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**Report of the 2ND Workshop of the International Collaboration on Advanced Vaccinology Training**

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**Highlights:**

* A total of 33 advanced vaccinology courses existed in 2022, with courses offered in each WHO region.
* A web platform established in 2019 provides easy access to the websites of existing vaccinology courses for potential applicants (ICAVT.ORG).
* In March 2022, the leaders of advanced vaccinology courses met with partners to further the aims of the International Collaboration on Advanced Vaccinology Training.
* A charter was developed for the Collaboration and membership is open to all advanced vaccinology courses.
* The COVID-19 pandemic resulted in the cancellation or postponement of some vaccinology courses while others moved online or became hybrid.
* Areas emphasized included:
  + Lack of sustainable funding remains a serious constraint for advanced vaccinology training.
  + Collaboration and information exchange through networks of alumni and between vaccinology courses and organization of refresher training are valued

**Keywords:** Vaccines, vaccinology, education, training, global vaccinology training, advanced vaccinology training workshop, International Collaboration on Advanced Vaccinology Training, National Immunization Technical Advisory Group, continuing education

**Abstract**

At a workshop on 22–24 March 2022 leaders of 33 advanced vaccinology courses were invited to meet with partners to further the aims of the International Collaboration on Advanced Vaccinology Training (ICAVT) initiated in 2018 to assist courses in addressing challenges in priority areas and facilitate interactions and exchange of information. This included: an update to the landscape analysis of advanced vaccinology courses conducted in 2018, sharing experiences and good practices in the implementation of virtual training, reviewing the training needs of target audiences, informing courses of the principles, challenges, and added value of accreditation, discussing course evaluations and measurement of course impact, reviewing principles and support needed for quality cascade training, reviewing COVID-19 impact on training and identifying remaining related training needs, and identifying solutions to facilitate refresher courses and ways to facilitate networking of courses’ alumni (particularly for virtual courses). The aims were to identify needs and impediments and implement necessary actions to facilitate sharing of information and resources between courses, to identify need for further developments of the e-Portal of the Collaboration (icavt.org) established to facilitate communication between the different courses and assist future course participants identify the most suitable course for them, and to discuss the formalization of the Collaboration. During the workshop, participants looked at several reports of surveys completed by courses and courses’ alumni or partners. The COVID-19 pandemic impacted the delivery of some vaccinology courses leading to postponement, delivery online or hybrid training events. Lack of sustainable funding remained a major constraint for advanced vaccinology training and needs to be addressed. The Collaboration was consolidated with responsibilities and benefits for the members better defined. There was strong support for the Collaboration to continue with the organization of educational sessions at future workshops. The meeting re-enforced the view that there was much enthusiasm and commitment for the Global Collaboration and its core values.

**Introduction**

To develop effective and safe vaccines of good quality, and to deliver life-course high-quality immunization services to the public, a well-trained, skilled, knowledgeable, and motivated workforce with good communication skills is needed. The Immunization Agenda 2030 (IA2030) clearly outlines the need for an adequate and effective immunization related workforce, as well as the need to strengthen evidence-based decision-making (1). The increasingly fast turn-over of managers within immunization program and within the vaccine manufacturing industry as well as the rapidly evolving vaccine armamentarium, the prospect of new vaccine delivery developments and the development of real world evidence and accumulation of post-licensing information on vaccines have resulted in the ongoing need for advanced vaccinology courses in order to educate the large pool of target trainees. The growing and changing complexity of the scientific evidence has to be taken into consideration to ensure optimal vaccination programs. There is also a need for frequent updates of knowledge for those in the area given the ever growing and ever-changing evidence.

Since 2000, advanced vaccinology courses have been organized in different regions of the world, aiming to strengthen vaccinology education for researchers, clinicians, educators, regulators, manufacturers and public health officials (2,3).

A first Global Vaccinology Training workshop was held in November 2018, bringing together leaders from advanced vaccinology courses around the world to carry out an extensive review of the existing courses worldwide, identify education gaps and future needs, and discuss potential collaborations (2). Two main outcomes arose from this workshop: 1) an informal Collaboration among the different courses with regular 6-monthly virtual meetings and development of several workstreams and facilitated exchange between the courses, and the 2) establishment of an e-portal (see below) to help those seeking more advanced training in vaccinology to identify vaccinology courses of interest to them. The aim of the e-portal is also to give more visibility to existing vaccinology training courses and support the sharing of information between these courses.

After more than three years of informal functioning of the Collaboration, in 2022 a second global workshop was organized to address challenges in priority areas; to further facilitate interactions, exchange of information and support networking amongst the group; and to review achievements, progress and concerns, all aimed at reinvigorating the Collaboration. In preparation for this second workshop the previous courses landscape analysis was updated in a comprehensive manner to document how the courses had evolved, particularly in the context of the challenges posed by the protracted COVID-19 pandemic (4). In 2022, a total of 33 advanced vaccinology courses in existence were identified with their representatives invited to participate in the 2nd workshop (see Annex 2). The planning group for the workshop identified critical partner organizations at the regional or global levels including technical ones and funding agencies which, together with a limited number of additional experts, were invited to participate in the meeting (see Annex 1). While invitations were also extended to the International Federation of Pharmaceutical Manufacturers & Associations (IFPMA), Biotechnology Innovation Organization (BIO), the Africa Center for Disease Control and Prevention, Gavi the Vaccine Alliance, and the Welcome Trust due to conflicting pressures mostly related to the COVID-crisis, these organizations did not attend.

A number of resources were produced ahead of the meeting. These included:

* A guide “Adapting to virtual teaching and learning” (5),
* A summary of the pros and cons of shifting to virtual training (6) based on the experienced shared by courses,
* An evaluation handbook (7),
* The results of various surveys completed with all courses in advance of the workshop including a draft report of the landscape analysis and access to individual questionnaires completed by each course,
* A summary of a survey on the sharing of information and related draft code of conduct for the sharing of information,
* A summary of a survey on the formalization of the collaboration and a draft Charter for the formalization of the Collaboration.

There was also an attempt to review the needs of their constituencies completed by various organizations including by the IFPMA. Further, alumni surveys were completed by selected courses to inquire about interest and value in networking, and refreshers/update needs.

The workshop was hybrid with both in person and virtual participation modes to facilitate attendance. The 3-day program is outlined in Annex 3. This article presents the key points from the presentations and the outcome of discussions.

