Misinformation and the Role of Community Health Workers in Vaccine Acceptance in India.
64. Presentation by Abdul Momin Kazi, MBBS, MPH, Aga Khan University Department of Pediatrics and Child Health in Karachi: To Explore the Role of mHealth Based Interventions Including Social Media to Improve Childhood Immunization Coverage During COVID 19 Pandemic in Pakistan.
65. Presentation by John Cook, PhD, Monash University Climate Change Communication Research Hub, Australia: Using Gamification To Combat Misinformation: Cranky Uncle, Vaccine Module.
66. Presentation by Alexandra Michel, MPH, Johns Hopkins Bloomberg School of Public Health, USA: How Does Training Focused on Equipping Individuals with Skills To Identify and Reject Vaccine Misinformation Affect Vaccine Information Seeking?
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73. Presentation by Helena Ballester Bon, MA, UNICEF Eastern and Southern Africa Regional Office, Social and Behavior Change Section: Measuring BeSD of COVID-19 Vaccination, UNICEF Application of Globally Standardized Data Collection Tools in Eastern and Southern Africa.
74. Presentation by Claire Thomas, BSc, Minority Rights Group International: Disparities in Access to Routine Childhood Vaccinations: Investigating Correlations with Diversity of Ethnicity, Language and Religion.
75. Presentation by Janan Dietrich, PhD, Bio-Behavioural Research Division Perinatal HIV Research Unit, South Africa: Translating lessons of HIV vaccine acceptance to COVID-19 vaccines among youth in South Africa.
76. Presentation by Susanne B Montgomery, PhD, MPH, MS, Loma Linda University School of Behavioral Health, USA: The Community Resiliency Model and How It Could Translate to Combatting Vaccine Hesitancy in Sierra Leone and Beyond.
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79. Presentation by Rupali Limaye, PhD, MPH, MA, Johns Hopkins Bloomberg School of Public Health, USA: What Can We Learn from Climate Change Misinformation to Inform Vaccine Hesitancy Strategies?
80. Sunny Sharma, MSc, Ipsos MORI: Using Attitudinal Segmentation to Support Public Health Initiatives in sub-Saharan Africa: Case studies in Kenya, Nigeria and Zambia.
81. Kenneth Davis, MA, Fraym: Using Geomapping Data Analytics to Assist Governments in Tailoring Mass Vaccination Campaigns.



ANNEX 1.
VARN2022 CONFERENCE AGENDA

8:00 – 9:30
a.m. EST

SESSION I

WELCOME & KEYNOTE ADDRESS

Welcoming Remarks by Stacey Knobler, MSc,

Vice President, Vaccine Innovation & Global Immunization, Sabin Vaccine Institute

Introduction of the VARN: Goals & Objectives

- **Kate Hopkins, PhD, MPH,** *Director of Research, Vaccine Acceptance & Demand, Sabin Vaccine Institute*
- **Ève Dubé, PhD,** *Medical Anthropologist, Quebec National Institute of Public Health, Canada*

Keynote Address by Robert Kanwagi, MPH, *Consultant for Gavi, the Vaccine Alliance - Demand Generation for COVAX: Understanding Vaccine Acceptance: Why It Matters, How It's Differentiated and Key Drivers*

Keynote Discussion Panel, 30 minutes

Moderator: Ève Dubé, PhD, *Quebec National Institute of Public Health, Canada*

Panelists:

- **Robert Kanwagi, MPH,** *Consultant for Gavi, the Vaccine Alliance – Demand Generation for COVAX*
- **Holly Seale, PhD, MPH,** *School of Population Health, University of New South Wales, Australia*
- **Abdul Momin Kazi, MBBS, MPH,** *Aga Khan University Department of Paediatrics and Child Health, Pakistan*
- **Mónica Berger González, PhD,** *Unit of Medical Anthropology in the Center for Health Studies at Universidad del Valle de Guatemala*

Moderated Audience Q&A, 20 minutes

SESSION II

ONE SIZE DOES NOT FIT ALL: INDICATORS OF VACCINE ACCEPTANCE AND UPTAKE FROM AROUND THE GLOBE

3:00 – 4:30
p.m. EST

Moderator: Holly Seale, PhD, MPH, *School of Population Health, University of New South Wales, Australia*

Presentation Panelists

- **Ève Dubé, PhD,** *Quebec National Institute of Public Health, Canada: COVID-19 Vaccine Acceptance in Quebec, Canada: Findings of Repeated Surveys Conducted Across 5 Waves*
- **Philip Wollburg, MSc,** *Data Production and Methods Unit, World Bank: Attitudes Towards COVID-19 Vaccination in Africa*
- **Ahmed Mushfiq Mobarak, PhD, MA,** *Yale University School of Management, USA: Last-Mile Delivery of COVID vaccines: Field Trials in Sierra Leone, Bangladesh, and India*
 - **Niccoló F. Meriggi, MSc,** *International Growth Centre Sierra Leone, will join us on the live panel on behalf of Dr. Mobarak*
- **Lisa Menning, MSc,** *World Health Organization Headquarters Department of Immunization, Vaccines, and Biologicals: The WHO Behavioral and Social Drivers (BeSD) Framework*
- **Helena Ballester Bon, MA,** *UNICEF Eastern and Southern Africa Regional Office, Social and Behavior Change Section: Measuring BeSD of COVID-19 Vaccination, UNICEF Application of Globally Standardized Data Collection Tools in Eastern and Southern Africa*
- **Claire Thomas, BSc,** *Minority Rights Group International: Disparities in Access to Routine Childhood Vaccinations: Investigating Correlations with Diversity of Ethnicity, Language and Religion*

Moderated Audience Q&A, 20 minutes

8:00 – 9:30
p.m. EST

SESSION III

HARNESSING SOCIAL MEDIA FOR PUBLIC GOOD: LESSONS LEARNED FROM SOCIAL LISTENING ON SOCIAL MEDIA/MESSAGING

Moderator: Margie Danchin, MBBS, PhD, *University of Melbourne Department of Paediatrics, Australia*

Presentation Panelists

- **Daniel Erchick, PhD, MPH,** *Johns Hopkins Bloomberg School of Public Health, USA: What Message Appeals are Most Persuasive to Nudge Vaccine-Hesitant Individuals to Accept a Vaccine?*
- **Rajiv Rimal, PhD, MA,** *Johns Hopkins Bloomberg School of Public Health, USA: Promoting the Second Dose of the Covid-19 Vaccine in Odisha, India: The Role of Humor, Collectivistic Appeal, and Gender*
- **Silvia Sommariva, PhD,** *UNICEF Eastern and Southern Africa Regional Office, Social and Behavior Change: Online Conversations on COVID-19 Vaccines in Eastern and Southern Africa: A Longitudinal Analysis of Social Listening Data*
- **Jeff Mulhausen, BS,** *Upstream Thinking: Redirecting Existing Demand for Information Towards Vaccine Confident Interpretation by Identifying Online Behavioral Nudge Interventions*
- **Rose Weeks, MPH,** *Johns Hopkins Bloomberg School of Public Health, USA: Building Rapport and Credibility with an AI Chatbot*
- **Naor Bar-Zeev, MBBS, PhD, MPH,** *Johns Hopkins Bloomberg School of Public Health, USA: Supporting Immunization Systems Through Chatbot-Powered Social Listening*

Moderated Audience Q&A, 20 minutes

5:00 – 6:30
a.m. EST

SESSION I

FIGHTING THE INFODEMIC: FRAMEWORKS, TRAINING AND SCIENCE-BASED GAMING

Moderator:

Abdul Momin Kazi, MBBS, MPH, *Aga Khan University Department of Paediatrics and Child Health, Pakistan*

Presentation Panelists

- **Tina Purnat, MS**, *World Health Organization Department of Epidemic and Pandemic Preparedness and Prevention*: WHO Preparedness and Prevention of Infodemic Harms: Infodemic Management Training Programme
- **Alexandra Michel, MPH**, *Johns Hopkins Bloomberg School of Public Health, USA*: How Does Training Focused on Equipping Individuals with Skills to Identify and Reject Vaccine Misinformation Affect Vaccine Information Seeking?
- **John Cook, PhD**, *Monash University Climate Change Communication Research Hub, Australia*: Using Gamification to Combat Misinformation: Cranky Uncle, Vaccine Module
- **David Scales, MD, PhD**, *Weill Cornell Medicine Division of Hospital Medicine, USA*: Evaluation of a Geographic, Community-Focused Infodemiology Intervention Addressing COVID-19 Vaccine Misinformation on Social Media Using an Implementation Science Framework

Moderated Discussion, 20 minutes

9:00 -10:30
a.m. EST

SESSION II

CROSS POLLINATION AND TRANSLATIONAL RESEARCH: MOVING FINDINGS INTO POLICY & PRACTICE

Moderator: **Nalini Anand, JD, MPH**, *Fogarty International Center, U.S. National Institutes of Health*

