VACCINOLOGY FOR CLINICAL AND PUBLIC HEALTH PRACTICE IN GHANA: VIRTUAL WORKSHOP AND POLICY PLENARY

REPORT

6-9 and 14-15 December 2021

PREPARED BY: THE HEALTH INTERVENTION AND TECHNOLOGY ASSESSMENT PROGRAM (HITAP), MINISTRY OF PUBLIC HEALTH, THAILAND

Contents

Abbreviations

Abbreviation	Definition
AAR	After-action review
ADP	Access and Delivery Partnership
CMC	Christian Medical College
EPI	Expanded Programme on Immunisation
GISAID	Global initiative on sharing all influenza data
HITAP	Health Intervention and Technology Assessment Program
HTA	Health technology assessment
JCVI	Joint Committee on Vaccination and Immunisation
LMIC	Low and middle income country
LSHTM	London School of Hygiene and Tropical Medicine
NHF	National Health Foundation
NUS	National University of Singapore
PGIMER	Post Graduate Institute of Medical Education and Research
SAVING	Sustainable Access and Delivery of New Vaccines in Ghana
SSHSPH	Saw Swee Hock School of Public Health
UNDP	United Nations Development Programme
VPD	Vaccine preventable disease
WHO	World Health Organisation

Acknowledgements

This report summarises the proceedings of the Vaccinology for Clinical and Public Health Practice: Virtual Workshop and Policy Plenary held on 6-9 and 15-16 December 2021. The workshop was a collaboration between the London School of Hygiene and Tropical Medicine (LSHTM), the Saw Swee Hock School of Public Health National University of Singapore (SSHSPH NUS), Ministry of Health, Ghana, the Access and Delivery Partnership and the Health Intervention and Technology Assessment Program (HITAP). The content of the workshop was led by and put together under the guidance of Prof. Mark Jit from LSHTM, who had developed this course along with SSHSPH NUS. We were privileged to have senior lecturers from LSHTM, NUS and other regional institutions who taught at the workshop. The organisation of the workshop was led by Ms. Aparna Anathakrishnan from HITAP, Mr. Brian Asare from the Ministry of Health, Ghana and Ms. Belynda Amankwa from ADP. The report was prepared by Ms. Madison Silzle with inputs from Ms. Aparna Ananthakrishnan and Saudamini Dabak from HITAP. Madison Silzle, Sarin KC, Dimple Butani, Ella Nanda Sari and Siobhan Botwright from HITAP provided support during the workshop.

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The findings, interpretations and conclusions expressed in this report do not necessarily reflect the views of the funding or participating agencies.

Executive Summary

A virtual 'Vaccinology for Clinical and Public Health Practice", course was co-organised by the Ghana Ministry of Health, the London School of Hygiene and Tropical Medicine (LSHTM), Saw Swee Hock School of Public Health National University of Singapore (SSHSPH NUS), the Access and Delivery Partnership (ADP) and the Health Intervention and technology Assessment Program (HITAP), Ministry of Public Health Thailand, on 6-9 and 14-15 December 2021.

The course was structured over six half-days on Zoom, largely focused on the academic understanding of various aspects of vaccinology and concluding with a policy plenary which translated these learnings into practical issues in the African context. The main objective of the course was to build technical capacity of stakeholders in the field of vaccinology and to contextualise learnings to the COVID-19 pandemic and vaccines. The workshop included a combination of lectures, case studies, and practical exercises to cover topics such as epidemiology and surveillance, vaccine trials and efficacy, and health economics of vaccines. The policy plenary focused on COVID-19 vaccine distribution and acceptance in Africa. The presenters included academics, programme managers, and public health specialists from institutions and organisations both international and regional to Africa. The policy plenary brought together a group of diverse experts, with an academic focus on the region and case studies highlighting historical examples of infectious disease management through vaccination, while drawing context for the current crisis. The other regional speaker addressed the issue of vaccine hesitancy in the region, drawing lessons from the Ebola outbreak. The plenary was moderated by partners from ADP.

The course was open to participants from the Sub-Saharan African region to encourage cross-border knowledge exchanges and rich learnings in the region. The workshop hosted a total of 53 participants, mostly from Ghana, Tanzania and Malawi. Overall, the participants found the course to be useful and complementary to their current work.

Introduction

The Health Intervention and Technology Assessment Program (HITAP) has been working with the Access and Delivery Partnership (ADP), hosted by the United Nations Development Programme (UNDP), to support countries to strengthen their capacity to strengthen evidence-informed decisions for health. HITAP has developed numerous partnerships with countries and academic institutions to provide internship opportunities, training workshops, technical advice to build capacity for Health Technology Assessment (HTA). These engagements aim to raise awareness on the need for HTA to realise an efficient health system and, subsequently, build the knowledge and technical capacity of such institutions to conduct HTA studies.

This purpose of this report is to provide an overview of the virtual vaccinology course held in December 2021, starting from the inception and the objectives, to optimising the proceedings of the course, feedback received, lessons learned and outcomes. The supporting information is provided in the Appendices.

Background

Inception of the Course

In 2019, HITAP hosted a vaccinology course in India to share the experience of using HTA in vaccines and strengthen regional capacity in the field of vaccinology. HITAP partnered with the London School of Hygiene and Tropical Medicine (LSHTM) and the Saw Swee Hock School of Public Health National University of Singapore (SSHSPH NUS), who in the past have jointly held a similar training course on vaccines. Colleagues from Ghana in attendance at this workshop in India found great utility in the programme towards their country priorities and in specific, in their initial response to the COVID-19 pandemic. In order to allow more diverse stakeholders in Ghana have access to this training, HITAP was requested to host a similar workshop for Ghana, with a focus on vaccinology in the age of COVID-19. The main objective of the course would be to build the technical capacity of multi-disciplinary stakeholders in the field of vaccinology through a training workshop and share global experiences on how vaccine policies may be prioritised for decision makers through a policy symposium.

To this end, a virtual course on Vaccinology for Clinical and Public Health Practice was organised between the Ghana Ministry of Health, the London School of Hygiene and Tropical Medicine (LSHTM), the Saw Swee Hock School of Public Health, National University of Singapore (SSHSPH NUS) and HITAP. Each organising institution brought deep and complementary experience in training, capacity strengthening and clinical and policy-relevant research in the field of vaccinology. In addition, speakers from the region were invited to provide relevant expertise, from the World Health Organisation African Regional Office (WHO AFRO).