**Objectives**

The specific objectives of the workshop were to: 1) Update the previously published landscape analysis of advanced vaccinology courses and reflect on the evolution since 2018; 2) Share experiences and good practices in the implementation of virtual training; 3) Review the training needs of target audiences and empower courses to adjust the content of the courses to meet the needs of their audiences and establish a regular needs assessment process; 4) Inform courses of the principles, challenges, and added value of accreditation; 5) Give participants the necessary background to improve courses’ evaluations and overcome related challenges; 6) Identify ways to support and facilitate cascade training; 7) Review the impact of the COVID-19 crisis and identify remaining related training needs; 8) Identify solutions to facilitate refresher courses; 9) Identify ways to facilitate networking of courses’ participants (particularly for virtual courses); 10) Identify needs and impediments and implement necessary actions to facilitate sharing information and resources between courses; 11) Identify any necessary developments of the e-portal of the Collaboration to facilitate activities of the Collaboration; and 12) Discuss the formalization of the Collaboration.

**Setting the stage - context**

Participants looked at COVID-19 and how it changed the world and immunization. This was followed by discussions around the biggest challenges for immunization.

The development and deployment of a COVID-19 vaccine in less than a year is one of the great scientific achievements of our time. However, there was tremendous injustice and inequity in the sharing of vaccines, with a huge gap between high income and low-income countries as well as in country inequities. Another key lesson of the pandemic was that while the science is not simple, ensuring actual vaccine uptake was even more difficult. It reminded us that the single most important tool we have in public health, and in vaccinology in particular, is the most basic – good communication with trust being the magic ingredient pulling everything together (8). The pandemic also reminded us of the fragility of the public health infrastructure and of routine immunization programs. COVID-19 was also the first pandemic of the social media age and mis/disinformation has been a significant factor with promotion of anti-vaccine propaganda, dubious therapeutics, and conspiracy theories.

Participants noted that immunization programs have to be firmly at the centre of conversations about health security as this can help unlock resources not constrained by health budgets. The most powerful actor for immunization is the Minister of Finance and vaccinologists need to be better able to make arguments that are responsive to their language and metrics.

The COVID-19 crisis has given many opportunities such as telemedicine, the development of immunization registries, utilization of the private sector for delivery of immunization, attraction of huge financial resources. It also highlighted many existing challenges such as inequalities, the impact of the social determinants of health, and the human resource uncertainties in a pandemic.

A list of global, regional and national challenges, some closely related to each other, as well as gaps and solutions were identified during a brainstorming evening session (supplemental information Table 1). A number of these have implications for course content and course focus adjustments.

**Landscape analysis**

As noted above the landscape analysis aimed to update the previous landscape analysis and provide insight into the impact of the COVID-19 crisis (4). A total of 33 courses were identified, including 23 courses identified in the previous landscape analysis. The 10 additional courses included newly established courses as well as courses which existed previously but were not identified in the earlier search. Three of the courses included in the previous landscape analysis had been discontinued. At least one vaccinology course is now being offered in each WHO region. Although the training capacity has increased tremendously, the demand still far exceeds the supply. The most frequent challenges reported included sustainable funding and identifying appropriate faculty. The pandemic impacted the delivery of several vaccinology courses which were postponed or reformatted to an online or hybrid training event. The discussion also flagged several important elements that help secure funds for a course such as accreditation, demonstration of need and impact, and proven sustainability.

**Supporting virtual training**

Improvement in electronic tools offer a great opportunity to provide a virtual learning experience of quality. The pandemic has accelerated the trend towards e-learning. The design and tailoring of e-learning courses needs to be done carefully, taking into account the target audience, the duration of the course, technological tools and preparation. Virtualization of a face-to-face course is not the same as virtual courses by initial design. Real time virtual classes require stable and reliable internet on the day of the training. It was argued that one could not fully replace in-person courses. For example, the reduced quality of networking amongst participants and faculty, the complexity of times zones, the lack of protected time with virtual versus in person training.

**Needs assessment**

Another major gap identified is the need for more basic vaccinology courses. Advanced courses need to review how they can help support addressing this need. Gaps in advanced training were identified such as emergency preparedness as well as gaps in organization of courses, infrastructure and content. To improve emergency preparedness, it is important to train: 1) decision-makers: Ministry of Health/ Department of Health; National Immunization Technical Advisory Groups (NITAGs)/ Regional Immunization Technical Advisory Groups (RITAGs); 2) implementers: immunization managers, clinicians, epidemiologists, Non-Governmental Organizations (NGOs); and 3) communication experts.

One discussion focused particularly on NITAGs needs. The most common NITAGs training needs are related to the formulation of the policy question, the extraction of the related evidence and adequate use of existing literature reviews. Sometimes de novo literature reviews are done in the evidence-to-recommendation process. Other needs are ability to understand modelling and health economics data, vaccine demand data and behavioral and other drivers of acceptance. These needs differ depending on the audience. The NITAG secretariat and the chair need trainings on the evidence-to-recommendation process and synthesizing the evidence while core members need training on understanding the evidence given their country’s context. Vaccinology courses are of great value for all NITAG members, to acquire or reinforce a broad common knowledge base across multiple disciplines. This is even more the case for NITAG members coming with social science background, which more and more NITAGs welcome in their midst.

The critical needs flagged by courses included: finding faculty that have enough time available to give targeted lectures, finding new faculty on specific areas and bringing in international speakers; adapting and improving teaching methods; ensuring course content was updated; sharing of lectures (risks and benefits); fitting the program to the context; identifying funding sources (risks and benefits); development of tools (websites, portals, official summaries); establishing and maintaining credibility; and building an effective alumni network. Further findings are noted in the supplemental materials.

Given the key role trust in healthcare providers and their vaccine recommendations play in vaccine acceptance, a vaccine training barometer developed under EU-Joint Action on Vaccination (9), was reviewed. This showed that a substantial proportion of those healthcare providers were not comfortable in answering some specific vaccination related questions. This was linked to the limited training in vaccinology in the curriculum of healthcare professionals. These health care professionals were, however, quite willing to take additional related training to be able to better communicate specific content. The Vaccine Training Barometer is seen as a valuable and sustainable tool for monitoring the need for training amongst healthcare providers involved in vaccines delivery. Its application in low and middle income countries needs to be assessed.

**Course accreditation**

Accreditation criteria are important in the creation and maintenance of effective learning for professionals uninfluenced by industry. Accreditation is one of several factors that builds the course’s credibility making it more attractive to participants even if they do not need to claim the credits, higher acceptance for faculty to join, and higher interest for sponsors with increased chances of funding.

Accreditation can be secured for face-to-face, virtual or hybrid events. Courses can also request accreditation for webinars and /or update/refresher activities. Even if there is no accreditation body in a country, accreditation could be secured from other accreditation institutions (https://www.accme.org).

**Course evaluations**

There are different levels and purposes of course evaluation beginning with participant satisfaction and moving along the scale to impact on patient/community health and well-being. One needs clarity on what needs to be measured in the evaluation and then choose appropriate evaluation methods based on the program’s goals and objectives. The availability of resources impacts the ability to address the more complex levels of evaluation. It is useful to consider using multiple methods of evaluation for any one program.