Presentation Panelists

- **Rajeev Seth, MD, MBBS**, *Bal Umang Drishya Sanstha (BUDS), India*: Translating BUDS Findings Into Local Policy and Advocacy
- **Ashima Gulati, BA, LLB (Hons.)**, and **Avani Airan, BA, LLB (Hons.)**, *#HumHongeKaamayaab, India*: Vaccination Uptake in Marginalised Communities in India: An Analysis of Government and Civil Society Interventions to Address the Gender and Economic Divide in Accessing Free COVID-19 Vaccines
- **Janan Dietrich, PhD**, *Bio-Behavioural Research Division Perinatal HIV Research Unit, South Africa*: Translating lessons of HIV vaccine acceptance to COVID-19 vaccines among youth in South Africa
- **Corrina Moucheraud, ScD, MPH**, *University of California Los Angeles Fielding School of Public Health, USA*: Barriers Towards HPV Vaccine Acceptance in Malawi
- **Susanne B Montgomery, PhD, MPH, MS**, *Loma Linda University School of Behavioral Health, USA*: The Community Resiliency Model and How It Could Translate to Combatting Vaccine Hesitancy in Sierra Leone and Beyond
- **Rupali Limaye, PhD, MPH, MA**, *Johns Hopkins Bloomberg School of Public Health, USA*: What Can We Learn from Climate Change Misinformation to Inform Vaccine Hesitancy Strategies?

Moderated Discussion, 25 minutes

1:00 – 2:30
p.m. EST

SESSION III

BOOSTING VACCINATION RATES: EFFICIENTLY INFORMING MASS VACCINATION CAMPAIGNS

Moderator: **Wahdae-mai Harmon-Gray, MD, MSc**, *University of Liberia College of Health Sciences*

Presentation Panelists

- **Dena Gromet, PhD**, *University of Pennsylvania Behavior Change for Good Initiative*: Behaviour Change for Good: Effective Strategies to Boost Vaccination Rates
- **Sunny Sharma, MSc**, *Ipsos MORI*: Using Attitudinal Segmentation to Support Public Health Initiatives in sub-Saharan Africa: Case studies in Kenya, Nigeria and Zambia
- **Kenneth Davis, MA**, *Fraym*: Using Geomapping Data Analytics to Assist Governments in Tailoring Mass Vaccination Campaigns
- **Ruth Carlitz, PhD**, *Tulane University, Department of Political Science, USA* and **Thespina Yamanis, PhD, MPH**, *American University, School of International Service USA*: Challenges to and Opportunities for Rolling Out the COVID-19 Vaccine in Tanzania
- **Sofia Imad, MPH**, *Artha Global, India*: Vaccine Acceptance in Urban Slum Communities in Maharashtra

Moderated Discussion, 20 minutes | Moderated Audience Q&A, 20 minutes

8:00-10:00
a.m. EST

SESSION I

ONE SIZE DOES NOT FIT ALL: COMMUNITY-CENTRIC APPROACHES TO PROMOTE VACCINE ACCEPTANCE & UPTAKE

Moderator: Chizoba Wonodi, MBBS, DrPH, MPH, *Women Advocates for Vaccine Access (WAVA), Nigeria*

Presentation Panelists

- **Baldeep Dhaliwal, MSPH**, *Johns Hopkins Bloomberg School of Public Health, USA*: Establishing an Understanding of Community-Level Misinformation and the Role of Community Health Workers in Vaccine Acceptance in India
- **Rubina Qasim, MSc**, *Institute of Nursing, Dow University of Health Sciences, Pakistan*: Using a Co-Design Approach in Designing and Testing Socio-Behavioural Interventions to Counter COVID-19 Related Misinformation and its Impact on Potential COVID-19 Vaccination in Karachi, Pakistan
- **Freddy Kitutu, PhD, MPH, MA**, *School of Health Sciences, Makerere University, Uganda*: Using Community Influencer Groups to Address COVID-19 Misinformation and Vaccine Hesitancy in Buikwe, Uganda
- **Benson Wamalwa, PhD, MSc**, and **Caroline Aura, PhD**, *University of Nairobi, Kenya*: A Community-led Virtual Intervention to Mitigate COVID-19 Misinformation and Increase COVID-19 Vaccine Acceptance in Kenya
- **Abdul Momin Kazi, MBBS, MPH**, *Aga Khan University Department of Pediatrics and Child Health in Karachi*: To Explore the Role of mHealth Based Interventions Including Social Media to Improve Childhood Immunization Coverage During COVID 19 Pandemic in Pakistan
- **Nadine Ann Skinner, PhD, MPA**, *Stanford Center for Health Education, Digital Medic, USA* and **Anne Kraemer Diaz, MA**, *Maya Health Alliance*: Understanding Vaccine Acceptance in Indigenous Populations in Southern Guatemala
- **Nadia Diamond-Smith, PhD, MSc**, *Department of Epidemiology and Biostatistics and Institute for Global Health Sciences at the University of California San Francisco, USA* and **Preetika Sharma, PhD**, *Postgraduate Institute of Medical Education and Research, India*: Why are Pregnant and Breastfeeding Women in Rural India who Want the COVID-19 Vaccine Not Getting Vaccinated?

Moderated Discussion, 20 minutes | Moderated Audience Q&A, 20 minutes

1:00 – 2:30
p.m. EST

SESSION II

TECHNICAL WORKING GROUP BREAKOUT SESSIONS

Brief Introduction to the Technical Working Groups by Kate Hopkins, PhD, MPH, *Sabin Vaccine Institute*

Technical Working Group Breakout Sessions

- **COMMUNITY-CENTRIC METHODS TO SUPPORT MARGINALIZED & HARD-TO-REACH POPULATIONS**
Co-Chairs: Ève Dubé, PhD, *Medical Anthropologist, Quebec National Institute of Public Health, VARN Chair* & **Robert Kanwagi, MPH**, *Consultant for Gavi, the Vaccine Alliance – Demand Generation for COVAX*
- **FIGHTING THE INFODEMIC & HARNESSING SOCIAL MEDIA FOR GOOD**
Co-Chairs: Rupali Limaye, PhD, MPH, MA, *Associate Scientist, Johns Hopkins Bloomberg School of Public Health* & **Angus Thomson, PhD**, *Senior Social Scientist, Consultant for UNICEF - Demand for Immunization*
- **DATA INTEGRITY & THE EVALUATION OF BEST PRACTICES**
Co-Chairs: Sunny Sharma, MSc, *Director of Global Health, Ipsos MORI* & **Kennedy Otworld, PhD**, *Director of Statistics, Perinatal HIV Research Unit, University of the Witwatersrand, South Africa*
- **SUPPORTING COMMUNITIES OF PRACTICE NETWORKS & PLATFORMS**
Co-Chairs: Stacey Knobler, MSc, *Vice President of Vaccine Innovation and Global Immunization, Sabin Vaccine Institute* & **Anant Bhan, MBBS, MHSc**, *Principal Investigator, Sangath, Bhopal, India and Adjunct (Visiting) Professor, Centre for Ethics, Yenepoya University, Mangalore, India*

11:00 pm –
12:30 a.m.
EST

SESSION III

CLOSING SESSION

Moderator: Kate Hopkins, PhD, MPH, *Director of Research, Vaccine Acceptance & Demand, Sabin Vaccine Institute*

Read-out from Working Groups

- **Baldeep Dhaliwal, MSPH**, *Johns Hopkins Bloomberg School of Public Health*: Community-Centric Methods to Support Marginalized & Hard-to-Reach Populations
- **Rubina Qasim, MSc**, *Institute of Nursing, Dow University of Health Sciences, Pakistan*: Fighting the Infodemic & Harnessing Social Media for Good
- **Theresa Sommers, PhD, MPH**, *Sabin Vaccine Institute*: Data Integrity & Evaluation of Best Practices
- **Anant Bhan, MBBS, MHSc**, *Principal Investigator, Sangath, Bhopal, India and Adjunct (Visiting) Professor, Centre for Ethics, Yenepoya University, Mangalore, India*

Highlights & Closing Remarks: Stacey Knobler, MSc, *Vice President, Vaccine Innovation & Global Immunization, Sabin Vaccine Institute*

ANNEX 2.
VARN2022 SPEAKER BIOS

Avani Airan, BA, LLB (Hons.), is a graduate of the National Law Institute University, Bhopal. She is a technology law and policy research professional with a passion to work towards accessibility and digital literacy. She has previously worked in the capacity of a Content Head and Teaching Coordinator for People United for Law Education and Rehabilitation (PULER), an NGO working for the empowerment of Indigenous communities in Madhya Pradesh, India. Her passion to bridge the gap in digital literacy also led her to be a long-term volunteer for Teach for India during the COVID-19 pandemic. Avani has co-founded #HumHongeKaamayaab, a not-for-profit organization working in the public health care sector. One of the projects executed by #HHK has been to increase awareness and bridge the accessibility gaps among the under-resourced, marginalized, and vulnerable communities in India to avail COVID-19 vaccination. In the last year, #HHK has been able to impact more than 100,000 individuals in 13 states. #HumHongeKaamayaab has been featured as a young NGO in public healthcare by NGOSTories, and the work has been published by Max India Foundation in their monthly newsletter.