The course was structured over six half-days on Zoom, largely focused on the academic understanding of various aspects of vaccinology and concluding with a policy plenary which translated these learnings into practical issues in the African context. The course was open to participants from the Sub-Saharan African region to encourage cross-border knowledge exchanges and rich learnings in the region. The workshop hosted a total of 53 participants, mostly from Ghana, Tanzania and Malawi. While participants were primarily recruited based on suggestions from participating countries, we also sent invitations to other countries including South Africa and organisations such as at the Africa Centres for Disease Control given the importance of the topic. We had deep interest from those departments and specialists most suited to the statistical pre-requisites needed for the program, but also those who found immediate relevance of the content to their current work on COVID-19 and other priority areas. The policy plenary was open to all and advertised via the ADP and HTAP social media channels such as twitter and also through ADP email

communications on their network. HITAP also circulated the policy plenary with all their networks. Promotional material is available in Appendix 3.

Objectives of the Course

Vaccination is the most effective tool in preventing many infectious diseases and vaccines are often a highly cost-effective way to make drastic mortality and morbidity reductions. The advent of Gavi immunisation support along with other conducive factors has allowed low- and middle-income countries (LMICs) to make huge advances in vaccine adoption and coverage over the last two decades. The last two decades have also been a "golden age" for the development of new vaccines. However, vaccine coverage advances have been stagnating and many of the vaccines licensed in this era have highly complex immunological, ecological and economic effects.

Planning the effective use of vaccines requires a new generation of public health professionals with multi-disciplinary skills who are able to understand issues around the immunological mechanism, safety, efficacy, effectiveness, population impact, effects on microbiological ecology, delivery, cost-effectiveness and public trust of vaccines. Developing capacity within LMICs for research and for the institutionalisation of evidence-informed policy on immunisation is increasingly important as countries look to the future beyond Gavi support when LMICs must govern and finance immunisation policies independently, in an effective and financially sustainable way.

Hence, the objectives of the course were to (i) increase the scientific and technical knowledge related to vaccinology, (ii) recognise the role of health technology assessment (HTA) in optimising scarce resources for vaccines, (iii) understand the political economy issues in vaccine policy at the national, regional and global levels, (iv) learn from partners and identify means for collaboration to further vaccine policy at the national, regional, and global levels, and finally (v) contextualise learnings to the current pandemic, specifically on COVID-19 vaccines.

The agenda, list of attendees and photos from the event can be found in Appendix 1. Participant Information Packet, Appendix 2. List of Attendees, Appendix 3. Communications materials, and Appendix 4. Evaluation Data.

Summary of Proceedings

Workshop Part 1 (6-9 December 2021) and 2 (14-15 December 2021)

Day 1 (6 Dec 2021)

Opening Remarks (Prof. Justice Nonvignon, University of Ghana): Opening the workshop, Prof. Nonvignon addressed the partnering organisations who led the workshop and observed the need for collaboration among African countries to support cross-border knowledge sharing and the improvement of regional vaccine programmes. This workshop comes at a time when vaccine policy has become even more of a priority in many African countries and will provide an opportunity for participants to update their knowledge of vaccinology and use these learnings to overcome challenges facing the vaccine community in the era of COVID-19.

Keynote Address (Dr. Somsak Chunharas, NHF): Dr. Chunharas contextualised this workshop to the current COVID-19 pandemic and encouraged participants to consider what this means for the field of vaccinology moving forward. The COVID-19 pandemic, particularly global inequities in COVID-19 vaccine distribution, has highlighted the need for global and regional solidarity on the issue of vaccine access, especially among LMICs. While global mechanisms can provide necessary guidance, regional capacity for research and policymaking is crucial to augment vaccine campaigns. For example, both WHO guidelines and research using regional real-world data have helped instruct Thailand's COVID-19 vaccination policies. Both global and regional knowledge can inform the development of good public health practices. This workshop provides a space for individuals to share knowledge and network across countries as well as strengthen capacity building in the field of vaccinology.

Epidemiological concepts related to vaccination (content adapted from Clarence Tam, presented by Dr. Hannah Clapham, SSHSPH NUS): This lecture contained an overview of the basic epidemiology of vaccines, including concepts such as population infection dynamics, reproduction number (R_0), and herd immunity threshold. Epidemiological concepts can help quantify the effect of vaccination on populations and compare different infection control strategies. For example, R_0, a measure of transmissibility, can be used to calculate the fraction of individuals in a population that need to be protected, though vaccination or natural immunity, to control a disease. Dr. Clapham went through several examples of these types of calculations and their applications. While vaccination provides direct protection to an individual, indirect protection, through herd immunity or natural immunity, should be considered as well. It is important to understand the data used to find R_0 values or infection dynamic models. For example, R_0 may be different in subgroups, and thus cannot be generalisable to all populations.

Surveillance and burden estimation (Prof. David Heymann, LSHTM): In this lecture, Prof. Heymann reviewed methods of determining vaccination priorities, and monitoring vaccination activities. Vaccines can be used for different strategies such disease control, elimination, or eradication. The nature of the vaccine preventable disease (VPD) may determine what vaccine strategy is used, for example influenza vaccines aim to control outbreaks, as it is not possible to eradicate the infection from the human population. Estimating prioritisation of vaccines can be done by gathering data from case reporting, serological surveys, and active surveillance. This data can inform where vaccines should be prioritised and for whom, as well as a means to prioritise between VPDs. Monitoring vaccine implementation is also an important component for informing vaccine prioritisation. This can include geographical surveillance of vaccine uptake and monitoring of vaccine effectiveness. Monitoring of polio vaccination against type 1-3 polio, for example, informed the decision to use of different types of vaccines to increase protection. Other types of information to monitor include vaccine misinformation. This is especially pertinent in the COVID-19 pandemic where

persistent misinformation about COVID-19 vaccines can lead to its low uptake and future outbreaks and variants.

