Building Global Capacity for COVID-19 Vaccination Through Interactive Virtual Learning

Shoshanna Goldin (✉ goldins@who.int)

World Health Organisation: Organisation mondiale de la Sante <https://orcid.org/0000-0001-8116-7010>

Nancy Hood

University of New Mexico - Albuquerque: The University of New Mexico

Alexandre Pascutto

World Health Organization: Organisation mondiale de la Sante

Celine Bennett

University of New Mexico - Albuquerque: The University of New Mexico

Ana Carolina Barbosa de Lima

University of New Mexico - Albuquerque: The University of New Mexico

Nicole Devereaux

University of New Mexico - Albuquerque: The University of New Mexico

Aleksandra Caric

World Health Organization: Organisation mondiale de la Sante

Karan Rai

Project ECHO

Shalini Desai

World Health Organization: Organisation mondiale de la Sante

Ann Lindstrand

World Health Organization: Organisation mondiale de la Sante

Bruce Struminger

University of New Mexico - Albuquerque: The University of New Mexico

Research

Keywords: workforce training needs, COVID-19, capacity building, peer-to-peer learning, digital learning

Posted Date: October 21st, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-955190/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Version of Record: A version of this preprint was published at Human Resources for Health on February 4th, 2022. See the published version at <https://doi.org/10.1186/s12960-022-00710-7>.

Abstract

Background

To support the introduction of the COVID-19 vaccine, the World Health Organization and its partners developed an interactive virtual learning initiative through which vaccination stakeholders could receive the latest guidance, ask questions, and share their experiences. This initiative, implemented between 9 February 2021 and 15 June 2021, included virtual engagement between technical experts and participants during a 15-session interactive webinar series as well as web and SMS-messaging discussions in English and French.

Methods

This article uses a mixed-methods approach to analyze survey data collected following each webinar and a post-series survey conducted after the series had concluded. Participant data was tracked for each session and feedback surveys were conducted after each session to gauge experience quality and content usability. Chi-square tests were used to compare results across professions (health workers, public health practitioners, and other).

Results

The *COVID-19 Vaccination: Building Global Capacity* webinar series reached participants in 181 countries or 93% of the WHO Member States; 78% of participants were from low-and middle-income countries (LMICs). More than 60% of participants reported using the resources provided during the sessions and 47% reported sharing these resources with colleagues. More than 79% of participants stated that this initiative significantly improved their confidence in preparing for and rolling out COVID-19 vaccinations; an additional 20.3% stated that the initiative “somewhat” improved their confidence. In the post-series survey, 70% of participants reported that they will “definitely use” the knowledge derived from this learning series in their work; an additional 19.7% will “probably use” and 8.6% would “possibly use” this knowledge in their work.

Conclusion

The *COVID-19 Vaccination: Building Global Capacity* learning initiative used a digital model of dynamic, interactive learning at scale. The initiative enhanced the WHO’s ability to disseminate knowledge, normative guidance, and best practices to COVID-19 vaccination stakeholders in real-time. This approach allowed the WHO to hear the information needs of stakeholders and respond by developing guidance, tools, and trainings to support COVID-19 vaccine introduction. The WHO and its partners can learn from

this capacity-building experience and apply best practices for digital interactive learning to other health programmes moving forward.

Background

Introducing the COVID-19 vaccines was the largest simultaneous vaccine deployment initiative in history. As such, the global immunization community needed mechanisms to access real-time normative guidance and implementation examples. The Access to COVID-19 Tools (ACT) Accelerator's Country Readiness and Delivery workstream (CRD) developed resources to support countries in preparing for and implementing COVID-19 vaccination at scale. These included three self-paced Massive Open Online Courses (MOOCs) available through the OpenWHO platform and accompanying job aides to support health workers and immunization professionals in deploying and administering the vaccines.

While the MOOCs and job aides were well-received by the global, national, sub-national, regional participants, they requested interactive training to support their preparation for COVID-19 vaccine deployment. In response, the WHO collaborated with Project ECHO, TechNet-21, UNICEF, the Sabin Institute's Boost community, and the COVID-19 Vaccine Equity Project to develop the *COVID-19 Vaccination: Building Global Capacity* virtual learning initiative. Implemented between 9 February 2021 and 15 June 2021, the aim was to reach a global audience, with a particular focus on supporting immunization focal points in low- and middle-income settings.