Neil Alperstein, PhD, is Professor Emeritus in the Communication Department at Loyola University Maryland, USA. He is the founding director of the Emerging Media graduate program. His latest book is titled, *Performing Media Activism in the Digital Age* (Palgrave, 2022). He is the author of *Mediated Social Connections: Friends, Fans, and Followers in the Digital Age* (Palgrave, 2019). Along with colleagues, he has recently published several articles regarding toxicity on social media regarding mask wearing, public health risk communication around the pandemic, and negative dominance for COVID-19 vaccine related information.

Aseel Ali AlSaeed, MBBS, is currently a postgraduate trainee of Family Medicine at Family Medicine Academy, Qassim KSA. She completed her MBBS from College of Medicine, University of Qassim. Dr. Aseel has special interest in diabetes care and aims to pursue a career in Diabetology subspecialty of family medicine. Her residency program is in family medicine where she intends to continue improving her research skills.

Nalini Anand, JD, MPH. After receiving her B.A. from Cornell University in 1991, Nalini assisted in conducting a two-year study at the Institute of Medicine on U.S. participation in the Children's Vaccine Initiative, and co-edited the resulting IOM report entitled *The Children's Vaccine Initiative: Achieving the Vision*. In 1996, Nalini graduated from Stanford Law School, and went on to practice law in the healthcare group at Hogan & Hartson in Washington, D.C. In 2009, she received an MPH from the Johns Hopkins Bloomberg School of Public Health. At NIH's Fogarty International Center since 2002, Nalini is the Director, Division of International Science Policy, Planning and Evaluation and Director, Center for Global Health Studies (CGHS). In the first of these roles, she is responsible for managing Fogarty's science policy, strategic planning and program evaluation activities. Second, she oversees a "think tank" that serves as a platform for short-term, project-based scholarship in global health science and policy. CGHS catalyzes research to address global health challenges through multidisciplinary and multi-sector scholarship, dialogue, collaboration and training.

Caroline Aura, PhD, is a Research Scientist at the University of Nairobi's Program on Frontline Healthcare Workers in Immunization and a grantee of the Grand Challenges Explorations program from the Bill and Melinda Gates Foundation-USA (<https://gcgh.grandchallenges.org/grant/improving-frontline-worker-and-caregiver-skills-vaccination-pain-management>). She has been a CO-I on Global Health Innovations, including the loyalty program (<https://savinglivesatbirth.net/a-loyalty-program-to-mobilize-and-sustain-maternal-and-neonatal-health/>) and the Barcodes program (<https://www.grandchallenges.ca/grantee-stars/0119-01/>). She is a Co-Founder of GrainBank and VaccineLink LTD, a social enterprise that connects caregivers to vaccination centers. Caroline has been working in the field of Child and Maternal Health for the last ten years and has vast experience and interest in this area.

Silas Ayako is a licensed clinical officer by profession, a Global Health enthusiast, humanitarian, health columnist, ICH Good Clinical Practice ER6 certified, certified BLS instructor and a member of African Journal of Health Sciences with a passion for clinical research and health-related surveys. He is knowledgeable in health systems, policies, strategies, project proposals and health strengthening mechanisms. He currently works with Kenya Red Cross in partnership with UNHCR as health implementing partner at the Kalobeyei Refugee Settlement and Kakuma Refugee Camp respectively in Kenya where he provides clinical services to the refugees, asylum seekers, returnees and the host community who are nomads/pastoralists. He has been directly involved in Covid-19 pandemic response as soon as it was declared a PHEIC where he has been working in a Covid-19 isolation center to-date. He has extensive experience in providing primary healthcare as his professional core in clinical medicine and surgery. He has first-hand knowledge in Covid-19 response and clinical management and preventive measures having responded to COVID 19 in Turkana County where he was responsible for setting up an isolation and quarantine center and directly provided clinical management to Covid-19 casualties. He would therefore like to contribute his expertise to help in restoring and preserving health in patients as we normalize the Covid 19 curve.

Anant Bahan, MBBS, MHSc, is Site-Principal Investigator, ESSENCE, EMPOWER Tata Trusts/LMSAI, SARATHA & SHARP, Principal Investigator, DRISHTi, TransCare COVID-19, and Co-Investigator, TransCare MedEd (Sangath Lead), EMPOWER J&J. Dr. Bahan works with Sangath at its Bhopal Hub office. He is a medical graduate with a master's degree (MHSc) in Bioethics from the University of Toronto in Canada. He is a researcher in global health, health policy and bioethics with over 18 years of experience and numerous publications to his name. Anant Bahan is currently one of the leading voices on issues related to medical ethics and social justice in India. He is also the immediate past president of the International Association of Bioethics (2017-19), serves as an Adjunct Professor in Yenepoya University and as an Adjunct Faculty at KMC, Manipal, and is a member of several committees.

Naor Bar-Zeev, MBBS(Hons), MPH, MBIostat, PhD, FRACP, FACTM, is an Associate Professor of International Health and Vaccine Sciences, pediatric and infectious diseases specialist, and statistical epidemiologist. Naor has worked in global child health, infectious diseases and vaccinology since the late 1990's across East Asia, the Pacific and Africa. He was formerly the Deputy Director and Director of Epidemiology at the International Vaccine Access Center at the Johns Hopkins Bloomberg School of Public Health, and before this led the Vaccines Research Group at the Malawi-Liverpool-Wellcome Trust Clinical Research Programme, University of Malawi. Naor is a clinical trialist, vaccine epidemiologist and statistician, and a pediatric infectious diseases physician.

James Bell, MSc, is an Associate Director in the Global Health research team at Ipsos, which works with a variety of public, private and third-sector organizations to bring the voice of end-users into public health decision-making processes. James leads social research projects with a focus on infectious disease prevention in Sub-Saharan Africa. Much of his work involves using qualitative and quantitative methodologies to inform intervention design in low resource settings, with a particular emphasis on HIV, TB and early infant vaccination. He also has a background in healthcare marketing research, which informs his methodological approach to investigating public health questions. James holds degrees from Cambridge and Glasgow universities, and an MSc in epidemiology from the London School of Hygiene and Tropical Medicine.

Helena Ballester Bon, MA, is a Social and Behavioural Specialist, working at the UNICEF Eastern and Southern Africa Regional Office since 2018. Her focus is on social and behavioral drivers of demand for health and immunization services in 21 ESA countries, including Ethiopia, Uganda, Kenya, Tanzania, South Sudan and Somalia among others. Helena is the chair of the ESACREDT demand TWG, a multi-partner coordination platform that supports the demand for C-19 vaccines in the ESA region. She was previously working for UNICEF HQ under the Immunization section, and the Democratic Republic of the Congo Country Office. She is also a member of the global Demand Hub and the Equity Reference Group.

Ruth Carlitz, PhD, is an Assistant Professor of Political Science at Tulane University (Louisiana, USA), where she teaches courses on international development and African Politics. Her research focuses primarily on the politics of public goods provision in low-income countries, from the perspectives of both governments and citizens. Her work has been published in *World Development*; *Perspectives on Politics*; *Public Administration*; *The Journal of Health Politics, Policy, and Law*; and other outlets. Ruth's regional expertise lies primarily in East Africa. She has conducted extensive fieldwork in Tanzania, and has also been involved in research activities in Kenya, Malawi, and South Africa. In addition to her academic research, Ruth has worked on studies commissioned by UN Women, the United States Agency for International Development (USAID), the International Budget Partnership and the World Bank.

John Cook, PhD, is a Postdoctoral Research Fellow with the Monash Climate Change Communication Research Hub. His research focus is understanding and countering misinformation about climate change, with an emphasis on using critical thinking to build resilience. He obtained his PhD at the University of Western Australia, studying the cognitive psychology of climate science denial. In 2007, he founded *Skeptical Science*, a website that won the 2011 Australia Museum Eureka Prize for the Advancement of Climate Change Knowledge. In 2013, he published a paper quantifying the 97% scientific consensus on climate change which was highlighted by President Obama and UK Prime Minister David Cameron. In 2015, at the University of Queensland, he led the development of a Massive Open Online Course on climate science denial, that has received 40,000+ enrollments from over 185 countries. He co-authored the college textbooks *Climate Change: Examining the Facts* and *Climate Change Science: A Modern Synthesis*, as well as the book *Climate Change Denial: Heads in the Sand*. His research covers four themes: Detection, Deconstruction, Debunking, and Deployment (summarized as the 4D Project). Detection involves training machine learning models, in collaboration with UK-based political scientists, to automatically detect and categorize climate misinformation in real-time. Deconstruction uses a critical thinking methodology developed with

University of Queensland philosophers to analyze and identify reasoning fallacies in misinformation. Debunking myths can take a variety of forms, and he collaborates with US-based communication researchers to experimentally test different approaches and improve psychological understanding of misinformation correction. Deployment involves putting into practice the theoretical insights from the first three themes. For example, the book *Cranky Uncle vs. Climate Change* applies critical thinking and inoculation research, combining climate science and cartoons to engage and educate readers about climate misinformation. Similarly, the *Cranky Uncle* game, developed with the U.S. creative agency *Autonomy*, applies the same approach in the form of a smartphone game that builds players' resilience against misinformation. He has coauthored a number of handbooks summarizing communication best-practices such as *The Debunking Handbook* and *Conspiracy Theory Handbook*.