Day 2 (7 Dec 2021)

Vaccine Efficacy (content adapted from Clarence Tam, presented by Dr. Hannah Clapham, SSHSPH NUS): In this lecture, Dr. Clapham reviewed the concept of vaccine efficacy and how we can measure it through different study types. Efficacy can be calculated against disease, infection, or infectiousness, depending on the type of data collected or study conducted. Vaccine efficacy is an important value, as it can help predict the impact of vaccination in a population, and measure vaccine performance over time. Dr. Clapham gave examples of several types of vaccine efficacy studies, including randomised control trials, case-control studies, household studies, and screening methods, each of which have pros and cons. For example, case-control studies are fast and low-cost, however they require individual vaccination records, which can unreliable. For example, not all individuals have access to their childhood vaccination records, and thus may have to rely on their memory to provide this data. This method is preferred for rare diseases, such as leprosy, for which scarring on an individual can provide proof of vaccination. In terms of evaluating the efficacy of COVID-19 vaccines, there is a lot of real-world data available. However, many factors such as mixing of vaccine types, efficacy against different COVID-19 variants, etc. are challenges to measuring efficacy over time.

Vaccine trials – phase I, II, II, and safety (Prof. Dicky Akanmori, WHO AFRO): This lecture reviewed the Vaccine Development Complex, the process by which vaccines become licensed, with a focus on COVID-19 vaccines, and how they differ. The primary goal of the Vaccine Development Complex is to determine how safe and effective vaccines are, through clinical trials and review boards, prior to licensure. Additionally, the fourth phase of clinical trials occurs after licensure to monitor the occurrence of adverse events after vaccination. The process of vaccine licensure is quite lengthy, and thus in the face of the COVID-19 pandemic, vaccines needed to be developed, tested for safety, and approved faster than licensure would allow. The alternative pathway for this to occur is to register for WHO Emergency Use of vaccines. This still requires a vaccine to undergo clinical trials to ensure safety but eliminates several steps post-clinical trials that are require for licensure. The process of managing clinical trials and registering a vaccine for emergency use or licensure is quite resource and time intensive. For many African countries, developing and/or manufacturing vaccines remains inaccessible.

Case studies in vaccination (Prof. David Heymann, LSHTM): This lecture highlighted challenges that countries face during vaccine campaigns through several case studies. Some of the main challenges discussed included vaccine hesitancy and reporting of infectious diseases. For example, rumors about the polio vaccine sterilising women and transmitting HIV in Nigeria led to much hesitancy and eventual suspension of the polio vaccine. This was also an interesting example to showcase how political leadership and their role in vaccine misinformation are strong determinants of uptake and an important issue of community mobilisation. After presenting this case study, Prof. Heymann asked participants to develop a plan addressing this issue, from both a national and international viewpoint. Many groups cited the importance of using locally specific leaders to dispel rumors, while also relying on organisations such as the WHO and UNICEF to provide support and credible evidence. These suggestions and the lessons learned from the case studies can be applied to other contexts as well, including COVID-19 vaccine campaigns.

Day 3 (8 Dec 2021)

Modelling vaccine preventable disease (Prof. Mark Jit, LSHTM): This lecture began with an overview of modelling, followed by a practical session during which participants went through a facilitated modelling exercise on Microsoft Excel. Modelling of VPDs is used to simplify and predict the spread of cases over time. Prof. Jit emphasised the importance of understanding the assumptions made when creating a model. He used the case of a model used to project Ebola cases in the 2014 outbreak in West Africa to illustrate this

point. This model predicted a sharp rise in cases, with more than 600,000 cases by the end of 2014. In reality cases rose at a much slower rate because people changed their behavior to slow the spread, which the model did not take into account. Although the model was heavily criticised, it may have helped encourage the behavior changes that slowed the outbreak in the end. Regardless, it is important to know what assumptions were made, so the model can be appropriately used and interpreted. There are different types of models, used for different types of VPDs. For example, the Susceptible - Infectious - Susceptible or SIS model is described by a disease progression in which Susceptible individuals become Infectious and then become Susceptible again after recovering from the infection. This model is used for diseases where no natural immunity is acquired and thus reinfection is possible, such as gonorrhea. Models need to take into consideration many factors such as the natural history of the VPD, the net reproduction number, heard immunity, as well as the behavior of individuals. After reviewing the components and types of models, participants built their own model of a measles outbreak, using the information and equations given during the lecture.

Day 4 (9 Dec 2021)

Statistical and reporting issues related to vaccine trials (Prof. Peter Smith, LSHTM): The topic of this lecture included how to determine the size of a vaccine trial, and the statistical assessment and reporting of phase 3 trials. While phase 1 and 2 vaccine trials test safety and immunogenicity, phase 3 trials aim to test vaccine efficacy and provide evidence for licensure. Phase 3 trials are powered such that the lower confidence interval of vaccine efficacy is above a specified level. For example, the WHO recommends that COVID-19 vaccines should show an estimated efficacy of greater than 50%, and prove the true efficacy is greater than 30%. This means that the phase 3 trial for a COVID-19 vaccine must be designed to have a lower confidence bound above 30% efficacy. Non-statistical factors must be considered as well when designing a vaccine trial, such as loss of participants due to drop out or death.

Herd immunity and other indirect effects of vaccination (Prof. Paul Fine, LSHTM): In this lecture, Prof. Fine explained the differences between direct and indirect effects of vaccination, with examples of case studies and calculations. Direct effects from vaccination are calculated by the vaccine uptake and efficacy, and results in an expected disease incidence reduction. Indirect effects are among both vaccinated and unvaccinated individuals and may result in a lower disease incidence than is predicted by just direct effects. Indirect effects are influenced by social patterns and mixing. For example, influenza vaccination of school children can help reduce risks among older adults if there is mixing of these two groups, as in a multigenerational family. Herd immunity is an example of an indirect effect in which unvaccinated individuals are indirectly protected from disease by being in a population of highly vaccinated individuals. Herd immunity theory is helpful when trying to determine the effects of vaccination but is complicated by real world factors such as non-random population mixing. Additionally, herd immunity may have some negative feedback due to "freeloaders", unvaccinated individuals who see the reduced risk from the effects of herd immunity and thus decide to not get vaccinated. This can contribute to the observance of disease cycles – continual rise and fall of infections over time.