Evaluations are more credible if anonymous.

The evaluation can be: short-term: changes in knowledge, competencies (a few weeks); midterm: Concrete behavior changes and implementation of commitment to change can be assessed within 3-4 months; Intermediate – after six months: to ensure that the knowledge and competencies are still there and if not used will be used; and long term: Impact of these behaviors. On the longer term, qualitative evaluations may yield better results by asking questions such as how the training may have affected career options, participation in national, regional or global immunization/vaccination decision-making bodies [i.e., NITAGs, RITAGs, Strategic Advisory Group of Experts on Immunization (SAGE)].

The impact of a course can also be monitored by: mentoring follow-up; interviews with learners; self-assessments throughout the year; measurement of alumni network interactions/connectivity (platform, social media), topics of interest; higher demand for training; or implementation of cascade or additional training activities by the participants.

**Multicourse applicants**

A proportion of courses’ candidates have already attended other advanced vaccinology courses. This poses challenges in the evaluation of the applications. Some of the interest in attending other courses may be due to a different emphasis of another course (more specialized versus general, complementary trainings), need for a refresher course after some years, and/or interest in expanding one’s networking. Attending multiple courses that have similar typology (course design and contents) is unlikely to have important incremental benefits and may block the opportunity for a participant who has never had the opportunity to attend an advanced course. However, this may be different for students attending courses that build on the knowledge of previous courses. It is therefore important to have clear and transparent selection criteria when assessing candidates to avoid overlap/duplication and look at cumulative experience. The differential impact of multiple training is very difficult, to assess. Thus, the contribution of a course in this context is best evaluated soon after it is held.

**Cascade Training**

Formal cascade training is complex and to do it seriously, one has to plan it, think about what is needed, and have the right resources to support it. Quality assurance and fidelity with respect to the original training materials are particularly challenging. One has to credit the original documents, look at what will be potentially lost in the adaptation, downsizing and/or translation of the materials. The risk for misinterpretation and misrepresentation must be considered. Further, if materials are not properly adapted, they may not fit the local context, culture, and resources. Audiences may differ in their needs and backgrounds and how well the cascaded materials fit. Some lectures and teaching material also quickly become obsolete. Further, there may be a challenge with faculty if their materials are being made public and freely available.

There was consensus that for advanced vaccinology courses engaging in formal cascade training has risks. For more basic vaccinology training, cascading of advanced course content may not be a good fit. Advanced courses should limit themselves to supporting the development of other courses/seeding courses and leave the organization of basic courses and mass training to organizations focused on these.

**COVID impact and related remaining training needs**

Tremendous knowledge on SARS-CoV-2/COVID-19 has been generated from interventional and observational studies, some of which would be of interest in the advanced vaccinology courses (e.g. communication skills, behavioral and social science insights, vaccine access, new vaccine platforms).

COVID-19 has taught us that we need to change how we communicate on vaccine efficacy and complex nuanced science findings. Indeed, today almost all vaccines available for COVID-19 have similar efficacy or effectiveness against severe disease or death but there is variability in prevention of infection and symptomatic disease. This has been very confusing to policy and program makers as well as to the general public. Another topic not previously dealt well with in advanced courses was the concept of bridging studies.

**Refresher courses**

In order to understand the need and scope of refresher courses, two surveys were conducted before the workshop. Overall, 547 alumni from the Annual African Vaccinology Course (AAVC) 2011-2020 and 167 alumni from the 2011, 2016 and 2017 Child Health Foundation (CHF)- INCLEN Trust International were surveyed. Responses were obtained from 100 (18%) AAVC and 27 (16%) CHF-INCLEN alumni. Most alumni had not attended other advanced vaccinology courses after attending AAVC or CHF-INCLEN courses.

Alumni indicated the need for refresher training activities to update, refresh and reinforce knowledge, provide an opportunity to network and share ideas. Refresher training should be focused on specific topics. Most alumni are open to attending an online vaccinology course for refresher training. It is critical that refreshers’ opportunities are easy, not expensive, and available in different formats. These can be webinars, recorded lectures, as well as short courses. It was suggested that alumni themselves could be involved in leading/organizing some of the refresher activities. Funders are needed to make these happen. It was also noted that accreditation and certificates of participation are useful for some participants. Whenever possible, refresher activities organized for alumni from one course could be made available to alumni of other courses.

**Facilitation of alumni and course networking**

A survey was implemented in February 2022 by sending a questionnaire to the alumni of the CHF-INCLEN in India and the vaccinology course in Chili. In total 38 alumni completed the questionnaire (23 in India and 15 in Latin America). The conclusion of the surveys is that alumni want networking; facilitation for exchange of knowledge and best practices are considered of value; workshops, seminars or conferences are preferred for networking; time constraints are certainly an issue; on-line meetings (virtual or hybrid) at least quarterly are desirable.

Face-to-face training is best for networking but sometimes there is no opportunity to attend these trainings (e.g., due to lack of funding) and virtual courses are the only option. Web-based videoconferencing tools have made huge technical progress especially during COVID-19. Most faculty and participants are now comfortable using them and gradually online networking will develop but it will never replace face-to-face opportunities. The ideal is to have face-to-face courses followed by virtual meetings. Networking virtually is easier if one has at least met once. There is a challenge for courses that have been online since the beginning, and they need to evaluate if they can build the trust relationships among participants.

Networking in the context of advanced courses could facilitate continuous-educational efforts. There is a unique opportunity for the networking enrichment-process and this should be included from the design of and during courses. Tailor-made post-course activities should be designed and implemented. Networking opportunities offered by advanced vaccinology courses are particularly important when courses give the opportunity to people from different backgrounds (industry, public health, regulators, academia, NGOs, private or public sector) to meet each other, have open discussions and understand each others’ perspectives.

In view of its importance, participants of the Collaboration meeting liked the idea of incorporating networking into evaluation and of formally evaluating networks after courses.

**Sharing of information and resources between courses**

A 13-question questionnaire on the sharing of information and resources between courses was sent to 30 directors representing the 33 courses. Responses were obtained from 27 (90%) respondents. Twenty-four respondents (89%) indicated the need to have access to additional resources: case studies or exercises (92% of those stating needs), evaluation tools (79%), video lecture recordings (67%), PowerPoint slides (63%), list of potential lecturers (63%), and background documents (54%). Twenty-two respondents (81%) were willing to share presentations/case studies/other materials on the password protected e-portal of the International Collaboration on Advanced Vaccinology Training. Most of those unwilling to share resources were MSc Programs and amongst the reasons for not sharing were company/sponsor agreements. About one-third of the respondents spontaneously mentioned the need for approval from authors/presenters. Twenty-three (85%) respondents mentioned that the resources can be used if properly acknowledged. Twenty-two (81%) respondents agreed that a code of conduct should be developed for sharing resources between courses. It was notably stated that this should be a document highlighting the basics with clear internal regulations. It should state good practices to adhere to, and not be prescriptive. Developers of resources should be acknowledged, and it should be stated that the purpose of sharing is for educational purpose, and not for publication or commercial use. This feedback on what courses considered as good practice was used for the development of the Code of Conduct on the sharing of information for the Collaboration (10).