Margie Danchin, MBBS, PhD, is a consultant pediatrician within the Department of General Medicine, Royal Childrens Hospital (RCH), and an Associate Professor and David Bickart Clinician Scientist Fellow, Department of Paediatrics, University of Melbourne and Murdoch Childrens Research Institute. As leader of the Vaccine Uptake Group, MCRI, she is an immunization expert with over ten years of experience in vaccine research and clinical work, both in Australia and in resource poor settings. Her research includes vaccine social science, program evaluation, health system strengthening in low resource settings, vaccine safety and vaccine clinical trials to improve the uptake and use of currently available vaccines, particularly among high risk-groups and in low- and middle-income countries. In Australia, she is the current chair of the Collaboration on Social Science in Immunisation (COSSI) Group, an initiative of the National Centre for Immunisation Research and Surveillance (NCIRS), a member of the NCIRS Scientific Advisory Committee and Australian Regional Immunisation Research Alliance (ARIA) and Chair, Paediatric Research committee (PRC) and on the Executive, PCHD, RACP. She is a trusted national spokesperson on vaccination issues and leader in vaccine acceptance with a strong advocacy role and prominent media

profile. Internationally, she is engaged as a consultant with WHO to improve confidence and uptake of the EPI schedule in the Philippines, is a member of Sabin's Vaccine and Acceptance Research Network (VARN) steering group and a member of the International Pediatric Association (IPA) Vaccine Trust Project Program Advisory Group. She is passionate about strong, respectful communication in healthcare and is leading collaborative development and promotion of clinician scientist pathways as Director of Clinician Scientist Pathways within the Melbourne Medical School (MMS) and one of the Associate Directors of the MACH-Track.

Kenneth Davis, MA, is a New Business Manager with Fraym's Global Development team interested in leveraging emerging technologies to build a more just, equitable, and peaceful world. He is currently working with public health stakeholders to use spatial population data produced through machine learning to better understand people in the most data-scarce parts of the world. Since the start of the COVID-19 pandemic, Kenneth has supported partnerships with multilateral organizations, global foundations, government agencies, and multinational companies to better mitigate the impact of the pandemic on the most vulnerable populations, develop more equitable country vaccination plans, and to disrupt the growing threat of medical misinformation and vaccine hesitancy. Previously, Kenneth worked as a business development professional at Global Communities and Creative Learning where he supported projects aimed at reducing the spread of HIV and preventing violent extremism. He has an MA in Ethics, Peace, and Global Affairs from American University and a BA in International Affairs and Religion from Florida State University.

Baldeep K. Dhaliwal, MSPH, (she/her) is in the doctoral program at Johns Hopkins Bloomberg School of Public Health in the Department of International Health, Social and Behavioral Interventions. She previously worked as a Research Associate II at the International Vaccine Access Center. She has a specific interest in utilizing qualitative research skills and community-based participatory research skills to better understand vaccine uptake and acceptance in India. Baldeep's work has focused on understanding multi-level

perceptions that impact vaccine-seeking behavior, while working with communities to co-create grassroots-level interventions to improve vaccine uptake. She previously worked as a healthcare consultant focusing on the implementation of the Affordable Care Act. She has policy and programmatic domestic healthcare experience, with extensive experience in working with stakeholders and effectively communicating with partners, funders, and peers.

Nadia Diamond-Smith, PhD, MSc, is an Assistant Professor in the Department of Epidemiology and Biostatistics and Institute for Global Health Sciences at the University of California, San Francisco (UCSF). She studies the intersection between women's empowerment and reproductive and maternal health, mostly in South Asia. She applies a gender lens to research and evaluation projects, using social and behavioral determinants of health framework. Dr. Diamond-Smith has a PhD in the Population, Family and Reproductive Health Department at Johns Hopkins Bloomberg School of Public Health and an MSc from the London School of Hygiene and Tropical Medicine in Sexual and Reproductive Health Research. She brings expertise in demography and epidemiology, mixed methods research and evaluation, gender analysis, mhealth/social media interventions and other intervention development and evaluation.

Anne Kraemer Diaz, MA, is an anthropologist and one of the co-founders of Maya Health Alliance, an organization created in 2006 to improve health in rural Guatemala. She has served as Executive Director since 2009. Her passion is building high-impact, collaborative, and culturally and linguistically appropriate health and development programs. Anne trained as a cultural anthropologist at the University of Kansas, where she received her master's degree and did doctoral coursework. She was the recipient of a Fulbright scholarship in 2007 to examine the relationship between rural Guatemalan communities and the NGOs that serve them. Anne lives in rural Guatemala with her husband and daughters. She speaks Kaqchikel and Spanish. She has been featured in ABC News, NBC News, La Prensa, and Al Jazeera.

Janan Dietrich, PhD, (she/her) is an award-winning and leading social and behavioral sciences Wits Researcher, the Director of the Bio-Behavioural Research Division at the Perinatal HIV Research Unit (PHRU) and co-founder of the newly formed African Social Sciences Unit of Research and Evaluation (ASSURE) of the Wits Health Consortium. As the PHRU's lead social scientist, she has been involved in health research for almost 17 years with specific expertise in HIV vaccines clinic research. Dietrich was also awarded funding through the Wits African Leadership in Vaccinology Expertise (ALIVE) consortium to understand attitudes of healthcare workers about COVID-19 vaccines. In 2020-2021 she won a Great Leap Forward: Championing Health Innovation Award from the Wits Health Consortium. Professor Janan is affiliated with the Health Systems Research Unit of the SAMRC and was the co-chair of the Southern African Social and Behavioural Group of the HIV Vaccine Trials Network (HVTN). Professor Janan is part of the Vaccine Safety and Confidence Building Working group of Columbia University. She has over 90 peer-reviewed publications, and is a research psychologist working within clinical research and biomedical sciences.

Eve Dubé, PhD, is a medical anthropologist. She is affiliated with Quebec National Institute of Public Health in Quebec, Canada. She is a research scientist at the Research Center of the CHU-Québec and an invited professor in the Department of Anthropology at Laval University. Her research program focuses on the sociocultural determinants of vaccination. She is the lead investigator of the Social Sciences and Humanities Network of the Canadian Immunization Research Network. She is interested in how to enhance vaccine acceptance and uptake and she is leading different projects around this issue. She sits on a number of committees as an expert on vaccine acceptance and hesitancy. She was a member of the World Health Organization working group on vaccine hesitancy.

Daniel Erchick, PhD, MPH, is an epidemiologist and faculty member in the Department of International Health at the Johns Hopkins Bloomberg School of Public Health. Dr. Erchick's research focuses on the evaluation of interventions to improve maternal, neonatal, and infant

survival and growth in low-resource settings. His expertise includes conduct of community-based randomized controlled trials and observational studies. Much of his work has occurred in rural areas of Nepal and Bangladesh as well as India. He is interested in understanding the drivers of vaccine hesitancy, social inequities, and approaches to improve health communication. Currently, he is involved in a study to identify the drivers of COVID-19 vaccine acceptance and hesitancy to support the development of communication approaches for rural, low-income communities in Nepal.

Miyola Cia Fernandes, BDS, MSc, is a Public Health Researcher and Dental Surgeon by profession. She graduated from the University College London (UCL) in 2020 with an MSc in Dental Public Health. Previously, she completed a Bachelor of Dental Surgery (BDS) from Goa Dental College and Hospital (Goa University) in 2017 and holds a Dental Council of India license to practice as a dental surgeon in India. Currently, she works at Parliamentarians with Innovators for India (PIIndia) as Research Director (Public Health) on their initiatives Immunise.in and Mindrise, currently funded by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). She also works closely with the Asian Development Research Institute on research projects: Health and Education in Bihar, and the Sabin Vaccine Institute-funded project “The Impact of Community-based Messaging Platforms on Vaccine-related Attitudes and Behaviors in India.” Biweekly, she practices (consults) as a Dental Public Health Consultant in Goa. Her research interests revolve closely around using quantitative methods in population-level public health dietary interventions, socio-economic determinants of health, social media for health promotion, and dental public health.