The initiative leveraged Project ECHO's nearly 20 years of experience using a virtual, case-based, "community of practice" approach to promote real-time, peer-to-peer learning among health workers and public health practitioners. The Project ECHO learning model promotes clinical and public health collaborative learning using videoconferencing in an "all teach, all learn" approach on a regional, national, or international scale. This model has been used to improve care and outcomes for chronic and acute health conditions; it has also supported the COVID-19 and other emergency public health responses globally.^{[1] [2] [3] [4] [5] [6] [7] [8] [9]}

The *COVID-19 Vaccination: Building Global Capacity* initiative included virtual engagement between technical experts and participants using a multipoint videoconferencing platform, with real-time polling, chat, and Q&A functions, in addition to instant messaging group communication and discussion fora in English and French on TechNet-21, a virtual global network of immunization providers. The aim was to create a learning ecosystem of real-time and asynchronous peer-to-peer learning networks through which health workers, public health practitioners, and other COVID-19 vaccination stakeholders could receive the latest guidance, ask questions, and share their experiences with COVID-19 vaccine introduction.

There is a growing body of evidence to support the effectiveness of webinars in advancing the knowledge of participants, and providing a safe and supportive environment for learning.^[10] Interactive engagement and knowledge gain through webinars are comparable in the promotion of student learning achieved through in-person training.^[11] For example, in a webinar series in the Republic of Korea, a majority of

participants reported higher likelihood of participating and asking questions in a virtual format compared to a live lecture.^[12] Participants have also been documented to appreciate the direct, real-time communication with other participants and facilitators offered through a webinar platform.^[13]

The COVID-19 pandemic accelerated the already increasing use of webinars to transfer information and train participants. However, concerns have been raised about limited access to workplace-based learning experiences, and effectiveness of technology-based competence assessments.^[14] While physicians in one survey reported feeling overwhelmed by the number of virtual meetings, they also expressed appreciation for the increase in international conferences and virtual courses now available from home during the COVID-19 pandemic.^[15] During the pandemic period, medical training seminars have experienced rapid growth in attendance with positive feedback and active participation from learners.^[16] Medical didactic seminars have been reported by the participants to be “very beneficial” with a majority (61%) of participants preferring the virtual format to in-person conferences.^[17]

This paper contributes to the literature on interactive digital learning by describing participation in and outcomes from the *COVID-19 Vaccination: Building Global Capacity* initiative. The mixed-methods approach and findings provide insight into how this webinar series supported COVID-19 vaccination capacity building, particularly in LMICs.

[1] Arora S, Thornton K, Murata G, Deming P, Kalishman S, Dion D, et al. Outcomes of treatment for hepatitis c virus infection by primary care providers. *N Engl J Med*. 2011 Jun 9;364(23):2199–207.

[2] Struminger B, Arora S, Zalud-Cerrato S, Lowrance D, Ellerbrock T. Building virtual communities of practice for health. *The Lancet*. 2017 Aug;390(10095):632–4.

[3] Bikinesi L, O’Byan G, Roscoe C, Mekonen T, Shoopala N, Mengistu AT, et al. Implementation and evaluation of a Project ECHO telementoring program for the Namibian HIV workforce. *Hum Resour Health*. 2020 Dec;18(1):61.

[4] Talisuna AO, Bonkougou B, Mosha FS, Struminger BB, Lehmer J, Arora S, et al. The COVID-19 pandemic: broad partnerships for the rapid scale up of innovative virtual approaches for capacity building and credible information dissemination in Africa. *Pan Afr Med J [Internet]*. 2020 [cited 2021 Oct 5];37. Available from: <https://www.panafrican-med-journal.com/content/article/37/255/full>

[5] Hong SY, Ashipala LSN, Bikinesi L, Hamunime N, Kamangu JWN, Boylan A, et al. Rapid adaptation of hiv treatment programs in response to covid-19 – namibia, 2020. *MMWR Morb Mortal Wkly Rep*. 2020 Oct 23;69(42):1549–51.

[6] Hans L, Hong SY, Ashipala LSN, Bikinesi L, Hamunime N, Kamangu JWN, et al. Maintaining ART services during COVID-19 border closures: lessons learned in Namibia. *The Lancet HIV*. 2021 Jan;8(1):e7.

[7] Hunt RC, Struminger BB, Redd JT, Herrmann J, Jolly BT, Arora S, et al. Virtual peer-to-peer learning to enhance and accelerate the health system response to covid-19: the hhs aspr project echo covid-19 clinical rounds initiative. *Annals of Emergency Medicine*. 2021 Aug;78(2):223–8.

[8] Wilson K, Dennison C, Struminger B, Armistad A, Osuka H, Montoya E, et al. Building a virtual global knowledge network during the coronavirus disease 2019 pandemic: the infection prevention and control

global webinar series. *Clinical Infectious Diseases*. 2021 Jul 15;73(Supplement_1):S98–105.

[9] Heard-Garris N, Arora S, Lurie N. Building physician networks as part of the zika response. *Disaster med public health prep*. 2017 Apr;11(2):259–61.

[10] Khurshid Z, De Brún A, Moore G, McAuliffe E. Virtual adaptation of traditional healthcare quality improvement training in response to COVID-19: a rapid narrative review. *Hum Resour Health*. 2020 Dec;18(1):81.