Participants also proposed the potential development of a one- or two-day refresher course for the Collaboration, with a selection of a few lectures from various courses in the name of the Collaboration. This would be a pragmatic implementation of sharing of resources and at the same time a useful refresher course for all courses’ alumni. One could organize a poll of subjects that could be included in the refresher course. It could be organized virtually with regional poles of people meeting locally.

**e-portal**

The e-portal (icavt.org) was developed as a separate independent website, easy and cheap to develop and maintain. Developments reflect work and consensus of the e-portal workstream and further insight and requests from the Global Collaboration via its regular teleconferences. The site is available, at least in part, in the 6 WHO official languages (English, French, Spanish, Chinese, Arabic and Russian). As of 22 March 2022, 31 courses were listed in the search module and specific information on courses of interest can be accessed via web links. Some information/documents are freely accessible whilst others can only be accessed by authorized users.

Using Google analytics, a review of the use of the e-portal was conducted for the one-year period between 15 March 2021 and 15 March 2022. During this period there were about 6000 users, mostly new users. The access was relatively stable over time and came from a total of 144 countries. Not surprisingly, the search page for courses was the most commonly accessed. The vast majority of access was in English (84%) followed by French (7.6%) and then by Spanish (3.7%), Chinese (2.3%), Arabic (1;4%) and Russian (0.9%). Access to the site is direct in 47.5% of cases which points to the circulation of the URL for direct access. Organic searches account for another 37.0% of access whilst 17.6% come from referrals from course websites (by decreasing order of frequency: ADVAC, CNVAC, ALIVE, Pasteur, ECAVI, IMMVAC, Sabin, CIFV, and SAVIC – See Annex 2 for a list of the acronyms).

There is both a need for the development/strengthening of some of the courses’ websites/pages and a need to further develop the portal building on achievements and expectations from this workshop. It was suggested that the e-portal should be restructured with two sub-domains (internet/intranet) - one for people looking for vaccinology courses and other interested parties and one for members of the Collaboration.

Finally, the discussion focused on the need to keep monitoring and evaluating the e-portal. A small survey of users would be useful asking them if they found what they were looking for and if any improvements could be made.

**Formalization of the International Collaboration on Advanced Vaccinology Training**

All participants agreed that they were committed to achieving the goals of the IA 2030 (1) and that a well-trained workforce will strengthen our immunization programs and decision-making processes.

The results of a survey on the need for formalization of the Collaboration conducted in preparation for the workshop were presented. A large majority of the responders supported a more formalized Collaboration to facilitate the exchange of information and help them address issues of concern. Participants were then given a chance to review and discuss the key points from the draft Collaboration Charter that was circulated ahead of the workshop and built on the results of the above-mentioned survey. Participants agreed that the aim for the Collaboration should be to foster collaborations between courses and create opportunities for pooling resources and increasing effectiveness through sharing experiences, lessons learned, and documentation. The major principle is that all courses have their own specificities, independence and sovereignty. Adhering to the Collaboration will in no way alter this and impede their autonomy.

Participants agreed with the proposed charter and the formalization of the Collaboration with some adjustments that were reflected in the final version of the Charter (10).

The vision of the Collaboration is to help realize a vaccinology practice and educational setting that is global, collaborative, and complimentary, better serving those who operate within it and, through it, serve communities around the world.

The mission of the Collaboration is to facilitate vaccinology education through the maintenance of a global list of credible advanced vaccinology courses so that interested audiences can better identify courses and programs that best suit their needs, and to support those courses by enhancing their visibility through the founding and maintenance of a Collaboration e-Portal, which will be updated by the Secretariat with help from Collaboration members.

The Collaboration is founded on and seeks to further advance the following values: honesty; openness; transparency; accountability; collaboration; trust; mutual growth and facilitation; professional development. Given these shared values, membership in the Collaboration is voluntary, based on shared goals, interests, and relationships of trust. In addition, all members are equal and respected.

A 5-member Steering Committee will function as the Collaboration’s executive decision-making body and will be mandated to provide strategic oversight and management of the Collaboration, and to ensure the development and implementation of an annual work plan that reflects the needs and priorities of its members, and that is consistent with the Collaboration’s Vision, Mission, and Objectives.

The Secretariat will be provided by ADVAC for an initial period of 3 years from this workshop onwards with funding from the Bill & Melinda Gates Foundation.

Membership is open to all advanced vaccinology specific courses without limitation with respect to the number of students trained per course/year. Courses should have obtained formal endorsement/accreditation from either a tertiary training institution and/or a training accreditation institution (e.g., continued medical education in a university faculty). Courses part of the initial core membership of the Collaboration are accepted as formal members of the Collaboration even if not accredited. It is expected that they can secure accreditation within a period of five years (from 24 March 2022), and they are strongly encouraged to do so as it is in their best interest.

Courses can be national, regional of global in terms of target audience. Courses can be short courses from a few days to a month time or graduating courses such as MSc, PhDs and DIU. They can be face-to-face, virtual or hybrid courses. For the time being, the Collaboration is limited to courses having a broad curriculum, and is not open to courses, even if advanced, focusing on a very narrow aspect of vaccinology. Courses organized by/for industry and intended exclusively for one company’s employees are not eligible to join the Collaboration.

Membership of a vaccinology course in the Collaboration does not mean endorsement of its content nor any certification of the quality of the teaching approach by the Collaboration.

Joining requires at least one person designated as a contact with the Collaboration. However, the course as a whole (or groups of courses when several are organized by the same institution(s)) is/are a member of the Collaboration and all those in charge ( a limit of up to 3 persons per course leadership is set, and if courses are organized by two or more partners, it is the responsibility of the course leadership to determine who the representatives are) of the organization of the course are invited to participate in the Collaboration.

**Conclusion**

The Collaboration has come a long way from the first global workshop on advanced vaccinology training held in 2018. The utilization of the e-portal and the enthusiasm and active participation in the videoconferences, surveys and the 2nd workshop all speak to the need and value of the Collaboration. The second workshop succeeded in bringing information on the requested topics and the discussion of several common challenges and potential solutions. The main recommendations from the first global workshop on advanced vaccinology training such as the creation of a web platform for information about available vaccinology training were implemented even though the COVID-19 crisis has limited the Collaboration’s activities. The importance of collaboration and information exchange through networks of alumni and between vaccinology courses was stressed as well as the need for refresher activities and updates for alumni.