Mónica Berger González, PhD, is a sociocultural anthropologist from Guatemala with a PhD in Sciences from ETH Zürich. She heads the Unit of Medical Anthropology at the Center for Health Studies in Universidad del Valle de Guatemala and is an associate researcher of the Swiss Tropical and Public Health Institute in Basel. Her research is focused on intercultural transdisciplinary processes to address plurimedical systems in

inequity, ethnomedicine of Mesoamerican populations, public health policy and its impact on Indigenous groups, One Health approaches, among others.

Dena Gromet, PhD, is the Executive Director of the Behavior Change for Good Initiative. Dena received her PhD in Psychology from Princeton University and has over a decade of experience in conducting research on the drivers of attitudes and behaviors across multiple domains. Dena was previously the Research Director for the Wharton People Analytics Initiative, and a Postdoctoral Fellow with the Wharton Risk Management and Decision Processes Center and with the MacArthur Foundation Law and Neuroscience Project.

Ashima Gulati, B.A., LLB., (Hons.), is a registered advocate from India, and has graduated from National Law Institute University, Bhopal. She has worked as a securities and capital markets lawyer at a premier law firm in India for three years. Currently, Ashima is working in the development sector, as a fellow at Teach for India, wherein she teaches in a government school in New Delhi. Ashima has co-founded #HumHongeKaamayaab, a not-for-profit organization working in the public health care sector. One of the projects executed by #HHK has been to increase awareness and bridge the accessibility gaps among the vulnerable communities to avail COVID-19 vaccination. In the last year, #HHK has been able to impact more than 100,000 individuals in 13 states. Ashima has also assisted more than 2,000 individuals to access welfare benefits. Ashima has also been nominated for India’s COVID Soldier Award 2021 by The Better India for her work at #HHK, and her classroom has been nominated as one of the most transformational classrooms in 2021 across 7 cities. She writes regularly for national dailies and web portals on education, public healthcare, and public policy.

Wahdae-mai Harmon-Gray, MD, MSc, has over five years of experience working as a medical doctor in various health facilities with significant clinical contributions to the fight against Ebola and COVID-19 in Liberia. She is an early career health researcher but

has worked in varied organizations, locally and internationally, including the Ministry of Health of Liberia, Aspen Medical Liberia, Maternity Care Coalition Philadelphia, KEMRI Wellcome Trust in Kenya and Infectious Disease Data Observatory (IDDO), UK. She has a strong understanding of the health sector and context in Liberia as well as the added value of quality data in decision-making. Her professional experiences have required strong analytical skills and the ability to work both independently and on teams with members of diverse backgrounds. She has contributed to a research project at IDDO that seeks to develop a data reservoir on five hemorrhagic diseases including Ebola, Lassa fever, Crimean Congo Yellow Fever and Rubella viruses. She is also a local consultant and country Lead for a Maternal and Neonatal Research project with the University of Oxford. She supported the National Public Health Institute of Liberia (NPHIL) to develop and validate the National Rapid Response Framework (nRRT) document for the preparedness and Response Plan for Liberia and provided technical support to 15 counties of Liberia to update the National Epidemic Preparedness and Response Plan. Presently, she serves as Acting Director of the Masters of Public Health Program at the University of Liberia. The position demands regular demonstration of good interpersonal, organizational, and time management skills to effectively achieve the goals of the program. It also positions her—among students, faculty, and national health leadership—as a champion for high-impact public health research that can generate evidence for addressing contextually relevant questions.

Kate Hopkins, PhD, MPH, is the Director of Research for the Vaccine Acceptance & Demand Initiative overseeing research programming across the Vaccine Acceptance & Demand team to implement program activities, expand and manage partnerships, invest in new research projects and continue the growth of Sabin’s thought leadership programming. Prior to joining Sabin, Kate spent 11 years living and working in sub-Saharan Africa conducting infectious disease prevention and psychosocial-behavioral research and health service program implementation in low- and middle-income countries—with particular focus on high-risk and

vulnerable populations. Managing multi-country and multidisciplinary teams, her past portfolio of work included supporting clinical research site operations and strengthening capacity for the conduct of HIV and COVID-19 vaccine clinical trials within the HIV Vaccine Trials Network and COVID-19 Prevention Network. Kate supported the implementation of the ENSEMBLE J&J Phase III clinical trial and the subsequent SISONKE J&J COVID-19 vaccination rollout amongst healthcare workers in South Africa. Kate has been a joint-Faculty Researcher for the Faculty of Health Sciences, University of the Witwatersrand in Johannesburg, South Africa, for nine years; and is a virtual course lecturer on Operational Research within a post-graduate diploma program in TB/HIV Management for the University of Cape Town in South Africa. She was awarded funding for her PhD study from the CDC as a PEPFAR-funded activity under its Cooperative Agreement with the South African Medical Research Council, earning her degree from the University of the Witwatersrand School of Public Health. She also holds a Masters in Public Health, with a focus on Global Health, from Boston University School of Public Health.

Sofia Imad, MPH, is a Junior Fellow at Artha where she leads the public health work. She previously worked for Mumbai-based IDFC Institute, supporting local governments in India to respond to the COVID-19 pandemic with evidence-based policy. Particularly, she supported COVID-19 vaccine acceptance research across India and developed a communications campaign to increase vaccine uptake in partnership with the Government of Punjab. Prior to joining the Institute, she managed global health programs in the public and private sectors. She worked for Sanofi, based out of Singapore and Mumbai, where she launched a new drug for tuberculosis in Asian countries. Previously, she worked with The MENTOR Initiative as a Program Director for malaria and neglected tropical diseases in Chad and Angola. Sofia was a board member of Urban Refugees, an NGO advocating for increased international focus on refugees in urban settings. She holds a Master's degree in International Relations from Sciences Po Bordeaux, France and a Master in Public Health, with a focus on infectious diseases, from the Pasteur Institute in Paris.

Chijioko Kaduru, MBChB, MPH, is a public health physician working for over fifteen years in public health program management, with ten of those years working in public health in low- and middle-income countries. He has worked over the years in improving child survival, combating HIV/AIDS, TB, and Malaria, improving adolescent and youth sexual and reproductive health and rights, and towards gender equality. He has led performance management of adolescent health programs, supported policy research, worked to strengthen the use of a human-centered design approach to improve adolescent mental health service utilization, and implemented communications for development interventions on youth sexual and reproductive health. He has previously worked as a Technical Assistant on the World Bank/GAVI supported National Strategy for Immunisation and Primary Healthcare (PHC) Systems Strengthening in Nigeria project, towards polio eradication and strengthening routine vaccination and PHC services. He has also previously worked as a Technical Advisor to the Nigeria Centre for Disease Control on COVID-19 containment, including supporting design of strategies, implementation of activities, and monitoring and evaluation of supported interventions.

Robert Kanwagi, MPH, has been appointed as a key consultant to Gavi, the Alliance, for Demand Generation for COVAX and was previously appointed the Civil Society Representative to the COVAX Demand Working Group for the COVID-19 Vaccine roll out. Robert's area of interest is working in complex situations to deliver health programs that target the most vulnerable. He was Programme Coordinator for the Ebola Vaccine Deployment Acceptance & Compliance Programme (EBODAC) for 6 years and served on the executive committee for the Sierra Leone program and the steering committee for the vaccine deployment in DRC. Robert has led the development of context specific strategies for community engagement, participation and compliance for two dose regimen vaccine and the development and testing of enabling technologies to support data management and communication in Sierra Leone, DRC, Rwanda and Uganda. Prior to joining EBODAC, Robert worked as a Technical Advisor for Adolescent Sexual Reproductive Health with International

Planned Parenthood Federation and as a Community Prevention Services Manager for USAID Northern Uganda Malaria AIDS & Tuberculosis (NUMAT) program in Uganda and with World Vision International in South Sudan as Integrated technical services Manager/Health Advisor. Robert holds a Bachelor of Arts Social Work & Social Administration from Makerere University Uganda, Master of Public Health from Lund University and post graduate diploma in International Youth & Adolescent work from Frobels Academy in Germany.

Abdul Momin Kazi, MBBS, MPH, is an Assistant Professor research, at the Aga Khan University Hospital. He is a physician (M.B.B.S in Dow Medical College, Pakistan), an epidemiologist (MSc. Vanderbilt University, TN USA) and is pursuing his PhD from the University of British Columbia, BC, Canada. Momin Kazi's work focuses around digital/mobile health (mHealth) based interventions applying mixed methods and using technology as a tool in research studies to improve vaccination coverage and decrease vaccine hesitancy. Currently Momin Kazi is involved as an investigator with multiple research studies funded through NIH, BMGF, GAVI and GCC, to name few. He is also codirector of "Research Methods & Applications for Digital Health" course, offered to graduate students at AKU. His work interest also includes development and evaluation of esystems for real time visualization of data, geospatial analysis and development of auto generated systems including (SMS and automated calls), digital applications and AI and ML models for improving maternal and child health including vaccination coverage and hesitancy. He has published over 60 papers with h-index of 19 and heavily advocating on vaccine preventable diseases, and maternal child health in lower-middle income countries.