Day 5 (14 Dec 2021)

Post-licensure monitoring (content adapted from Clarence Tam, presented by Dr. Hannah Clapham, SSHSPH NUS): In this lecture, Dr. Clapham reviewed how monitoring helps capture the full impact of vaccination, not just the "honeymoon period" right after licensure of a vaccine. Monitoring looks at vaccine coverage, effectiveness, and safety over time, to capture events such as waning immunity or low coverage. For example, monitoring of the incidence of mumps in Singapore showed that an increase in cases was likely due to lower vaccine efficacy over time. There are many methods of evaluating vaccines post-licensure, and the preferred method depends highly on the context – location, type of VPD, history of outbreaks, resources available, etc. Surveillance by location may be useful to identify areas of low vaccine coverage or outbreaks, whereas serological surveys may be important for understanding vulnerable age

groups. Monitoring of COVID-19 vaccines can be quite complicated due to factors such as mixing and matching of vaccines, COVID-19 variants, and many different intervention approaches. However, the sheer volume of data can help us effectively monitor these vaccines.

Getting vaccines to where they are needed (Dr. Margaret Gyapong, SAVING Consortium): In this lecture, Dr. Gyapong shared Ghana's experience with two different vaccine rollouts – the malaria vaccine and COVID-19 vaccine. In Ghana, vaccine policy is determined at the national level, while implementation is at the district level. Routine childhood vaccination is delivered through facilities and mobile outreach teams. This established framework was used for delivery of the newly approved malaria vaccine in 2019. Although delivery was feasible through these routine systems, additional steps needed to be taken to ensure that parents would return for their child to receive all four doses, and for healthcare workers to be trained properly. The approach for the COVID-19 vaccine rollout required different tactics. Ghana's EPI system oversaw the COVID-19 vaccine campaign, which organised systems outside of routine vaccination schemes, such as drone delivery of vaccines. Ghana continually monitored the success of vaccine delivery to quickly address issues that arose. The difference between malaria and COVID-19 vaccine rollouts highlighted the need for context specific vaccine delivery systems to efficiently use resources while maximising vaccine uptake. Dr. Gyapong ended this session by talking about the SAVING consortium, which was organised to identify and address malaria vaccine implementation challenges in Ghana. The partnership will use this work to strengthen the implementation of new medical interventions in the future.

Day 6 (15 December 2021)

Economics of vaccination (Prof. Mark Jit, LSHTM): This lecture reviewed the role of economic evaluations of vaccination programmes and what tools are available to evaluate the cost of vaccines. The economics of vaccines is extremely influential in the decision-making process of vaccine programmes and allows us to explicitly see what we value by measuring trade-offs. All around the world, vaccine decision making has been shifting from informal to more technical methods. Technical methods include modelling, economic evaluation, and expert advisory committees. For example, in the UK the Joint Committee on Vaccination and Immunisation (JCVI) reviews epidemiological and economic evidence from many sources and makes a recommendation to the Health Secretary and the Department of Health. The advisory committees that evaluate economics of vaccines must consider many criteria, including the sustainability of cost, and equity of vaccine delivery. In order to help countries decide if a vaccine should be introduced to a country, Gavi has developed an evaluation criterion using many health, social, and economic criteria. Economic evaluation of COVID-19 vaccines is quite challenging as the conditions of the pandemic changes rapidly. In order to obtain accurate results, one would need to consider real time data, which is resource intensive and may not produce detailed results.

Policy Plenary: Vaccinology in the age of COVID-19 in Africa (15 Dec 2021)

The purpose of this discussion was to contextualise learnings to COVID-19 in Africa to understand what steps need to be taken to end the pandemic and support future response to outbreaks. Ms. Cecilia Oh, from UNDP moderated the session, outlining the key themes for this session, which included (1) translating learning into policy decisions, (2) how we can create equitable access locally and globally, (3) addressing vaccine hesitancy, and (4) looking to the future in the African region.

The format included two presentations from speakers, followed by a moderated question and answer session with the audience.

Using COVID-19 vaccines: lessons from control of vaccine preventable diseases (Prof. David Heymann, LSHTM): To begin this discussion, Prof. Heymann assessed our current understanding of COVID-

19 vaccines and what strategies we can use to control the pandemic with vaccines. Uncertainties about the protection of vaccines, natural immunity, and herd immunity thresholds for COVID-19 make it difficult to predict what strategies will be most effective. However, we do know that COVID-19 cannot be eradicated and thus must focus on managing population immunity and controlling outbreaks. Both vaccines and natural immunity have an important role in achieving this. Modification of current COVID-19 vaccines and development of new COVID-19 vaccines are necessary, as well as better understanding correlates of immunity. Even though vaccines may not prevent infection entirely, they will still be very important for preventing serious disease and outbreaks, as well as ensuring safe gatherings and travel.

Other strategies that came up during discussion included a One Health approach of understanding human and animal health as non-distinct, which could incorporate vaccination of animals and use of surveillance databases like GISAID. One Health will be important for containing future pandemics, but it is key to work with local communities to decide what approaches should be implemented and how.

Community engagement for vaccine acceptance in the region (Mr. Robert Kanwagi, Africa regional vaccine expert): Next, Mr. Kanwagi spoke about COVID-19 vaccine confidence and several of the key takeaways learned from COVID-19 vaccination in Africa. In a review of COVID-19 vaccine uptake across Africa, he suggested that the main drivers of low uptake were (1) difficulties with addressing safety concerns, (2) supply constraints and gaps in service delivery, (3) inability to manage high demand, and (4) new priority populations. Confidence in vaccines varied greatly across regions of Africa, some of the main concerns stemming from misinformation, religious concerns, access issues, safety concerns, and lack of trust in the vaccine or government. To increase vaccine uptake, one must first identify and categorise hesitant and challenged populations. Mr. Kanwagi explained 5 different classifications for this population based on resistance to vaccine and accessibility to get a vaccine. This type of population segmentation proved to be very successful in creating targeted initiatives for lowering hesitancy and increasing uptake. Other strategies that helped delivery of vaccines included understanding context specific means of communication and leveraging of partnerships across sectors and locations. In summary, a deep understanding of issues and populations is necessary to create tailored outreach, which proves to be more successful than a "one size fits all" approach.

Evaluation

Feedback was collected via Zoom polls both after the workshop on Day 6 and after the policy plenary. A summary of these polls is provided below.