[11] Gegenfurtner A, Ebner C. Webinars in higher education and professional training: A meta-analysis and systematic review of randomized controlled trials. *Educational Research Review*. 2019 Nov;28:100293.

[12] Nadama HH, Tennyson M, Khajuria A. Evaluating the usefulness and utility of a webinar as a platform to educate students on a UK clinical academic programme. *J R Coll Physicians Edinb*. 2019;49(4):317–22.

[13] Gegenfurtner A, Zitt A, Ebner C. Evaluating webinar-based training: a mixed methods study of trainee reactions toward digital web conferencing. *International Journal of Training and Development*. 2020 Mar;24(1):5–21.

[14] Cleland J, McKimm J, Fuller R, Taylor D, Janczukowicz J, Gibbs T. Adapting to the impact of COVID-19: Sharing stories, sharing practice. *Medical Teacher*. 2020 Jul 2;42(7):772–5.

[15] Ismail II, Abdelkarim A, Al-Hashel JY. Physicians' attitude towards webinars and online education amid COVID-19 pandemic: When less is more. Ashkenazi I, editor. *PLoS ONE*. 2021 Apr 16;16(4):e0250241

[16] Lee Y-M, Park H, Pyun S-B, Yoon YW. Enforced format change to medical education webinar during the coronavirus disease 2019 pandemic. *Korean J Med Educ*. 2020 Jun 1;32(2):101–2.

[17] Elsayes KM, Marks RM, Kamel S, Towbin AJ, Kielar AZ, Patel P, et al. Online liver imaging course; pivoting to transform radiology education during the sars-cov-2 pandemic. *Academic Radiology*. 2021 Jan;28(1):119–27.

Methods

Initiative development: The *COVID-19 Vaccination: Building Global Capacity* learning series had two objectives: 1. to amplify use of and receive feedback on the Act Accelerator Country Readiness and Delivery Workstream's COVID-19 vaccine introduction guidance, tools, and training resources and 2. to share best practices and lessons learned on key aspects of COVID-19 vaccine introduction and administration through case studies and peer-to-peer engagement. The 15 one-hour learning sessions were divided into two sub-series, complementing the resources developed by the Act Accelerator's Country Readiness and Delivery workstream led by the WHO, UNICEF, and Gavi. Five of the sessions focused on topics relevant for health workers while 10 of the sessions focused on topics relevant for national and sub-national focal points. Participants were recruited through email announcements and programme websites, hosted by TechNET-21 and Project ECHO, to join the sessions relevant to their professional or personal interests. Certificates were provided for each session attended. Participants were not expected or required to attend every session.

The live webinars supplemented the OpenWHO MOOCs for national/sub-national focal points on preparing for COVID-19 vaccine introduction and health workers on safe administration of COVID-19 vaccine that were launched in December 2020 (Annex 1). The webinars were complemented by TechNet-21's web discussion fora and cloud-based instant messaging groups in English and French. These fora allowed peers and webinar organizers to interact between sessions. By the end of the webinar series, approximately 1,000 members were participating in the English or French channels of the instant messaging mobile platform; these instant messaging discussion groups have actively continued beyond the end of the webinar series.

The overarching goal of this initiative was to make COVID-19 vaccination information transparent and readily accessible to all. As such, the sessions were marketed through mailing lists, social media, the TechNet-21 and Boost online platforms, and word of mouth. Registration for the sessions was open to the public. Session materials (i.e. recordings, presentations, and responses to questions posed during the session) were posted on publicly accessible websites, such as those hosted by TechNet-21 and Project ECHO, and shared on the mobile SMS channels in English and French, to facilitate access.

Each session included presentations or panel discussions by technical experts and/or peer learning through country case studies as well as allocated time for questions from participants. The subject matter experts responded to participants' questions in writing or verbally during the live webinars; selected questions submitted during the registration process were also addressed. Questions that were not addressed during the webinar due to lack of time were collected and sent to the presenters for compilation into a Q&A document that was shared by email with all participants and posted on the TechNet-21 platform. Participants' questions and recommendations via the post-session surveys, in addition to the ACT Accelerator's identification of COVID-19 vaccination bottlenecks, were used to determine the topics that would be beneficial to focus on during the subsequent sessions.

Participant demographics and attendance. Demographics were collected when participants registered for webinars. Participants provided their name, email, organization, city, profession, and country or region. Attendance reports were automatically saved based on the unique webinar registration link received by each participant. Webinar registration and attendance data were linked using the participant's email address. Participants had the option to self-report their profession from a list provided.

Surveys. A link to an electronic survey was shared with all webinar participants during and after each session. The post-session survey gave participants the opportunity to provide feedback and receive an attendance certificate. The survey asked participants about their knowledge of the session's topic before and after; relevance of session to their current work; balance of lecture and interactivity; and intention to use what was learned in their work. In addition, Project ECHO distributed a final post-series survey link during the last session and in two subsequent emails to all programme registrants to solicit feedback about the entire learning initiative, regardless of the number of sessions they completed. Survey questions are available in Annex 2. The University of New Mexico Health Sciences Institutional Review Board approved this evaluation (ID 20-469) and its consent process.