Lack of sustainable funding remains an ongoing constraint for advanced vaccinology training and needs to be addressed. It is important in the future to see that the Collaboration continues with the organization of educational sessions that help courses enhance emphasis on what we know and do not know.

The formalization of the Collaboration and signing of its Charter and code of conduct by courses should further facilitate the exchange of documents and resources and joint activities in support of all advanced vaccinology courses. The benefit should also expand beyond the courses with membership in the Collaboration which, although not directly involved in formal cascade training, can support the development and implementation of other more basic vaccinology training activities. Collectively these courses are a huge resource for decision makers such as NITAG members and they help break communication barriers between industry, regulators, policy makers, program managers, immunizers, academics and other interested parties in a legitimate manner that minimizes potential for conflicts of interests.

The meeting reenforced the view that there was real enthusiasm and commitment for the Global Collaboration and its core values.

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**Conflict of interest**

The authors declared that they have no conflict of interest with the design and content of this publication

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**Annex 1:** List of participants

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Magid AL-GUNAID, NITAG Vaccinology Course, GHD|EMPHNET, Jordan;

Lizzelott ANDERSSON, Latin America Online Vaccinology Course, Carlos Slim Foundation, with endorsement of the National Autonomous University of Mexico, Mexico;

Sandra ANGELE, Fondation Mérieux, France;

Narendra ARORA, Child Foundation/INCLEN, India;

Nyambath BATMUNKH, WHO Regional Office for the Western Pacific;

Erica BERGHMAN, Certificat Interuniversitaire en Vaccinologie, Université libre de Bruxelles, Belgium ;

Paolo BONANNI, Vaccine and Vaccination Strategy, University of Florence, Italy;

Marc BONNEVILLE, Fondation Mérieux, France;

Mohammed BOUSKRAOUI, Inter-University Diploma in Vaccinology, Faculty of medicine University Cadi Ayyad, Morocco;

Cheikh S B BOYE, International Course on Vaccinology, Université de Dakar, Senegal;

Nyasha CHIN’OMBE, Master of Science in Vaccinology, University of Zimbabwe; Zimbabwe;

Joanna COLBOURNE, Clinical Vaccinology Course, National Foundation for Infectious Diseases (NFID), United States of America;

Béhazine COMBADIERE, MOOCS Vaccinology and Institut Pasteur International Vaccinology Course, INSERM, France;

Clare CUTLAND, African Leadership in Vaccinology Expertise (Alive), University of the Witwatersrand, South Africa;

Tarik DERROUGH, European Center for Disease Control, Sweden;

Arnaud DIDIERLAURENT, University of Geneva, Switzerland;

Carine DOCHEZ, University of Antwerp, Belgium;

Philippe DUCLOS, ADVAC Advanced Course of Vaccinology, University of Geneva, Switzerland;

Esra EKINCI, Summer Course on Vaccinology for Students, University of Antwerp, Vaccine and Infectious Diseases Institute, Belgium;

Quamrul HASSAN, WHO Regional Office for the Eastern Mediterranean, Egypt;

Louise HENAFF, World Health Organization, Switzerland;

Benjamin KAGINA, VACFA Annual African Vaccinology Course, University of Cape Town, South Africa;

Jean-Louis KOECK, CIFV, Direction Centrale du Service de Santé des Armées, France;

Jean-Pierre KRAEHENBUHL, IMVACC, Health Sciences E-training Foundation, Switzerland;

Wiebe KÜELPER-SCHIEK, Robert Koch Institute, Germany;

Paul-Henri LAMBERT, University of Geneva, Switzerland;

Ann LINDSTRAND, World Health Organization, Switzerland;

Noni E MACDONALD, Dalhousie University, Canada;

Alice MALACHANE, WHO, Academy, France;

Oliver Ombeva MALANDE, Vaccinology Course for Health Professionals, East Africa Centre for Vaccines and Immunization (ECAVI), Uganda & Kenya;

Liudmila MOSINA, WHO Regional Office for Europe, Denmark;

Nivashnee NAICKER, Centre for the AIDS Programme of Research in South Africa, South Africa;

Sidy NDIAYE, WHO Regional Office for Africa, Denise NANICHE, Development and Application of Vaccines in Global Health, ISGlobal-Barcelona Institute for Global Health, Hospital Clinic, University of Barcelona, Spain;

Varsetile NKWINIKA, SAVIC Higher Certificate in Vaccinology and Vaccinology Short Course, Sefako Makgatho Health Sciences University, South Africa;

Hanna NOHYNEK, Finnish Institute for Health and Welfare, Finland;

Kate O’BRIEN, World Health Organization, Switzerland;

Sonia PAGLIUSI, Developing Country Vaccine Manufacturers Network, Switzerland; Bénédicte PANSIER, Fondation Mérieux, France;

Stéphane PAUL, Leading International Vaccinology Education (LIVE), Université Jean Monet, France;

Nicolas PEYRAUD, Médecins Sans Frontières, Switzerland ;

Armelle PHALIPON, MOOCS Vaccinology and Institut Pasteur International Vaccinology Course, Institut Pasteur, France;

André PICARD, Globe and Mail, Canada;

Valentina PICOT, Mérieux Fondation, France;

Winsley ROSE, INDVAC, Christian Medical College, India;

Brian SHAW, Ciro de Quadros Vaccinology Course for Immunization managers in Latin America, Sabin Vaccine Institute, United States of America;

Jennifer SANWOGU, Pan American Health Organization, United States of America;

Melanie SAVILLE, Coalition for Epidemic Preparedness, UK;

Sarah SCHILLIE, Centers for Disease Control and Prevention, United States of America;

Meru SHEEL, Advanced vaccinology for the Asia-Pacific, University of Sidney, Australia;

Anisur Rahman SIDDIQUE, UNICEF, United States of America;

Lisbeth SOEDERBERG, Oxford Vaccinology Course, University of Oxford/Jenner Institute, UK;

Christoph STEFFEN, World Health Organization, Switzerland;

Rajinder SURI, Developing Country Vaccine Manufacturers Network, Switzerland; Laura TEBLICK, Summer Course on vaccinology for students, University of Antwerp, Vaccine and Infectious Diseases Institute, Belgium;

Naveen THACKER, International Pediatric Association, India;

Jane TIPPING, Faculty of Medicine, University of Toronto, Canada;

Pierre VAN DAMME, Summer Course on Vaccinology for students, University of Antwerp, Vaccine and Infectious Diseases Institute, Belgium;

Rodolfo VILLENA MARTINEZ, International Advanced Vaccinology Course, University of Chile, Chile;

Likui WANG, Chinese Vaccinology Course, University of Chinese Academy of Sciences, China;

Anh WARTEL, IVI International Vaccinology Course, International Vaccine Institute, Korea;

Melinda WHARTON, US Centers for Disease Control and Prevention, United States of America;

Dace ZAVADSKA, Global NITAG Network, Lettonie.