Workshop/Technical course Evaluation

The workshop poll received 16 responses, all of whom said they would recommend this workshop to their colleagues. Respondents indicated they found the workshop well prepared, learned more about vaccinology, and will be able to use this knowledge for their own activities (see Figure 1). Many participants indicated they would have liked to have more practical sessions (see Figure 2), however all the sessions were found to be useful.

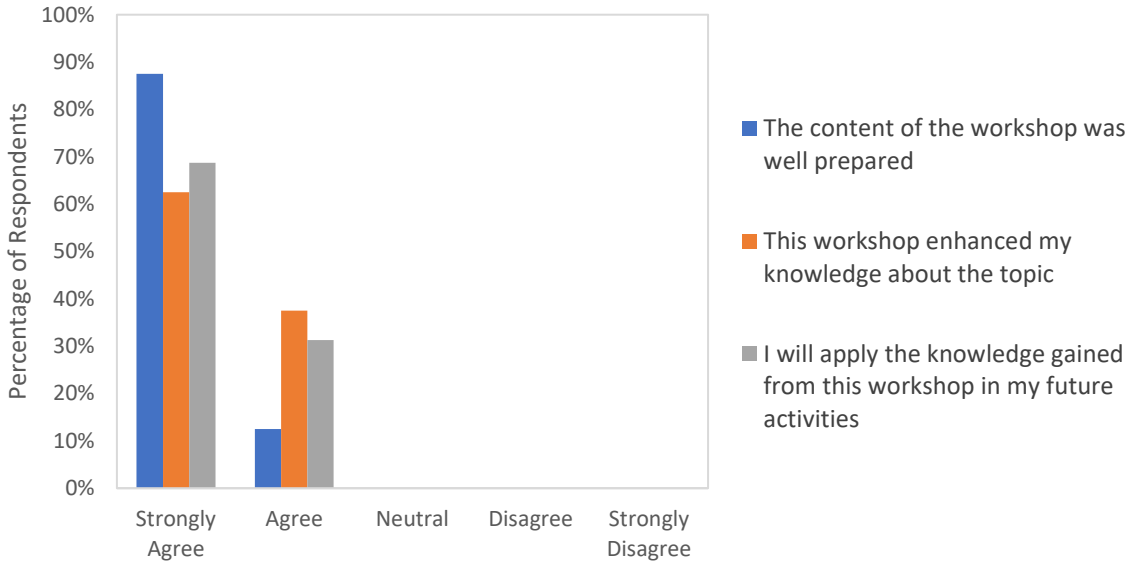

Figure 1. Summary of respondent's perceptions of the workshop

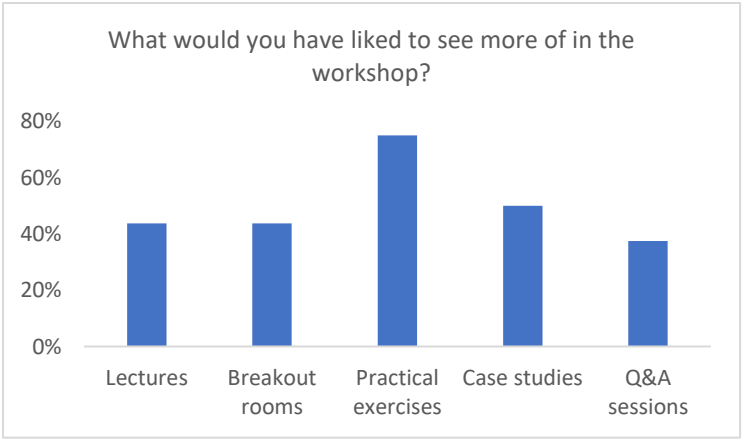

Figure 2. What type of sessions respondents would like to see more of in the workshop

Policy Plenary Evaluation

The policy plenary poll received 17 responses. All respondents found the session useful (see Figure 3). Most respondents indicated they heard about the policy plenary through a colleague or friend, and a few individuals were referred by a website or other means. Sixteen of the respondents indicated they would like to attend more sessions like the policy plenary in the future.

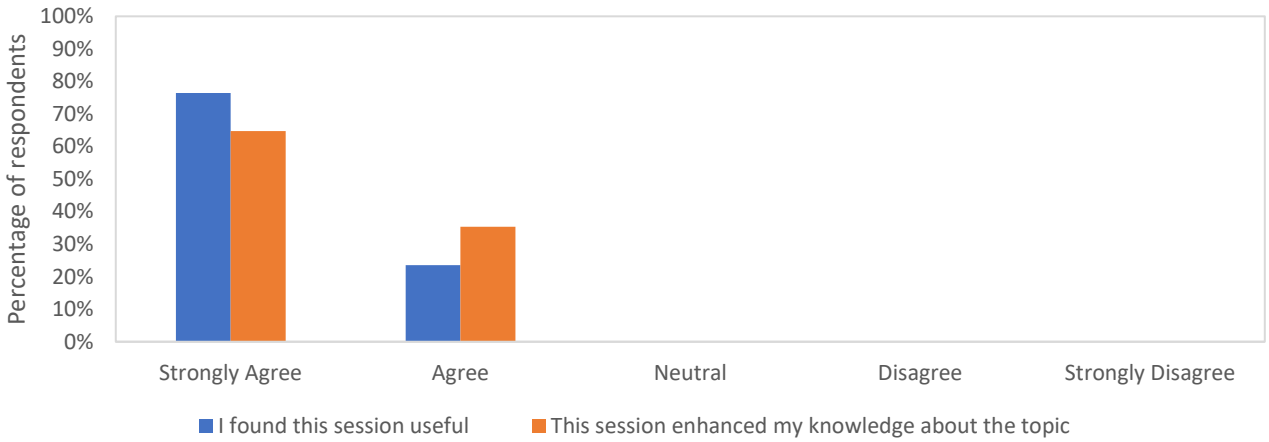

Figure 3. How useful respondents found the policy plenary

Outcomes

Through this workshop, HITAP has strengthened its existing partnerships with ADP, LSHTM and SSHSPH NUS, and established a significant step in its ongoing partnership with the Ministry of Health, Ghana. Furthermore, it provided the opportunity to engage with participants and speakers from diverse backgrounds.