Mayya Kelova, MA, is a Programme Coordinator at Minority Rights Group International (MRG). She supervises the 'Diversity: Impact on Vaccine Equality' (DIVE) program. Mayya is a multimedia expert, researcher, and photographer with a focus on human rights, international relations, and marginal identities. Over the past ten years, she worked for the United Nations, private companies, non-profit organizations, and media outlets in the US, Europe, and Eurasia. She holds an MA

in Human Rights from the Department of Legal Studies of the Central European University and a BA in Journalism and Mass Communications from the American University in Bulgaria.

Freddy Eric Kitutu, PhD, is a Senior Lecturer of Health Systems Pharmacy and Researcher at Makerere University in Uganda. He serves as the Dean of the School of Health Sciences at Makerere University College of Health Sciences. Since April 2, 2020, Dr Kitutu has been a member of the Epidemiology Advisory Committee of the Presidential Scientific Initiative on Epidemics (PRESIDE), chaired by the Senior Presidential Advisor on Epidemics, that has contributed to the national COVID19 response. He has a doctoral degree in Medical Science from Uppsala University, Sweden. He teaches courses for undergraduate pharmacy students and postgraduate pharmacy and public health students. His research interests include antimicrobial resistance, interventions to promote antimicrobial stewardship, patient safety, pharmaceutical and health systems interventions to improve adequate access to life-saving health technologies including vaccines. He is also the Leader of the Sustainable Pharmaceutical Systems (SPS) unit at Makerere University School of Health Sciences.

Patience Kiyuka, PhD, is a scientist based at the Kenya Medical Research Institution. Her research interests are on vaccine development, vaccine hesitancy, understanding the immunity to malaria and molecular epidemiology of respiratory diseases. Alongside her research work, Patience is committed to science communication. She has produced virtual reality videos, directed plays and been on radio shows to promote public understanding and participation in science.

Stacey Knobler, MPH, MSc, is the Vice President of Vaccine Innovation & Global Immunization at the Sabin Vaccine Institute. She has more than 20 years' experience researching and developing programs and recommendations related to public health, the management of health systems, vaccines and vaccination. As VP, Vaccine Innovation & Global Immunization at Sabin, Stacey leads Sabin's strategic planning efforts across

organizational programming; convenes global experts to recommend strategies for accelerating and transforming vaccine development and delivery; assesses changing policies and practices across the vaccine development, regulatory and response landscape; and reviews how emerging technologies can benefit future vaccine development and delivery. With the Fogarty International Center at the U.S. National Institutes of Health, Stacey supported strategic planning and program direction for the Division on International Epidemiology and Population Studies, inclusive of the Malnutrition and Enteric Disease Study (MAL-ED), the Multinational Influenza Seasonal Mortality Study (MISMS), and training and capacity-strengthening initiatives focused on bioinformatics and phylogenetics, epidemiological modeling and data analytics, and biosafety and biosecurity systems in Sub-Saharan Africa, South Asia, Latin America, and the Middle East. At the National Academy of Sciences Institute of Medicine (NAM), she was the founding director of the Forum on Emerging Infections, led multiple projects to establish global public health priorities—including the scale-up of antiretroviral treatments and neurological and psychiatric disorders—and she developed a partnership effort between the National Academies and 8 African Academies of Science (ASADI). Stacey has published over 45 peer-reviewed articles and edited volumes. She earned a Master's of Science degree in Public Health from the London School of Hygiene & Tropical Medicine in the UK. Stacey serves on the steering committee of the Influenza Vaccine Roadmap Initiative and is a member of the Global Funders Consortium for Universal Influenza Vaccine Development.

Paul LaBarre, MS, MBA, is the Vice President of Global Business Development at PharmaJet. As an impact-driven executive, focused on improving health outcomes globally, he has 25 years of Global Health and Medical Technology experience across the innovation value chain including regulatory, strategy, research, product development, and market analysis. He began his medical device career designing disability interventions in the private sector and hold several patents. He has held key business development roles at prominent healthcare support organizations including UNICEF and PATH. Most recently he was Senior Vice President,

Access and Innovation for SightLife, the world's leading eye bank. Paul has co-authored over 35 publications and holds a Bachelor of Science degree in Mechanical Engineering from Northwestern University, a Master of Medical Engineering from the University of Washington, and an MBA from Mount Vernon Nazarene University.

Rupali J. Limaye, PhD, MPH, MA, serves as a full-time faculty member at the Johns Hopkins Bloomberg School of Public Health, in the Departments of International Health, Epidemiology, and Health, Behavior and Society. Widely seen as an expert in vaccine behavior and decision-making, including vaccine hesitancy and acceptance, she serves as the Deputy Director at the International Vaccine Access Center. Primarily focusing on infectious diseases, Dr. Limaye is a social and behavioral scientist and health communication scholar. Her mixed-method work examines how various influences affect health behavior and how to leverage those influences to affect positive behavior change. She also studies how health information can best be communicated to individuals in different contexts and through different channels. In her 15 years of working in global health, she has worked in more than 30 countries from both research and implementation perspectives, on topics including immunization, family planning, HIV/AIDS, maternal and child health and alcohol, and teaches classes on health behavior change and persuasive communication. She received her PhD from the Johns Hopkins Bloomberg School of Public Health. She also holds an MPH in global health, an MA in international affairs, a BA in political science, and a BS in journalism.

Lisa Menning, MSc, brings almost 20 years of progressive experience in global health communications, social and behavior change, community engagement and advocacy, covering the non-profit, public and private sectors. Her work has spanned a range of health topics including immunization and vaccines, HIV/AIDS and cancer in resource-poor settings. In her current role at WHO, Lisa manages IVB's portfolio of work that is focused on confidence and uptake for vaccination and addressing hesitancy. In this role, her focus is on developing normative guidance and supporting tools and materials that draw on the latest evidence from the social and behavioral

sciences, providing technical support to regions and countries, and collaborating with partners.

Alexandra Michel, MPH, is a freelance science writer with an interest in data journalism. She mostly focuses on behavioral science, psychology, neuroscience, and public health. Alexandra has written extensively about research on management, the workplace, and organizational science. She is also interested in using data visualization for telling stories. She is always interested in opportunities to make complex or technical information more accessible to non-academic audiences. Alexandra currently works as a research associate at the International Vaccine Access Center where she primarily focuses on projects at the intersection of behavioral science, health communication, and infectious disease prevention. She is currently working on studies that address vaccine hesitancy and mis/disinformation on social media. She completed a Master of Public Health at the OHSU-PSU School of Public Health in Portland, Oregon. She is interested in mixed-methods in public health research, evidence-based policy implementation, social epidemiology, and data visualization for health promotion. As an undergraduate Alexandra double-majored in neuroscience and English at Oberlin College. She has a minor in art history.

Ahmed Mushfiq Mobarak, PhD, MA, is a Professor of Economics at Yale University with concurrent appointments in the School of Management and in the Department of Economics. Mobarak is the founder and faculty director of the Yale Research Initiative on Innovation and Scale (Y-RISE). He holds other appointments at Innovations for Poverty Action, the International Growth Centre (IGC) at LSE, and the Jameel Poverty Action Lab (J-PAL) at MIT. Mobarak has several ongoing research projects in Bangladesh, Malawi, Nepal, Pakistan, and Sierra Leone. He conducts field experiments exploring ways to induce people in developing countries to adopt technologies or behaviors that are likely to be welfare improving. He also examines the complexities of scaling up development interventions that are proven effective in such trials. For example, he is scaling and testing strategies to address seasonal poverty using migration

subsidies or consumption loans in Bangladesh, Nepal and Indonesia. His research has been published in journals across disciplines, including *Econometrica*, *Science*, *American Economic Review*, *The Review of Economic Studies*, the *American Political Science Review*, *Proceedings of the National Academy of Sciences*, and *Demography*, and covered by *The New York Times*, *The Economist*, *NPR*, *BBC*, *NBC*, *The Washington Post*, *Wall Street Journal*, *Science*, *Nature*, *The Times* (London), and other media outlets around the world. He received a Carnegie Fellowship in 2017. Mobarak is collaborating with the government of Bangladesh and other local institutions to devise evidence-based COVID response strategies for Bangladesh and for other developing countries. He is collaborating with governments and NGOs in India, Pakistan, Nepal and Bangladesh to distribute facemasks to over 100 million people based on the results of the NORM model. The approach and results have been covered by *BBC*, *Foreign Policy*, *The New York Times*, *The Washington Post*, *Vox*, and media in India, Pakistan, Bangladesh, Nepal, Nigeria, Germany, UK, Sweden, Denmark, among others. The work is supported by the Bill and Melinda Gates Foundation, *Givewell.org*, the Global Innovation Fund, and Yale Macmillan Center.