Analyses. Chi-square tests were used to compare results across professions (health worker, public health practitioner, and others) and participating countries' World Bank income status. Wilcoxon signed ranks test was used to compare knowledge before and after sessions. Quantitative analyses were conducted in SPSS 28.0. Open-ended text responses were coded systematically using NVivo 1.4.1.

Results

From 9 February 2021 until 15 June 2021, 3,058 individuals from 181 countries participated in at least one webinar with similar numbers of health workers and public health professionals (Table 1); there were 6,893 additional views of the webinar through YouTube. The *COVID-19 Vaccination: Building Global Capacity* webinar series reached participants in at least 93% of WHO Member States, with 78.1% of participants from low- and middle-income countries (Table 1).

The attendance size in the live sessions ranged widely depending on the topic; the most-attended session (932 participants) focused on interpersonal communications for COVID-19 vaccination while the least well-attended session (185 participants) focused on adaptive leadership for COVID-19 vaccine introduction. Since the participants attended an average of 2.2 sessions, the total number of attendees participating in real-time (>6,600) is substantially larger than the total number of individuals (3,058) who participated in the live webinar sessions. Nearly 45% of participants attended more than one session, with the highest repeat attendance rates for health workers (Table 2). Of the 3,058 participants in the series, the post-session survey response rate was 46.4% and 7.5% for the post-series survey. More than 76% of the post-series survey respondents attended four or more sessions compared to 14.7% of all participants.

Participants used a variety of learning strategies: of the 228 who completed the post-series survey, 52% reported participating in all three of the COVID-19 vaccination training opportunities: 1) the mobile SMS based channels, 2) OpenWHO COVID-19 MOOCs, and 3) the *COVID-19 Vaccination: Building Global Capacity* webinars (Figure 1). Respondents from low-income countries were more likely to report participating in all three training types (68.0% vs. 43.3%, $p < .001$).

Post-series survey respondents reported using information in various ways after the session, including watching session recordings and sharing resources with colleagues (Figure 1). Of the 228 post-series survey respondents, 61 (26.8%) responded to the open-ended post-series survey questions that they used resources from these sessions in discussions with colleagues or to train others. In addition, 23 of the 228 respondents specifically mentioned the knowledge that they gained, receiving the most up-to-date and accurate information, learning ways to communicate about the vaccine, the interactive learning dynamic, and hearing about others' experiences as the most helpful components of the initiative.

In after-session surveys, respondents rated their post-session knowledge significantly higher than before the session (Figure 2) ($p < .001$). In the post-series survey, most respondents (79.6%) reported that their confidence in preparing for and rolling out COVID-19 vaccination increased "a lot" because of the initiative. However, frontline providers were less likely to report an increase in confidence than public health practitioners or other occupations (72.5% vs. 86.4% vs. 85.7%, $p = .04$). Additionally, participants

who attended four or more sessions were more likely to report their confidence increased “a lot” compared to those who attended fewer sessions (83.8% vs. 65.4%, $p = .004$).

In the after-session surveys, 70% of participants reported that they will “definitely use” the knowledge derived from this series in their work; an additional 19.7% will “probably use” and 8.6% would “possibly use” this knowledge in their work. A number of respondents highlighted the value of their knowledge gains in their responses to the open-ended post-series survey. Comments from participants include that “the knowledge I received is immeasurable” and that their “knowledge and understanding about the operational aspects of COVID-19 vaccine roll-out improved.” Due to this increased awareness, participants indicated that it enabled themselves and their families to “be in a better position to take care of ourselves and the community around us.”

There is also evidence that the webinar series led to planning and action. Most survey respondents said they would “definitely use” what they learned in their work; public health professionals were most likely to report this (Table 2). More than 60% of participants reported using the resources provided during the sessions and 47% reported sharing these resources with their colleagues. In particular, challenges with vaccination hesitancy and programme implementation were cited most frequently as the content they would share with field staff. In addition, 39.9% of participants stated that they would use the information gained from this series to make guidelines, protocols, and/or develop their National Development and Vaccination Plans.

Participants emphasized the role of this series in enabling them to fulfill their roles and responsibilities related to COVID-19 vaccine introduction. Within the post-series survey, 19 participants (8.3%) responded to the open-ended question that this series empowered them to take action and advocate for changes or policies. In particular, learners highlighted the importance of this series in ensuring that they had access to timely information when it was most needed. For example, participants indicated that the *COVID-19 Vaccination: Building Global Capacity* initiative helped them to make “evidence-based recommendations at the national level on COVID-19 planning, deployment, roll out, monitoring and evaluation, and the overall management of COVID-19 vaccines.” Other participants used the information and resources to draft and propose “technical guidance on regulatory matters on the COVID-19 vaccine” for their national COVID-19 task forces; to review National Deployment and Vaccination Plans for COVID-19 vaccines; and to “counsel the community about the vaccine and resolve misleading information about the vaccine” (Table 3).