The subject of vaccinology is of importance for many stakeholders, including academia, policymakers, healthcare workers, and community organisers. This workshop was timely given the many challenges and innovations that have been observed in vaccinology across the pandemic, both on COVID-19 and others such as malaria, for which the vaccine has been piloted in Ghana and has been recommended for widespread use[1]. Future offerings of this course will need to consider how different stakeholders can most benefit from the course, and how to facilitate sharing knowledge between these sectors.

Holding this workshop virtually helped promote knowledge sharing and increase accessibility in both Africa and Asia. As seen by this workshop, having participants from Ghana, Malawi, and Tanzania provided space in which participants from each location could share their experiences and exchange ideas. This format, in which several key countries are targeted, could inform the structure of future courses, or other options may be sought to facilitate other kinds of knowledge sharing. HITAP may look to organise a course in the African and Asian regions and will need to consider the geographical scope of such a course.

During the workshop, it was evident that this course is highly valuable in the context of the COVID-19 pandemic. The pandemic changed many aspects of vaccine development, delivery, and access, as well as perceptions around vaccination, many of which will persist into a post-pandemic era. As the COVID-19 pandemic highlighted the need and priority of vaccines, countries can use this to promote strengthening of vaccine delivery systems, routine vaccination programs, and vaccine policies. Building technical capacity, especially in LMICs, will be key to bolstering these efforts. There might also be an opportunity to include other aspects within vaccinology, such as vaccine development and laboratory systems which may be of specific relevance to the challenges of vaccine equity that are a critical concern in our efforts to address the pandemic outbreak.

[1] https://www.who.int/news/item/06-10-2021-who-recommends-groundbreaking-malaria-vaccine-for-children-at-risk

Lessons Learned

Following completion of the event, HITAP staff conducted an After-Action Review (AAR) to reflect upon any successes, difficulties, and key learnings from the event to ensure that future activities can benefit from this experience. The main topics that were covered are detailed below.

Virtual format

The main takeaways from conducting this workshop related to hosting it virtually, which was a first. The course was held virtually over Zoom which allowed for greater accessibility for both participants and speakers. The diverse group of participants helped facilitate knowledge exchange and perspective sharing between the represented regions. This type of cross-learning may not have been as notable had the course been held in one location.

To reduce fatigue over Zoom, the workshop was structured as half-day sessions spread over six days, with the policy plenary concluding the sixth day. To help connect sessions between days and over the weekend, summaries and recap sessions were held at the beginning of each day. Many participants indicated they found it helpful to maintain continuity of the course and solidify key concepts learned.

Some of the challenges of hosting this workshop over Zoom included maintaining attendance and engaging participants in discussion. Participants were encouraged to attend all workshop sessions, however attendance varied greatly for most participants, with some only attending one day. A total of 20 participants attended every day, including the policy plenary at the end. For participants who showed high levels of interest but could not attend every day, we were able to share the recordings, along with relevant course materials, at the end of the workshop.

In discussions with the team in Ghana after the workshop, their only suggestion too was about finding means to provide in-person facilitation for the practical exercises, especially those on modelling. However, since the "new normal" has now required exclusively online modalities, perhaps a day for a deep dive on these methods, or a follow-up session exclusively for this topic might be beneficial. To increase participation and discussion among participants over Zoom, they were encouraged to ask questions with the chat function and breakout rooms were used periodically for small group activities. HITAP had one designated leader per breakout room to help facilitate discussion. There were varying levels of engagement across the rooms and while some participant found the rooms helpful, others did not.

Overall feedback

Overall, the feedback from the attendees was very positive and demonstrated that the course was complementary to their current and future work. Ghana Ministry of Health and others from the Ghana Food and Drug Administration reported to have found the course of great value to their work and the country, specifically noting that they were grateful for the stellar lecturing opportunity that this collaboration could bring. The content of the course was contextualised to the COVID-19 pandemic and the policy plenary focused on how the course learnings can be applied within the African region. Key learnings from this event will help guide future adaptations of this workshop.

Future editions of the course

The AAR was also helpful in working through how we might envision the future iterations of these workshops, from the standpoint of our objectives towards building capacity in the discipline of vaccinology, specifically on who the target audience should be and what the impact of this course would translate to. Suggestions to include some aspects of vaccinology such as vaccine discovery, development and manufacture were raised, given their applicability in the current context with regards to COVID-19 vaccines and their production potential expanding to newer parts of the world. These updates to the agenda could also mean that we expand the speakers to include other scientific or research organisations. Another

important discussion topic was on ensuring sustainable funding streams to keep this course accessible and available to all those interested, possibly modelling it as a short course that is region-specific or global in its reach. In the near term, there is a suggestion to re-run the programme for the Africa CDC and include more country representation from the region.

Appendices

Appendix 1. Participant Information Packet

Workshop on Vaccinology for Clinical and Public Health Practice

6-9 and 14-15 December 2021

Participant Information Packet

Organized by:

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1. About the workshop

Welcome to the workshop on Vaccinology for Clinical and Public Health Practice! This workshop will be held by the Ministry of Health, Ghana, the London School of Hygiene and Tropical Medicine (LSHTM), the Saw Swee Hock School of Public Health, National University of Singapore (SSHSPH NUS) and the Health Intervention and Technology Assessment Program (HITAP), Ministry of Public Health, Thailand. The organizing institutions bring deep and complementary experience in training, capacity strengthening and clinical and policy-relevant research in the field of vaccinology. This workshop is supported by the Access and Delivery Partnership (ADP). This workshop has been previously held in other countries, most recently in India, in November 2019, and offers an opportunity to discuss important issues related to vaccinology in light of the COVID-19 pandemic.

The sessions will aid in increasing the understanding of vaccinology and how it can be used to address the challenges faced in making vaccine policy a priority for health systems and decision makers. The technical content of the workshop will primarily focus on the epidemiology and economics of vaccines, topics of importance particularly in the context of the current COVID-19 health crisis. Participants will learn how to model vaccine preventable diseases, review vaccination case studies, and gain other health technology assessment skills. These learnings will be translated into policy discussions at the closing plenary session, with case examples and contextual issues of vaccinology in Sub-Saharan Africa, with emphasis on the challenges from the pandemic.

Thank you for your interest and registering for this six-day workshop and policy plenary. We are looking forward to learning and engaging with you. Please look through this participant information packet prior to the start of the workshop, as there are important details about joining the workshop.