**Annex 2. Courses participating in the Global Vaccinology Training Collaborative and having provided information used during the workshop**

Advanced Course of Vaccinology (ADVAC), Mérieux Foundation and the University of Geneva;

Advanced Vaccinology Course in India (INDVAC), Christian Medical College, Vellore;

Advanced vaccinology for the Asia-Pacific;

African Leadership in Vaccinology Expertise (ALIVE), Master of Science (MSc) (Med) in the field of Vaccinology, The University of the Witwatersrand, Johannesburg;

Afro-ADVAC-African Advanced Vaccinology course, African Leadership in Vaccinology Expertise (ALIVE), The University of the Witwatersrand, Johannesburg;

Annual African Vaccinology Course (AAVC), University of Cape Town;

Certificat Interuniversitaire en Vaccinologie, Université Libre de Bruxelles, Université Catholique de Louvain, Université de Liège, Belgium:

Chinese Vaccinology Course (CNVAC), Medical School, University of Chinese Academy of Sciences;

Ciro de Quadros Vaccinology Course for Immunization Managers in Latin America, Sabin Vaccine Institute;

Clinical Vaccinology Course, National Foundation for Infectious Diseases (NFID);

Cours international francophone de vaccinologie (CIFV), Université de Bordeaux - Service de santé des armées - Groupe d’études en préventologie;

Development and Application of Vaccines in Global Health, IS Global-Barcelona Institute for Global Health, University of Barcelona, Spain;

Diplôme International Inter Universitaire de Vaccinologie (DIUI), University of Dakar;

Diplôme International de Vaccinology, Cadi Ayyad University Marrakech;

Summer course on vaccinology for students, Antwerp University;

Vaccinology Course for Health Professionals, East Africa Centre for Vaccines and Immunization (ECAVI);

Epidemiological Evaluation of Vaccines: Efficacy, Safety and Policy, London School of Hygiene & Tropical Medicine;

Higher Certificate in Vaccinology (HCert), South African Vaccination and Immunisation Centre (SAVIC), Sefako Makgatho Health Sciences University;

International Advanced Vaccines Course, University of Chile;

International Vaccinology Course, Institut Pasteur Paris;

International Vaccinology Course, International Vaccine Institute (IVI), Seoul;

Latin American Online Vaccinology Course (DILVAC), Carlos Slim Foundation;

Leading International Vaccinology Education (LIVE), Master of Science;

Master of Advanced Studies of Vaccinology (IMVACC), University of Lausanne;

Master of Science in Vaccinology; University of Zimbabwe;

Master in Vaccinology and Pharmaceutical Clinical Development, University of Siena, Institute for Global Health;

MOOCS vaccinology, Institut Pasteur, Paris;

NITAG Vaccinology Course EMRO, GHD/EMPHNET and NESI/University of Antwerp;

Vaccinology in Africa MSc Level Course, Jenner Institute, University of Oxford;

University of Oxford Vaccinology programme (Human and Veterinary Vaccinology, Clinical Development and Biomanufacturing), Jenner Institute and University of Oxford;

Vaccines and Vaccination Strategies, University of FIorence, Italy;

Vaccinology and Immunotherapeutics, University of Saskatchewan;

Vaccinology Short Course (VSC). South African Vaccination and Immunisation Centre (SAVIC), Sefako Makgatho Health Sciences University.

**Annex 3:**

**Agenda**

**Second Workshop of the Global Collaboration on Advanced Vaccinology Training**

**22-24 March 2022**

**Les Pensières, Center for Global Health, Veyrier-du-Lac/Zoom**

Organized by ADVAC with funding from the Bill & Melinda Gates Foundation (INV-010383)

**Members of the organizing committee:**

Carine Dochez, Network for Education and Support in Immunisation (NESI), Belgium

Philippe Duclos, University of Geneva, Switzerland

Paul-Henri Lambert, University of Geneva, Switzerland

Noni MacDonald, Dalhousie University, Canada

Hanna Nohynek, National Institute of Health and Welfare, Finland

Christoph Steffen, WHO

Naveen Thacker, International Paediatric Association, India

Nicolas Theopold, Bill & Melinda Gates Foundation

Melinda Wharton, Centers for Disease Control and Prevention, USA

**Aims of the workshop:** Further the aims of the Global collaboration on advanced vaccinology training, help courses address challenges in priority areas and facilitate activities and exchange of information

**Specific objectives:**

1. Update the landscape analysis of advanced vaccinology courses and reflect on the evolution since 2018
2. Share experiences and good practices in the implementation of virtual training
3. Review the training needs of target audiences and empower courses to adjust the content of the courses to meet the needs of their audiences and establish a regular needs assessment process
4. Inform courses of the challenges, added value and principles of accreditation
5. Give participants the necessary background to improve courses’ evaluations and overcome related challenges
6. Identify ways to support and facilitate cascade training
7. Review COVID impact and identify remaining related training needs
8. Identify solutions to facilitate refresher courses
9. Identify ways to facilitate networking of courses’ participants (particularly for virtual courses)
10. Identify needs and impediments and implement necessary actions to facilitate sharing information and resources between courses
11. Identify any necessary developments of the e-Portal of the Collaboration (https://www.global-vaccinology-training.com/) to facilitate activities of the Collaboration
12. Discuss the formalization of the Collaboration and review and endorse the proposed charter or a version modified as necessary

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| **Time** | **Session**  **Day 1: Tuesday, 22 March 2022** | **Presenters** | **Co-Chairs** |
| 16:00-16:50 | Informal introduction of early arrivers to each other over tea/coffee |  |  |
| 17:00 | **Welcome - Introduction - Objectives for the meeting** | Philippe Duclos, University of Geneva, Switzerland |  |
| 17:10 | **Introduction of participants** |  |  |
| 17:40 | **Session 0: Setting the stage .......**  How COVID has changed the world: 15 min.    How COVID changed immunization: the global perspective: 15 min.  How COVID changed immunization in low- and middle-income countries: 15 min.    Questions and answers: 25 min. | Andre Picard, Globe and Mail, Canada  Kate O’Brien, WHO  Narendra Arora, INCLEN, India | Pierre Van Damme, University of Antwerp &  Philippe Duclos University of Geneva |
| 18:50 | **SESSION 1: Update on landscape analysis of existing vaccinology courses (30 min.)**  Summary presentation: 10 min.  Questions and discussion: 20 min. | Carine Dochez, NESI, Belgium | Noni MacDonald, Dalhousie University, Canada  &  Paolo Bonanni, University of Florence, Italy |
| 19:20 | **Dinner "tasks"**  Meet table mates  Questions for discussion  1. What are the 3 biggest challenges you see in immunization: globally, regionally, your country?  2. What does your course/your program/your work bring that could address one/some/all of the challenges?  3. Where are the gaps and what are potential solutions? | Noni MacDonald, Dalhousie University, Canada |  |
| 19:30 | **Dinner with assigned tables - Questions** |  |  |