Respondents provided feedback on how to improve for the future. Of the 228 respondents to the post-series survey, 17 (7.5%) suggested engaging more types of stakeholders (nationally, regionally, and globally), particularly government officials, that may be involved in COVID-19 vaccination planning and deployment. In addition, 15 respondents (6.6%) recommended adding more tangible resources (e.g. handouts and resources to teach others) and practical examples specific to low- and middle-income contexts.

Table 1. Webinar participation and country income by participant profession

	Health worker	Public health	Other	Total* (some participants joined both series so the overall participant total is lower than the sum of the two series)
Participation				
Total	1,469 (48.0%)	1,336 (44.6%)	253 (8.3%)	3,058
Health worker focused sessions	1,012 (52.7%)	699 (36.4%)	210 (10.9%)	1,921
National/subnational focused sessions	954 (44.8%)	1,029 (48.4%)	144 (6.8%)	2,127
Country income				
Low income	334 (48.1%)	325 (46.8%)	35 (5.0%)	694
Lower middle income	545 (46.7%)	514 (44.0%)	108 (9.3%)	1,167
Higher middle income	215 (51.1%)	167 (39.7%)	38 (9.0%)	420
High income	373 (48.6%)	322 (42.0%)	72 (9.4%)	767

Table 2. Webinar session results by participant profession

	N	Total	Health worker	Public health	Other	p-value
Participation records	3,058					
Attended 2+ webinar sessions	3,058	44.9%	48.0%	42.8%	37.9%	.002
Post-session surveys	3,067					
Right balance of didactic and interactive learning	3,023	89.9%	90.6%	89.2%	89.4%	.437
Knowledge increased (before and after)	3,021	64.4%	64.8%	64.9%	61.5%	.400
'Very' or 'extremely' relevant to work	3,026	80.5%	78.6%	85.6%	74.8%	<.001
'Definitely' plan to use what was learned	3,023	70.1%	68.4%	75.8%	62.3%	<.001
Follow-up survey	228					
Participated in all three WHO training formats	221	52.0%	50.0%	57.5%	42.3%	.334
Met needs 'a little' or 'a lot' better than other COVID-19 trainings	225	74.2%	71.6%	77.8%	73.1%	.602
Confidence increased 'a lot'	225	79.6%	72.5%	86.4%	85.7%	.038

Table 3. Responses to the question “How did you use the learnings and resources you received from this series”

Topic	Quote	Participant type
Webinar benefits	"The resources help me to follow up with the updated information of vaccination."	Health worker
	"This webinar empowered me in making evidence-based recommendations at the national level on COVID-19 planning, deployment, roll out, monitoring and evaluation, and the overall management of COVID-19 vaccines. Without these webinars, I wouldn't have had that type of timely information when I most needed it as a regulatory focal point in my country"	Public health
	"They contained information that was up to date and as well applicable as it was time for planning for vaccine deployment at my location so I felt my needs were being supported all the time."	Public health
Knowledge/ confidence	"I improved my knowledge as a lead nurse"	Health worker
	"The knowledge I received is immeasurable."	Health worker
	"My knowledge and understanding about the operational aspects of COVID-19 vaccine roll-out improved."	Other
	"This information helped me and my family be in a better position to take care of ourselves and the community around us."	Health worker
Planning/ action	"I drafted and proposed technical guidance on regulatory matters on the COVID-19 vaccine to key staff in the Ministry of Health who are involved in the overall COVID-19 task force."	Public health
	"I could better review the country's NDVP."	Other
	"I used the webinar resources to counsel the community about the vaccine and resolve misleading information about the vaccine."	Public health
Sharing/ training others	"I shared some resources with colleagues particularly on vaccine hesitancy and programme implementation. We had a great discussion on how we can not only implement our programme better but a possibility to find opportunities in the COVID-19 Vaccine supply in African countries."	Health worker
	"The knowledge gained was disseminated to field staff through meetings in local languages."	Health worker
	"I used attached documents after each session to read them and discuss with colleagues to develop and instruct based on our local context."	Public health

Discussion/conclusion

The *COVID-19 Vaccination: Building Global Capacity* initiative created a model of dynamic, interactive learning at scale. This initiative reflected the WHO's desire to rapidly disseminate guidance, tools, and resources for effective deployment and administration of COVID-19 vaccines. The WHO and its partners

also used this platform to answer questions and promote peer learning through inclusion of country case studies. Participants used this initiative to ask technical experts questions and share comments, familiarize themselves with new guidance and insights, flag challenges related to COVID-19 vaccination, and receive support with their COVID-19 vaccination planning and introduction.