2. Workshop Objectives and Agenda

This course aims to enhance the following:

- Scientific and technical knowledge in vaccinology
- Recognition of the role of health technology assessment (HTA) in optimising scarce resources for vaccines
- Understanding the political economy issues in vaccine policy at the national, regional, and global levels
- Learning from partners and identify means for collaboration to further vaccine policy at the national regional and global levels
- Contextualising learnings to the current pandemic, specifically on COVID-19 vaccines.

To achieve these objectives, the four-day course will be structured as a six-day virtual workshop (Dec 6-9th and 14-15th), with a concluding policy plenary. The sessions will cover the political economy of vaccinology, addressing how policy makers can surpass the challenges faced in making vaccine policy a priority for health systems and decision makers. The technical content will primarily focus on the science and economics of vaccines, a topic of importance particularly in the context of the current COVID-19 health crisis.

Agenda

PART 1 (6-9th December 2021)

Time (GMT)	DAY 1- Monday, 6th Dec	Time (GMT)	DAY 2- Tuesday, 7th Dec	Time (GMT)	DAY 3- Wednesday, 8th Dec	Time (GMT)	DAY 4 - Thursday, 9th Dec
9:00–10:00 (1hr)	Opening remarks **(*Prof. Justice Nonvignon, Ministry of Health, Ghana)*** Keynote Address (***Dr. Somsak Chunharas, Former Deputy Minister of Public Health, Thailand and President, National Health Foundation, Thailand*****)**	**09:00–09:30** (30mins)	Recap and Day overview ***(Prof. Mark Jit, LSHTM)***	**09:00–09:30** (30mins)	Recap and Day overview ***(Dr. Hannah Clapham, NUS)***	**09:00–09:15** (15mins)	Recap and Day overview ***(Prof. Mark Jit, LSHTM)***
10:00–10:30 (30mins)	Introduction activity agenda and course overview (***Prof. Mark Jit, LSHTM)***	**09:30–10:15** (45mins)	Vaccine efficacy ***(Dr. Hannah Clapham, NUS)***	**09:30–10:30** (1hr)	Modelling vaccine preventable diseases ***(Prof. Mark Jit, LSHTM)***	**09:15–10:45** (1hr 30mins)	Statistical and reporting issues related to vaccine trials ***(Prof. Peter Smith, LSHTM)***
10:30–10:45 (15min)	**BREAK**	**10:15–11:00** (45mins)	Vaccine trials - phase I, II, III and safety ***(Prof. Dicky Akanmori, WHO AFRO)***	**10:30–11:00** (30mins)	**BREAK**	**10:45–11:15** (30mins)	**BREAK**

10:45–11:45 (1hr)	Epidemiological concepts related to vaccination ***(Dr. Hannah Clapham, NUS)***	**11:00–11:30** (30mins)	**BREAK**	**11:00–12:30** (1hr 30 mins)	Practical on modelling vaccine preventable diseases ***(Prof. Mark Jit, LSHTM)***	**11:15–12:15** (1hr)	Herd immunity and other indirect effects of vaccination ***(Prof. Paul Fine, LSHTM)***
11:45-12:45 (1hr)	Surveillance and burden estimation ***(Prof. David Heymann, LSHTM)***	**11:30 – 1:00** (1hr 30mins)	Case studies in vaccination (interactive class exercise) ***(Prof. David Heymann, LSHTM)***				

PART 2 (14-15th December 2021)

Time (GMT)	DAY 5 - Tuesday, 14th Dec	Time (GMT)	DAY 6 - Wednesday, 15th Dec
09:00 – 09:30 (30mins)	Recap and Day overview ***(Prof. Mark Jit, LSHTM)***	**09:00 – 10:00** (1hr)	Economics of vaccination ***(Prof. Mark Jit, LSHTM)***
09:30 – 10:30 (1hr)	Post-licensure evaluation ***(Dr. Hannah Clapham, NUS)***	**10:00 – 10:15** (15mins)	Closing remarks ***(Prof. Mark Jit, LSHTM)***
10:30 – 11:00 (30mins)	**BREAK**	**10:15-10:30** (15mins)	**BREAK**
11:00- 12:00 (1hr)	Getting vaccines to where they are needed ***– Dr. (Margaret Gyapong, SAVINGS Consortium)***	**10:30-12:00** (1hr 30 mins)	**Policy Plenary**: Vaccinology in the age of COVID-19 in Africa *- Modelling to support decisions on COVID-19 vaccines and the political economy of vaccines* ***(Prof. Mark Jit, LSHTM)*** *- Using COVID-19 vaccines: lessons from control of vaccine preventable diseases* ***(Prof. David Heymann, LSHTM)*** **-** Learning from the South African COVID-19 experience ***(Dr. Ijeoma Edoka, RITAG, South Africa)*** ***-** Community engagement for vaccine acceptance in the region* ***(Mr. Robert Kanwagi, World Vision)***

*Please note that the agenda is subject to updates

3. Zoom Instructions and Guidelines

Meeting Information:
Please login to Zoom at this link each day: https://zoom.us/j/92957669678

Meeting ID: 929 5766 9678

Participant Guidelines:

1. Please enter Zoom on time and attend all days of the workshop. Ensure that your internet connection is as stable as possible. There is no need to turn on your videos ,in case of network difficulties. We encourage you to use your video if you are speaking to allow the audience to connect with you.
2. A Certificate of Participation will be awarded to those who attend **all sessions** at the end of the workshop. You will also be required to complete a feedback form at the end of the workshop. To ensure that certificates are given to those who complete the workshop, attendance will be monitored every day.
3. Please indicate your full name, organization and country in the Zoom name, i.e. "Aparna Ananthakrishnan (HITAP, Thailand)"
4. Please ensure that all microphones (except those of the speakers', presenters', and facilitators') are muted during the live sessions (except for exercise breakout rooms).
5. To maximize the time allotted for the live sessions, all questions, comments, and clarifications shall be entertained as per discretion of the facilitator team.
6. Participants who would like to speak shall use the 

button and wait for the acknowledgement of the facilitator before unmuting microphones.
7. Participants may also submit their questions, comments, and clarifications through the Zoom chat box. Please be advised that the facilitator team may not be able to respond to all questions, comments and clarifications depending on the volume of queries received.
8. The practical sessions will use the 'breakout room' function to allow for smaller groups to come together. Each participant will be assigned to a room which will have a facilitator to guide and help with the activities.
9. Please be advised that all sessions will be recorded and should you have any reservations about the same, please do email us at vaccinology2021@hitap.net.