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| **Time** | **Session**  **Day 2: Wednesday, 23 March 2022** | **Presenters** | **Co-Chairs** |
| 08:30 | **SESSION 2: Supporting virtual training (1.5 hrs)**    Sharing the example of a virtual Master’s course in vaccinology: International Master in Vaccinology IMVACC (University of Lausanne -UNIL): 15 min.  User feedback: 2 alumni to give direct feedback: 10 min.  Questions and answers: 10 min.  Discussion: 55 min | Jean-Pierre Kraehenbuhl, Health Sciences E-training Foundation, Switzerland    Nivashnee Naicker, University of KwaZulu-Natal & Nicolas Peyraud, MSF | Christoph Steffen, WHO  &  Jean-Pierre Kraehenbuhl, Health Sciences E-training Foundation, Switzerland |
| 10:00 | **Coffee/Tea break** |  |  |
| 10:30 | **SESSION 3: Needs assessment (2.5 hrs)**  Report of the survey of audiences: 20 min.  Discussion: 15 min.  Listing of key issues and break-out session to come up with solutions organized according to different themes. Each group to take one aspect as a priority and to spend some time more briefly on the other aspects: 1 hr  Plenary: 30 min. | Varsetile Nkwinika, Sefako Makgatho Health sciences University, South Africa | Hanna Nohynek, National Institute for Health and Welfare, Finland  &  Varsetile Nkwinika, Sefako Makgatho Health sciences University, South Africa |
| 12:05 | **Lunch** |  |  |
| 13:30 | **Session 3: Needs assessment (ctd)** |  |  |
| 14:30 | **SESSION 4: Courses’ accreditation for Continuing Medical Education (40 min)**  The principles of accreditation: 10 min.  The added value and challenges of accreditation: 10 min.  Discussion: 20 min. | Jane Tipping, University of Toronto  Philippe Duclos, University of Geneva | Carine Dochez, NESI  &  Sue Ann Costa Clemens, University of Siena, Italy (Unable to join) |
| 15:10 | **SESSION 5: Courses’ evaluations (2 hrs)**  Current evaluation processes and evaluation principles and recommendations: 25 min.  Questions and answers: 15 min.  Breakout session to discuss courses challenges: 50 min. | Jane Tipping, University of Toronto | Philippe Duclos, University of Geneva  &  Behazine Combadière, INSERM, France |
| 16:10 | **Coffee/Tea break** |  |  |
| 16:30 | **SESSION 5: Courses’ evaluations (ctd)**  Breakout session to discuss courses challenges (ctd)  Plenary discussion on challenges: 20 min.  Recap: 10 min. |  |  |
| 17:30 | **SESSION 6: Cascade training (1.5 hrs)**  Definition and pros and cons of cascade training with audience polling: 35 min.  Examples: 10 min.  Plenary Discussion 45 min. | Noni MacDonald, Dalhousie University, Canada & Winsley Rose, Christian Medical College, India  Naveen Thacker, International Paediatric Association & Christoph Steffen, WHO | Noni MacDonald, Dalhousie University, Canada  &  Winsley Rose, Christian Medical College, India |
| 19:00 | **Dinner** |  |  |

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| **Time** | **Day 3: Thursday, 24 March 2021** | **Presenters** | **Co-Chairs** |
| 08:30 | **SESSION 7: COVID impact and related remaining training needs (30 min.)**  Topics of interest for the vaccinology course leveraging the continuous knowledge on SARS-CoV-2 infection: 15 min.  Discussion: 15 min. | Anh Wartel, International Vaccine Institute, Korea | Naveen Thacker, International Paediatric Association  &  Anh Wartel, International Vaccine Institute, Korea |
| 09:00 | **SESSION 8: Refresher/updating/completing courses (30 min.)**  Rationale for refreshers (from the learners’/participants’ perspectives), Demand for refreshers (based on the course conveners’ perspectives), and Different strategies the course conveners can use to address the needs for refresher courses: 15 min.  Plenary discussions on how course conveners can leverage on each other to meet the needs of refresher courses: 15 min. | Benjamin Kagina, University of Cape Town, South Africa  Naveen Thacker, International Paediatric Association | Naveen Thacker, International Paediatric Association  &  Benjamin Kagina, University of Cape Town, South Africa |
| 09:30 | **SESSION 9: Facilitation of networking (1 hr)**  How to create networks and keep people engaged. What we need to do before, during and after the course to facilitate networking, how to make people feel part of a network and how to maintain it after the course: 15 min.  Report of survey of alumni: 15 min.  Discussion 30 min. | Rodolfo Villena, University of Chile | Naveen Thacker, International Paediatric Association  &  Rodolfo Villena, University of Chile |
| 10:30 | **Coffee/Tea break** |  |  |
| 11:00 | **SESSION 10: Sharing of information and resources between courses (1.5 hrs)**  Presentation on the needs and facilitating factors: 15 min.  Presentation of the proposed code of conduct on the sharing of information: 10 min.  Discussion: 1hr 05 min. | Carine Dochez, NESI  Naveen Thacker, International Paediatric Association | Paul-Henri Lambert, University of Geneva  &  Ombeva Malande, East Africa Centre For Vaccines and Immunization, Kenya |
| 12:30 | **Lunch** |  |  |
| 13:45 | **SESSION 11: e-Portal (45 min.)**  Demonstration of the current e-Portal of the collaboration and indication of current use: 15 min.  Need for further developments (building on previous discussions at the meeting):  10 min.  Discussion : 20 min. | Philippe Duclos, University of Geneva  Lisbeth Soederberg, University of Oxford, UK | Philippe Duclos, University of Geneva  & Lisbeth Soederberg, University of Oxford, UK |
| 14:30 | **SESSION 12: Formalization of the collaboration (1.5 hr)**  Introduction: Session Plan and summary of needs survey: 10 min.  Rationale, background and principles for collaborations: 15 min.  Discussion: 10 min.  The Collaboration - Major Charter Points: 55 min | Noni MacDonald, Dalhousie University  Narendra Arora, INCLEN  Noni MacDonald, Dalhousie University  Philippe Duclos with interactive discussion involving all participants facilitated by Noni and Narendra | Noni MacDonald, Dalhousie University, Canada  &  Narendra Arora, INCLEN, India |
| 16:00 | **Summary of the meeting**  Presentation: 15 min.  Additional comments by all | Noni MacDonald, Dalhousie University |  |
| 17:00 | **Closure of the meeting** |  |  |