The interactive nature of this digital learning initiative allowed the WHO to hear COVID-19 vaccination stakeholder experiences in real-time as they prepared and implemented COVID-19 vaccination delivery programs. The questions and comments during the sessions, in the post-session feedback surveys, and the discussion fora served as real-time feedback mechanisms that the Covax workstream on Country Readiness and Delivery used to identify needs and develop new resources accordingly. In particular, the SMS-based mobile app enabled robust dialogue with participants. Resources were developed based on questions or requests from this initiative including: job aides explaining why there may be extra doses in a vaccine vial, how to communicate to pregnant women about COVID-19 vaccination, and how to manage vaccines without vaccine vial monitors at vaccination service points.

Although the feedback received from this initiative was overwhelmingly positive, a key limitation is the small percentage of participants who completed the post-series survey. While the participants who completed the post-series survey were more likely to have participated in more sessions, the small sample size impedes our ability to generalize our findings.

Traditionally, the WHO headquarters receives feedback on the guidance and education resources it produces primarily from WHO regional and national staff and/or from Ministries of Health (MOH). The structure and format of the *COVID-19 Vaccination: Building Global Capacity* initiative allowed a wider range of stakeholders (including health workers, MOH programme staff, students, and the public) to engage directly with technical experts, ask questions, and share their experiences. The results of the evaluation of this initiative highlight the strong interest of local, national, regional, and global stakeholders in receiving real-time resources through an interactive capacity-building programme and having communication channels through which they could ask their questions and receive answers from global experts related to COVID-19 vaccination. As such, the *COVID-19 Vaccination: Building Global Capacity* initiative allowed WHO to support the development of potential champions for COVID-19 vaccination globally. The modular nature of the programme allowed participants to attend sessions that were relevant to their work and provided an online curated learning resource that could be used as a participant's role changed or as their country's COVID-19 immunization programme evolved.

Additionally, the initiative provided a trusted source of information in a period where misinformation constituted a significant global challenge.^{[18] [19] [20]} As participants highlighted through the post-session and post-series surveys, the knowledge gained from the webinars helped them to spread accurate information and encourage others to learn about COVID-19 vaccines. Ensuring access to real-time and accurate information on COVID-19 vaccines and vaccination increased confidence in preparing for and rolling out COVID-19 vaccination, particularly for national and sub-national public health officers, and helped participants to respond to the global COVID-19 pandemic and infodemic.

The WHO, TechNet-21, Project ECHO, and the other partners are now considering how best to incorporate learnings from this initiative into future digital health capacity building efforts for emergency response and routine health programmes. The findings align with previous studies suggesting that interactive need- and people-centered digital health can be effectively used for capacity building in low- and middle-income countries.^{[21] [22]} For example, participants from the African region comprised about 46% of total attendees of this series.

The WHO and TechNet-21 are considering innovative tools and approaches that can be used to enhance their capacity building programmes. The overwhelmingly positive feedback from this initiative and participants' requests for more inclusive digital learning opportunities demonstrate that there is strong interest in further using digital capacity building programmes to promote both rapid normative guidance dissemination and peer learning. As such, the WHO and TechNet-21 are exploring opportunities to adapt or develop current learning initiatives to allow for learning and community engagement by leveraging low-bandwidth and low-cost SMS-based apps and videoconferencing technology. Using these platforms could enable the WHO and its partners to reach and interact with stakeholders at scale. In light of the *COVID-19 Vaccination: Building Global Capacity* experience, WHO technical experts have expressed interest in conducting similar types of interactive initiatives for other pathogen prevention and control programmes such as seasonal influenza and antimicrobial resistance.

^[18] Banerjee D, Meena KS. Covid-19 as an “infodemic” in public health: critical role of the social media. *Front Public Health*. 2021 Mar 18;9:610623.

^[19] Jamison AM, Broniatowski DA, Dredze M, Sangraula A, Smith MC, Quinn SC. Not just conspiracy theories: Vaccine opponents and proponents add to the COVID-19 ‘infodemic’ on Twitter. *HKS Misinfo Review* [Internet]. 2020 Sep 9 [cited 2021 Oct 5]; Available from: <https://misinforeview.hks.harvard.edu/?p=2462>

^[20] Kalichman SC, Eaton LA, Earnshaw VA, Brousseau N. Faster than warp speed: early attention to COVID-19 by anti-vaccine groups on Facebook. *Journal of Public Health*. 2021 Apr 9;fdab093.

^[21] Wilson K, Dennison C, Struminger B, Armistad A, Osuka H, Montoya E, et al. Building a virtual global knowledge network during the coronavirus disease 2019 pandemic: the infection prevention and control global webinar series. *Clinical Infectious Diseases*. 2021 Jul 15;73(Supplement_1):S98–105.