Susanne Montgomery, PhD, MSN, MPH, is a social/behavioral epidemiologist with a focus on hard-to-access, underserved populations experiencing health disparities. She has received funding from NIH, CDC, the State of California and many foundations, has published over 140 peer-reviewed articles, and has conducted and/or served as a consultant on many evaluation and research projects in the US as well as in internationally, including Rwanda, Sierra Leon, South Africa, Congo, Cameroon, South America, South East Asia, India, and refugee projects in Europe. She is part of a regional vaccine hesitancy research group, is certified as a CRM guide and leads several translational CRM research efforts.

Corrina Moucheraud, ScD, MPH, is an Associate Professor in the Department of Health Policy and Management at the Fielding School of Public Health (University of California Los Angeles), and Associate Director at the UCLA Center for Health Policy Research. Dr. Moucheraud

is a global health policy and systems researcher, focused on the question: "how can we deliver high-quality, efficient, equitable, sustainable health services in resource-constrained health systems?" Dr. Moucheraud obtained her ScD from the Department of Global Health and Population at the Harvard T.H. Chan School of Public Health, and her MPH from the Department of Health Behavior at the University of North Carolina Gillings School of Global Public Health.

Jeff Mulhausen, BS, is a co-founder in the firm Upstream Thinking, one of the first groups established solely on the premise of deploying innovation across public and private sectors for maximum human impact. Jeff's expertise centers on the application of human-centered-design methodology to define new value propositions and inform their design. These approaches combine to form a robust approach to gaining stakeholder insight, generating creative solutions and developing execution roadmaps. Uniquely, Upstream curates these methods in a customized manner to design new behaviors across the ecosystem for maximum impact. His projects include helping shape a new patient-centered cancer care model with the LiveStrong Foundation, the application of innovation principles for a future vision of the Austin Independent School District, and increasing demand for HIV prevention methods in sub-Saharan Africa for the Bill & Melinda Gates Foundation. A recent 3-year project with adolescent girls and young women (AGYW) in South Africa resulted in a pilot intervention that was recognized in the 2021 Fast Company World Changing Ideas Awards in the Health category. Prior to Upstream, Jeff built and led an international team of designers to define new innovation strategies for both start-up and Fortune 500 engagements. He now focuses on partnering with organizations to deliver broader market and social impact through the application of design tools and innovation methodologies. He holds a Bachelor of Science in Industrial Design from the Ohio State University. Since 2009, he has crafted and co-instructed a series of courses on Design Thinking for Business Innovation at the McCombs School of Business at the University of Texas, Austin.

Andrés Ochoa Toasa, MA, is a data scientist at UNICEF's Evaluation Office. He was the lead global analyst through the 2020-2021 pilot implementation of the Community Rapid Assessment, a rapid assessment system to provide real-time information on behavioral insights related to COVID-19 programming. During his time in UNICEF's Evaluation Office, Andrés has worked as methodological and analytical support piloting the use of new methods and innovative technological applications for evaluation purposes. This has included designing and testing the use of participatory mechanisms for UNICEF corporate evaluations, modelling the use of mobile phone surveys for real-time rapid assessment systems, and piloting the use of population and administrative data for evaluative purposes. Prior to joining the UN system, Andrés worked in analytical and field roles in development operations in the United States, Kosovo, Colombia, and in Ecuador, his home country. Andrés holds a master's degree in international affairs, specialized in Advanced Policy and Economic Analysis, from the School of International and Public Affairs at Columbia University and is a graduate in law and international relations from Universidad San Francisco de Quito in Ecuador.

Tina D. Purnat, MS, is Team Lead for Infodemic Management in the Unit for High Impact Events Preparedness, Department of Global Infectious Hazard Preparedness at WHO. Tina has worked for over 20 years at the WHO, European Union and academia. Her expertise amalgamates health research, analysis and policy-making with an emphasis on promoting the use of health information and evidence in decision-making and for policy-making. As part of the WHO COVID-19 response, she worked in developing and formulating WHO infodemic response and infodemic management interventions, for which she received the WHO Pathfinder and Innovation Award 2021.

Rubina Qasim, RN/RM, BScN, MScN, is working as Assistant Professor at the Institute of Nursing & Midwifery, Dow University of Health Sciences Karachi, Pakistan. Rubina has more than 10 years of teaching and research experience in both public and private sector academic institutions in Pakistan. Her area of research is maternal and child

health including routine immunization, hesitancy, and vaccine acceptance among marginalized, hard-to-reach populations. Rubina is the recipient of Sabin 2020 Social and Behavioral Research Grant. She is leading a team of research staff including volunteer undergraduate nursing students, working for the health and social uplifting of the marginalized population living in the slum peri-urban Karachi, Pakistan.

Rajiv N. Rimal, PhD, MA, is Professor and Chair of the Department of Health, Behavior & Society at the Johns Hopkins University Bloomberg School of Public Health. His PhD is in Health Communication (Stanford University, 1995) and he specializes in communication and behavior change work. He recently led a Gates Foundation-funded intervention to implement a social norms-based intervention to reduce anemia in Odisha, India and another project to promote immunization in Nepal. Over the last 25 years, he has conducted behavior change interventions and evaluations in several countries, including Ethiopia, India, Malawi, Namibia, Nepal, Mexico, Serbia, Uganda, and the United States. His team is heavily involved in COVID-19 research to understand the factors accounting for vaccine hesitancy. This includes studying how marginalized populations (e.g., tribal groups in India, mothers who give birth at home in sub-Saharan Africa) react to public health interventions and how they process information about vaccines. He is particularly interested in studying how interventions can succeed or inadvertently cause more harm. He serves as a member of the World Health Organization's Behavioral Insights' technical advisory group.

David Scales, MPhil, MD, PhD, is an internal medicine hospitalist and medical sociologist at Weill Cornell Medicine and Chief Medical Officer at Critica, an NGO focused on building scientific literacy. Dr. Scales' research interests center on medical communication with a focus on mixed methods approaches to training "infodemiologists" to build Covid-19 vaccine confidence in online communities.

Holly Seale, PhD, MPH, is a Social Scientist at the School of Population Health, University of New South Wales in Sydney Australia and the Deputy Chair for the Collaboration on Social Science and Immunisation. Over 17 years, Holly has led a research program focused on the sociological aspects of infectious diseases and infection prevention. Specifically, her research encompasses the individual, and organizational factors that influence acceptance with infection prevention strategies and community engagement. Her research spans pharmaceutical and non-pharmaceutical prevention strategies, includes qualitative and quantitative research approaches and consumers such as hospital healthcare workers, special at-risk groups (people with underlying illness, migrants/refugees), students and the general public. She works closely with local and state health departments to lobby for improved opportunities for vaccination, as well as to improve communication packages.

Rajeev Seth, MD, MBBS, is a US-trained, American Board-certified, senior consultant pediatrician, with a special interest in realizing child rights to health and protection for all children. At present, Dr Seth leads BUDS (<http://www.budsngo.org/>), a registered non-profit organization, which works on delivery of child health and welfare for the marginalized children of India. Dr Seth is also the National Project Lead, India Child Protection Medical Professional Network (ICPMPN), Past Chair, Indian Child Abuse Neglect & Child Labour Group (<https://www.icancl.org/>), Past President, Indian Academy of Pediatrics Delhi. Dr Seth also serves as President-Elect of International Society for Prevention of Child Abuse & Neglect (ISPCAN), Denver USA (<https://www.ispcan.org/>). Dr Seth graduated from India's leading medical college: the All India Institute of Medical Sciences (AIIMS) and received the prestigious Sorel Catherine Freyman prize for being judged the topmost MD pediatric resident. He completed a US residency training from University of California San Francisco, USA and post doctoral fellowship at Children's Hospital Los Angeles, and lived in US (1989-1998). After his return to India, Dr Seth has volunteered his professional time as a social pediatrician in the non-profit sector to provide medical care, social and rehabilitation services to street, orphan & vulnerable children of India. In 2003, Dr Seth co-founded BUDS, which has

reached out to serve the medical, child rights and protection needs of more than 40,000 vulnerable children since his inception. Recently, BUDS has partnered with Johns Hopkins Bloomberg School of Public Health (JHU) to implement the “Vaccine Impact on Cognition and Schooling (VICS): A pilot study in India” (2019-2020). The VICS project is supported by the Value of Vaccination Research Network (based at Harvard Chan School) funded by a grant from BMG foundation. Dr Seth has served as the Indian PI of the Indo-US Bill Melinda Gates Grand Challenge Award (2017-2019) and the Indo-US R03Grant (2015-2017), National Institute of Health USA & Department of Biotechnology, Government of India. Dr Seth has several academic publications and awards, including the Dr Taro Takemi Memorial Oration (2013) by The Congress of Confederation of Medical Associations in Asia and Oceania (CMAAO); Distinguished Service Award ISPCAN (2012); Fellowship of American (FAAP) & Indian Academy of Pediatrics (FIAP), Felicitation for outstanding service IAP Delhi (2011), McAllister Foundation Award and Sorel Catherine Freyman Prize, AIIMS, New Delhi amongst many others.