**Supplemental information:**

**Table 1: List of global, regional and national challenges to immunization identified during a brainstorming evening session**

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| **Challenges** | **Gaps** | **Solutions** |
| Global  Vaccine access and supply inequity  Public health infrastructures  Regulatory capacity  Vaccine awareness Communications  Antivaccine lobbies  Trust of populations and vaccine hesitancy (which may be more of a problem in high income countries where the antivaccine lobbies have a loud voice)  Misinformation regarding vaccines  Healthcare infrastructure especially in LMICs  Lack of human resources  Vaccination coverage  Lack of funding  Inadequate immunization data  Interaction between science and politics  Territories with difficult access  Political will  Corruption  Courses tend to favour anglophones. This excludes other language speaking groups especially French/Spanish speaking countries/groups.  Regional  International migration/displacement of people (within and between countries)  Different recommendations per country  Mismatch between regional needs and the supply/support for the programmes  Lack of funding  Country  Vaccination coverage  Catch-up of children who were missed  Different recommendations by different advisory groups  Lack of funding | Expert Knowledge  Knowledge of professionals and future ones  Education: train young teachers in high schools, religious associations community, social media, influencers  Investment and facilities  Fellowships  Specialized courses  Computer literacy  Multi-linguistic issues  Funding and sustainability  Financing and related vaccine inequity.  Education – the speed and scale of knowledge does not translate to all Need tailored education packages  At the country level: need culturally appropriate, context-specific (based on local epidemiology) – policies, practices and education are needed  Integration of systems and learnings from COVID into routine immunisation – integration by design not by necessity is needed.  (This may extend to systems but also to the involvement of other sectors to support workforce such as military and civil society.) | NITAG and decision-making  Improve communications   * Improve communication, messaging i.e. paying attention to safety of yourself and your family * Media training as is being done in many courses to increase awareness * Better network of communication – (digital way – personal message) * Document impact of vaccination and make data easily available (real time data for the whole population) * Focus on preventative versus curative, starting early in life * Local awareness of disease - vaccine preventable diseases and impact on severe forms of disease * Make positive impact with true information using social media to counter the false information that is circulated in the social media * Target different groups in the society e.g. politicians, educators, public etc. to create awareness about the benefits of immunization * Provision of adaptable information and knowledge – for e.g. through NITAG resource centre.   Addressing funding gaps – more donors - interaction with donors and governments  Improve training   * Train the next generation of vaccinologists * Courses addressing media, sociological aspects – need for multidisciplinary experts * Tailoring courses – in-country courses (e.g. epidemiology/local context) * Specialized courses tailored to audience needs – for politicians, manufacturers, regulators and health care workers * Increase amount of educational hours in vaccines and vaccination and related benefits in the basic curriculum * Training of healthcare workers to tackle vaccine hesitancy and promote vaccine benefits * Train the trainers * Training of manufacturing companies’ staff in LMICs * Implement translations during courses in areas where there are more than one language groups represented. Modules need to be translated into the respective languages. * Having online courses would enable greater participation from different groups. There could be multiple tailormade courses for different groups in the society e.g. policy makers, program managers, influential groups of the lay public e.g. teachers etc. * Cascade training may be one way of increasing the reach with these multiple groups * Improve local capacity building for courses, so that there is a greater pool of educators. * Develop case studies to learn from COVID – focus on implementation science and operational research * The multi-disciplinary nature helps build expertise amongst those who are working in vaccinology * The courses offer a pool of experts that can be tapped on for greater learning and discussion – build content area expertise * Collective action is needed from those organising courses and participating to demonstrate the value of these advanced courses and training – both for funding of courses and for institutions to support participation of trainees   Address needs regarding vaccine supply inequity and regulatory capacity in terms of training  Dialogue with people who are making the decision  Addressing political will   * Form an advocacy group from within the vaccinology experts that can lobby with the powers that be to make them aware of the importance of immunization   Improving public health infrastructures, specifically human resources   * Recruit more personnel * Redeployment of non-healthcare staff during times of need e.g. during mass vaccination campaigns   Equitable distribution of vaccines:   * GAVI eligibility positioning can be re-looked at to enable many countries to continue their ongoing programmes and delay their graduation from being ineligible. * Enhance local production of vaccines with technology transfers |

**Supplemental information:**

**Table 2: Gaps and needs identified with respect to the contribution of NITAGs to emergency situations and emergency preparedness.**

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| **Gaps** | **Needs** |
| * It takes so long to make policies, leaving inadequate flexibility and adjustability in policies during crisis time yet time matters in emergencies * The amount of information and speed with which it reaches NITAGs is inadequate * Lack of preparedness and prepared sites for clinical trials during the times of emergencies * Lack of experts for NITAGs - most of them are engaged in different assignments or government work. The selection criteria for the members of the NITAG are not always clear * It is not clear what the NITAG priorities or contribution should be during emergencies which makes it hard for governments to engage with them (lack of political involvement and awareness) * There is often lack of government/politician dialogue or education about the NITAG, their role and responsibilities * Lack of clarity on the audiences and the messages of the NITAGs * What should be the contribution of the NITAG to communication is not clear, and at times during the last pandemic they have been invisible or not vocal * Where are the lessons learnt from past emergencies? | * NITAGs should be able to communicate with the public and the media during emergency times * There is need to carry the lessons learnt and gained knowledge for the next emergencies * NITAGs need policies that are flexible and adjustable as time is a factor during emergencies * There is need for rapid exchange and active dialogue between the NITAGs and other stakeholders such as manufacturers, scientists etc. as it is with SAGE. This would help in decision making. How fast this information reaches NITAGs matters. There should be access to data in real time. * Because there are different types of emergencies, clinical trial sites have to be prepared ahead of time should there be another pandemic or crisis * A list of stakeholders and interested partners should be generated to earlier engagement and dialogue * Expert direct contact with NITAGs is important during emergency. This gives the NITAGs an opportunity to hear from the experts and discuss with them on what data is available. This would ensure that the NITAGs are well involved in their country's decision making and can guide the country better. * Experts within the countries, regions, and globally need to come together with specific targets on how to prepare for the next emergency. It is important to know the elements of action and priorities ahead of time because time is critical during pandemics. * Vaccinology courses can help break the wall of connection to the NITAGs by creating a continuum of dialogue and information * What decisions and what we do during emergencies should not affect other aspects of vaccination * Role of the NITAGs should be clearly defined * Governments should use NITAG knowledge and expertise, as well as be educated about the NITAGs and their role |