^[22] Khurshid Z, De Brún A, Moore G, McAuliffe E. Virtual adaptation of traditional healthcare quality improvement training in response to COVID-19: a rapid narrative review. *Hum Resour Health*. 2020 Dec;18(1):81.

Declarations

Ethics approval and consent to participate: The surveys used were reviewed by the Univeristy of New Mexico Institutional Review Board and received ethics approval.

Consent for publication: No information in this article includes individual person's data in any form. All authors have agreed to publication of this manuscript.

Availability of data and materials: All *COVID-19 Vaccination: Building Global Capacity* session materials are publicly available on TechNet-21: <https://www.technet-21.org/en/topics/covid-19-vaccine> The datasets during and/or analysed during the current study available from the corresponding author on reasonable request.

Conflicts of interest: The authors declare that they have no competing interests.

Funding: The Country Readiness and Delivery workstream (WHO) is providing the funding for open-source publication of this article.

Authors' contributions: SG, AP, AC, SD, CB, and BS co-drafted the manuscript. SG was the WHO lead for the COVID-19 Vaccination: Building Global Capacity initiative; BS was the Project ECHO lead for the initiative. NH, ACBL, and ND coded the qualitative responses and conducted the data analyses. CB formatted the references. KR and AL were key to the initiative's implementation and provided substantive feedback during the review process.

Acknowledgements: We would like to acknowledge the Country Readiness and Delivery (CRD)'s Communications, Advocacy, and Training working group for their insight, the CRD leadership for their support, Daniel Brigden, Sanjeev Arora, Sarah Clements, Denise Traicoff, Jutta Lehmer, Tania Pal Chowdhury, Nikhil Saxena, Arunima Srivastav, Soham Bhaskar, Unish Sachdeva, Sunil Anand, Geraldine Nemrod, and all the session presenters for their support in making this initiative possible.

References

1. Arora S, Kalishman S, Thornton K, Komaromy M, Katzman J, Struminger B, et al. Project ECHO (Project extension for community healthcare outcomes): a national and global model for continuing professional development. *J Contin Educ Health Prof.* 2016 Jul;36(1):S48–9.
2. Arora S, Thornton K, Murata G, Deming P, Kalishman S, Dion D, et al. Outcomes of treatment for hepatitis c virus infection by primary care providers. *N Engl J Med.* 2011 Jun 9;364(23):2199–207.
3. Banerjee D, Meena KS. Covid-19 as an “infodemic” in public health: critical role of the social media. *Front Public Health.* 2021 Mar 18;9:610623.
4. Bikinesi L, O'Bryan G, Roscoe C, Mekonen T, Shoopala N, Mengistu AT, et al. Implementation and evaluation of a Project ECHO telementoring program for the Namibian HIV workforce. *Hum Resour Health.* 2020 Dec;18(1):61.
5. Cleland J, McKimm J, Fuller R, Taylor D, Janczukowicz J, Gibbs T. Adapting to the impact of COVID-19: Sharing stories, sharing practice. *Medical Teacher.* 2020 Jul 2;42(7):772–5.
6. Colella JP, Bates J, Burneo SF, Camacho MA, Carrion Bonilla C, Constable I, et al. Leveraging natural history biorepositories as a global, decentralized, pathogen surveillance network. Morrison TE, editor. *PLoS Pathog.* 2021 Jun 3;17(6):e1009583.