Preetika Sharma, PhD, is presently a research associate at PGIMER Chandigarh. Her research interests include socio-cultural anthropology, feminist theory, relationship between identity and space, mHealth and public health. She is currently working on multiple international projects that focus on maternal and neonatal population in the Indian context.

Sunny Sharma, MSc, leads the Global Health unit within Ipsos, based in London. Ipsos is a global social and market research company with offices in approximately 100 countries. Ipsos is a full-service research organization with a variety of data collection capabilities and experts from a range of disciplines providing interpretation and strategic guidance based on research results. Sunny has worked in Global Health since 2014 and his research spans across HIV, TB, family planning, nutrition and vaccine hesitancy. Within vaccine hesitancy, he has led a research program to understand social and behavioral determinants of early infant immunization in Guinea, Nigeria and Ghana. Most recently, he has led a number of projects aimed

at understanding attitudes towards vaccinating against COVID-19 among adults in a number of Sub-Saharan African countries.

Nadine Ann Skinner, PhD, MPA, is a qualitative researcher for the Stanford Center for Health Education’s Digital Medic initiative. Dr. Skinner is a recent graduate from the International Comparative Education program at the Stanford Graduate School of Education. Her research focuses on the relationships between the philanthropic sector, social movements, and nongovernmental organizations with the global education sector. She is a mixed-methods researcher with extensive experience with qualitative methods, including research design and content analysis. She has over ten years of experience working in research, evaluation, and grants and program management in international organizations, government agencies, community-based organizations, and global philanthropic foundations in multiple countries in the Americas and has partnered with multiple organizations in Guatemala. Dr. Skinner has an MPA from Cornell University in Social Policy and a BA from the University of California, Santa Cruz in Politics and History.

Silvia Sommariva, PhD, is a consultant for UNICEF Eastern and Southern Africa Regional Office, Social and Behavior Change section. Her work focuses on digital social listening, rumor tracking and infodemic management to inform risk communication and community engagement strategies around COVID-19 and its impacts. Her background is in public health, health policy research, and fact-checking. Prior to joining UNICEF, she was a research associate at the World Health Organization Collaborating Center on Social Marketing and Social Change, where she co-developed a social marketing training curriculum and delivered technical support to countries across Latin America in the application of social marketing to public health interventions. Silvia has a PhD in Public Health from the University of South Florida, where she specialized in community-based research and social marketing. She is also the co-founder of Italy’s leading fact-checking organization, Pagella Politica.

Theresa Sommers, PhD, MPH, is the Senior Manager of Research for the Vaccine Acceptance and Demand Initiative at the Sabin Vaccine Institute. Her background spans infectious disease programming and policy, including pandemic preparedness and response, within multilateral (WHO) and bilateral (US CDC) health organizations and on-the-ground qualitative health research in Sub-Saharan Africa and the Southern US. She has also worked within academic institutions and the nonprofit sector to support infectious disease capacity building and research in LMICs. She has been adjunct faculty of multiple universities for over six years, teaching both undergraduate and graduate-level courses and is currently an affiliated Researcher for the Migration and Health Project Southern Africa within the African Centre for Migration and Society at Wits University (South Africa), as well as a Course Director in Research Ethics at the Department of Infectious Disease and Global Health at Tufts University, Cummings School of Veterinary Medicine. Theresa holds a PhD in Global Governance and Human Security (Global Health track) from the University of Massachusetts Boston, an MPH from Boston University, and a BA from Wellesley College.

Eliza Squibb, BFA, uses textile design to bridge the worlds of art and science. Collaborating with a wide range of professionals in health and research communities, artists, and artisans, Eliza creates textile patterns that communicate health information specifically for communities with low-literacy or language barriers that prevent equitable healthcare access. Eliza’s textile patterns have been funded by grants, including two Grand Challenge Exploration grants from the Bill & Melinda Gates Foundation, and used for communication and public outreach during community-based public health campaigns in West Africa. Eliza’s research in traditional art practices and artisan entrepreneurship has taken her to North Africa and South America, where she organized design workshops in Yine-Yami, Shuar, and Shipibo indigenous communities in the Peruvian Amazon. Originally from Maine, Eliza is currently based in Providence, Rhode Island, where she received a BFA in textile design from the Rhode Island School of Design. Eliza has taught in RISD’s textile department and Project Open Door, RISD’s college access program for Rhode Island teens.

She is a co-instructor for D-Lab Design, a course at the Massachusetts Institute of Technology that connects innovative global start-ups and nonprofits with teams of student engineers. Eliza is a 2019 Atlantic Fellow for Global Health Equity, a program by Atlantic Philanthropies and George Washington University.

Claire Thomas, BSc, is Deputy Director of Minority Rights Group (International). Claire has a special interest in the power of disaggregated data (including data on ethnicity, language and religion) to improve policy and therefore increase inclusion of otherwise marginalized groups. She has consistently advocated for better investigations and understanding of how groups who face discrimination fare in accessing services. One methodology pioneered by MRG with her guidance, is the minority inclusion audit which reviews programs post hoc for whether they reached ethnic, religious and linguistic communities equally/according to levels of need. Claire's work is not limited to vaccinations or even health in general but also covers access to all humanitarian and development services as there is considerable common ground and learning in data capture and analysis and policy reform across service-type boundaries.

Benson Wamalwa, PhD, MSc, is Lead Contact/Principal Investigator, SABIN project. Benson holds a PhD in Biotechnology and Bioinformatics (Mie University, Japan) and is a Research Scientist and Lecturer at the University of Nairobi in Kenya. Dr. Wamalwa is a member of the Saving Lives at Birth (SL@B) Community of Innovators; a grantee of the Stars in Global Health Innovation (Grand Challenges Canada); an awardee of the Grand Challenges Explorations program (Bill and Melinda Gates Foundation, USA) and a Volkswagen Foundation Fellow at the Leibniz University Hannover in Germany. His research interests are in global health innovations with emphasis on vaccinology, immunization and bioactive molecules from extremophiles.

Rose Weeks, MPH, is the Director of Communications for the International Vaccines Access Center (IVAC). She develops communications strategies and leads partner engagement for diverse projects across IVAC. She worked with IBM Research to develop the AI chatbot VIRA and studies vaccine confidence through the lens of social media. In addition, Ms. Weeks serves as the Sr. Communications Advisor for the Johns Hopkins Center for American Indian Health, developing public communication campaigns that support tribes and Native organizations in countering the threat of COVID-19 and other infectious disease. She received her bachelor's degree from Vassar College and her MPH from the Johns Hopkins Bloomberg School of Public Health.

Philip Wollburg, MSc, is an economist in the World Bank's Development Data Group in the Data Production and Methods Unit and a core team member for the World Development Report 2021 on Data for Better Lives. His research interests include agriculture, poverty, and climate impacts in low-income countries, as well as methodological aspects of and technological innovation in the measurement of key development indicators. Prior to joining the World Bank, he worked with the Food and Agriculture Organization of the UN (FAO) and led a project aimed at delivering innovative renewable energy solutions to smallholder agricultural and fisheries communities in East Africa. He holds a post-graduate degree in development economics from the University of Oxford.

Chizoba Wonodi, MBBS, DrPH, MPH, is public health physician with over twenty-seven years' research and program experience in Africa, Asia and America. She serves as the Nigeria Country Director at the International Vaccine Access Centre (IVAC). In this role, she leads an important portfolio of work on technical assistance, implementation research and policy advocacy to improve immunization service delivery and primary health care systems in the country. She is currently the principal investigator for a Gates Foundation-funded project to improve immunization uptake by sending SMS messages to inform,

educate and remind caregivers of their child's vaccinations. Implemented as a cluster randomized trial, this intervention – the Immunization Reminder and Information SMS System – is intentionally large in scope to demonstrate how innovations like SMS reminders can be taken to scale. In keeping with her focus on public health practice, Dr. Wonodi founded the Women Advocates for Vaccine Access (WAVA), a coalition of Civil Society Organizations in Nigeria advocating for increased uptake of vaccines and for sustainable financing of immunization programs. WAVA serves as the secretariat for the national platform, the Expanded Civil Society Initiative for Immunization (ECSII) in Nigeria. At the global level, Dr. Wonodi holds the vice chair position of the Gavi CSO Platform Steering Committee, a body that coordinates Civil Societies active in immunization.

Thespina Yamanis, PhD, MPH, is Associate Professor at the School of International Service at American University. She holds a PhD in Health Behavior from the University of North Carolina at Chapel Hill's Gillings School of Global Public Health. She studies social and structural determinants of health disparities and community-based interventions to reduce health disparities. Dr. Yamanis has worked in Tanzania for the past 16 years on HIV prevention for adolescents, and recently on Tanzania's COVID-19 response. She also works on Latino immigrant health in the U.S.



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