7. Elsayes KM, Marks RM, Kamel S, Towbin AJ, Kielar AZ, Patel P, et al. Online liver imaging course; pivoting to transform radiology education during the sars-cov-2 pandemic. *Academic Radiology*. 2021 Jan;28(1):119–27.
8. Excler J-L, Saville M, Berkley S, Kim JH. Vaccine development for emerging infectious diseases. *Nat Med*. 2021 Apr;27(4):591–600.
9. Gegenfurtner A, Ebner C. Webinars in higher education and professional training: A meta-analysis and systematic review of randomized controlled trials. *Educational Research Review*. 2019 Nov;28:100293.
10. Gegenfurtner A, Zitt A, Ebner C. Evaluating webinar-based training: a mixed methods study of trainee reactions toward digital web conferencing. *International Journal of Training and Development*. 2020 Mar;24(1):5–21.
11. Hans L, Hong SY, Ashipala LSN, Bikinesi L, Hamunime N, Kamangu JWN, et al. Maintaining ART services during COVID-19 border closures: lessons learned in Namibia. *The Lancet HIV*. 2021 Jan;8(1):e7.
12. Heard-Garris N, Arora S, Lurie N. Building physician networks as part of the zika response. *Disaster med public health prep*. 2017 Apr;11(2):259–61.
13. Hong SY, Ashipala LSN, Bikinesi L, Hamunime N, Kamangu JWN, Boylan A, et al. Rapid adaptation of hiv treatment programs in response to covid-19 – namibia, 2020. *MMWR Morb Mortal Wkly Rep*. 2020 Oct 23;69(42):1549–51.
14. Hunt RC, Struminger BB, Redd JT, Herrmann J, Jolly BT, Arora S, et al. Virtual peer-to-peer learning to enhance and accelerate the health system response to covid-19: the hhs aspr project echo covid-19 clinical rounds initiative. *Annals of Emergency Medicine*. 2021 Aug;78(2):223–8.
15. Inside the mammoth undertaking of global vaccine distribution [Internet]. [cited 2021 Oct 6]. Available from: <https://www.who.int/news-room/feature-stories/detail/inside-the-mammoth-undertaking-of-global-vaccine-distribution>
16. Ismail II, Abdelkarim A, Al-Hashel JY. Physicians' attitude towards webinars and online education amid COVID-19 pandemic: When less is more. Ashkenazi I, editor. *PLoS ONE*. 2021 Apr 16;16(4):e0250241.
17. Jamison AM, Broniatowski DA, Dredze M, Sangraula A, Smith MC, Quinn SC. Not just conspiracy theories: Vaccine opponents and proponents add to the COVID-19 'infodemic' on Twitter. *HKS Misinfo Review* [Internet]. 2020 Sep 9 [cited 2021 Oct 5]; Available from: <https://misinforeview.hks.harvard.edu/?p=2462>
18. Kalichman SC, Eaton LA, Earnshaw VA, Brousseau N. Faster than warp speed: early attention to COVID-19 by anti-vaccine groups on Facebook. *Journal of Public Health*. 2021 Apr 9;fdab093.
19. Khurshid Z, De Brún A, Moore G, McAuliffe E. Virtual adaptation of traditional healthcare quality improvement training in response to COVID-19: a rapid narrative review. *Hum Resour Health*. 2020 Dec;18(1):81.

20. Lee Y-M, Park H, Pyun S-B, Yoon YW. Enforced format change to medical education webinar during the coronavirus disease 2019 pandemic. *Korean J Med Educ*. 2020 Jun 1;32(2):101–2.
21. Nadama HH, Tennyson M, Khajuria A. Evaluating the usefulness and utility of a webinar as a platform to educate students on a UK clinical academic programme. *J R Coll Physicians Edinb*. 2019;49(4):317–22.
22. Struminger BB, Arora S. Leveraging telehealth to improve health care access in rural america: it takes more than bandwidth. *Ann Intern Med*. 2019 Sep 3;171(5):376.
23. Struminger B, Arora S, Zalud-Cerrato S, Lowrance D, Ellerbrock T. Building virtual communities of practice for health. *The Lancet*. 2017 Aug;390(10095):632–4.
24. Talisuna AO, Bonkougou B, Mosha FS, Struminger BB, Lehmer J, Arora S, et al. The COVID-19 pandemic: broad partnerships for the rapid scale up of innovative virtual approaches for capacity building and credible information dissemination in Africa. *Pan Afr Med J [Internet]*. 2020 [cited 2021 Oct 5];37. Available from: <https://www.panafrican-med-journal.com/content/article/37/255/full>
25. Tan-Torres Edejer T, Hanssen O, Mirelman A, Verboom P, Lolong G, Watson OJ, et al. Projected health-care resource needs for an effective response to COVID-19 in 73 low-income and middle-income countries: a modelling study. *The Lancet Global Health*. 2020 Nov;8(11):e1372–9.
26. Tatar M, Wilson FA. The largest vaccination campaign in history: A golden opportunity for bundling public health interventions. *J Glob Health*. 2021 May 22;11:03076.
27. Walker PGT, Whittaker C, Watson OJ, Baguelin M, Winskill P, Hamlet A, et al. The impact of COVID-19 and strategies for mitigation and suppression in low- and middle-income countries. *Science*. 2020 Jul 24;369(6502):413–22.
28. Wilson K, Dennison C, Struminger B, Armistad A, Osuka H, Montoya E, et al. Building a virtual global knowledge network during the coronavirus disease 2019 pandemic: the infection prevention and control global webinar series. *Clinical Infectious Diseases*. 2021 Jul 15;73(Supplement_1):S98–105.
29. Wouters OJ, Shadlen KC, Salcher-Konrad M, Pollard AJ, Larson HJ, Teerawattananon Y, et al. Challenges in ensuring global access to COVID-19 vaccines: production, affordability, allocation, and deployment. *The Lancet*. 2021 Mar;397(10278):1023–34.
30. Yarber L, Brownson CA, Jacob RR, Baker EA, Jones E, Baumann C, et al. Evaluating a train-the-trainer approach for improving capacity for evidence-based decision making in public health. *BMC Health Serv Res*. 2015 Jun;15(1):547.

Figures

Figure 1

Resources used by participants (follow-up survey respondents, n=228)

Figure 2

Self-reported knowledge of session topic (post-session survey respondents, n=3,062)

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Annex1and2.docx](#)