Please refer to the Zoom User Guidance document sent to your email as an attachement for further instructions about how to use Zoom (i.e. How to raise your hand, join a breakout room, etc.).

4. ADP Community

The ADP Community brings together stakeholders from a broad range of sectors and disciplines to accelerate access and delivery of new health technologies. The combined experience of Community members' and ADP in-country partners provides a rich source of learning, enabling opportunities for South–South exchanges and for members to learn from each other. As well as bridging across silos, a main objective of the ADP Community is to link members across a set of focus countries (Ghana, India, Indonesia, Malawi, Tanzania, Thailand and Senegal) and beyond.

Please join the ADP Community prior to the start of the workshop at this link: https://adphealth.org/community/join-us/

Once joined you will be added to a group for the workshop, where you will have access to workshop materials and can engage with other participants, even after this workshop has concluded.

5. Contact Information

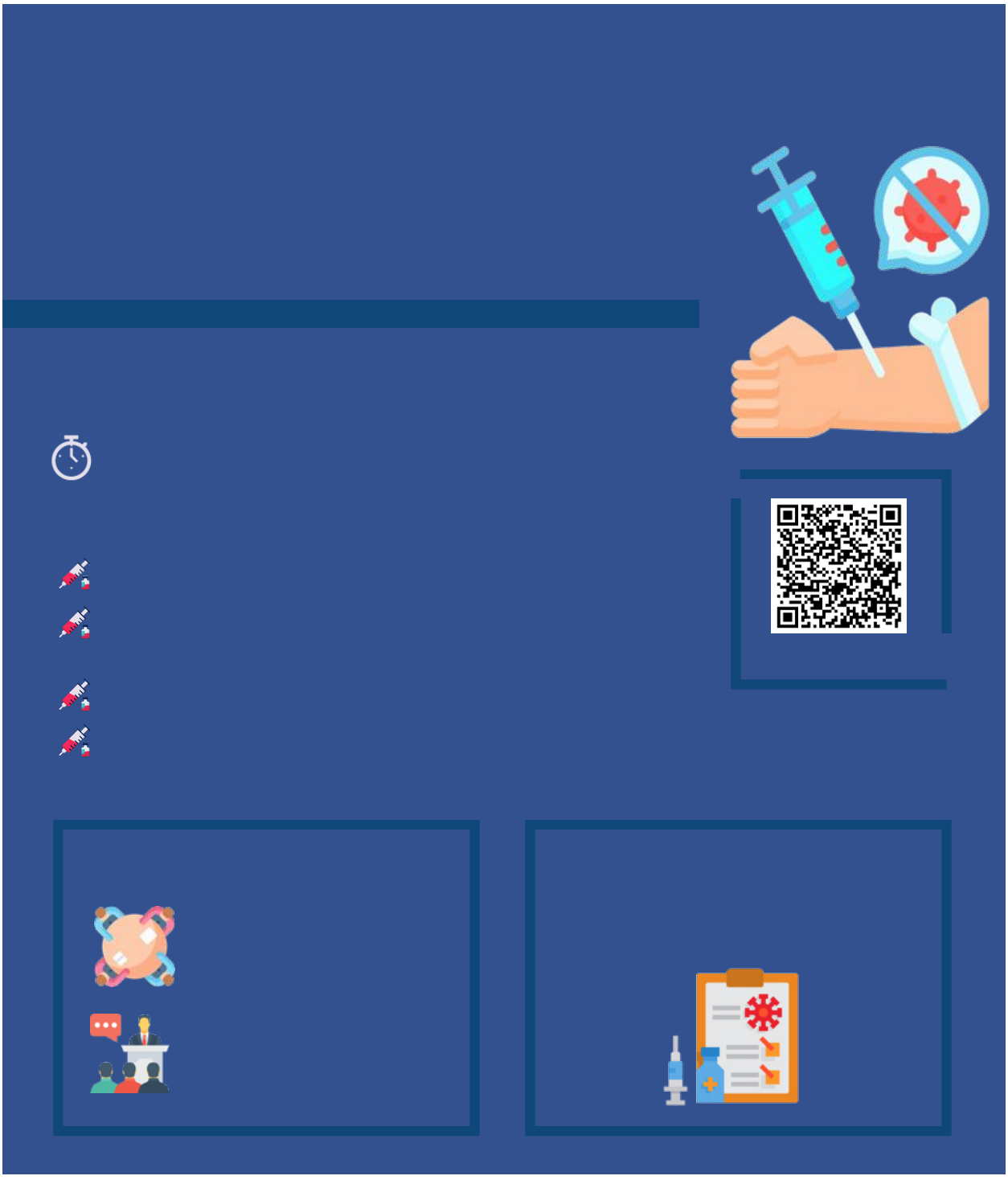
For more information about the workshop please contact: vaccinology2021@hitap.net or Aparna Ananthakrishnan at aparna.a@hitap.net

Appendix 2. List of Attendees

No.	Name	Country	Organisation
1	Abena Asamoah Amoakohene	Ghana	Food and Drugs Authority, Ghana
2	Adela Ashie	Ghana	Food and Drugs Authority, Ghana
3	Akosua Serwaa Okyere	Ghana	Food and Drugs Authority, Ghana
4	Andrew Kigombola	Tanzania	Maryland Global Initiatives
5	Angela Ackon	Ghana	WHO, Ghana
6	Augustina Koduah	Ghana	University of Ghana
7	Bernadette Chibwanna	Malawi	Ministry of Health, Malawi
8	Bona Ventura Nestroy	Tanzania	Ministry of Health, Tanzania
9	Clara Deusdedith Kweyamba		
10	Daniel Ankrah	Ghana	Korle-Bu Teaching Hospital
11	David Ameyaw	Ghana	Syreon Research institute
12	Dr. Maureen Martey	Ghana	Ministry of Health, Ghana
13	Edith Gavor	Ghana	Ministry of Health, Ghana
14	Emmanuel Taylor		
15	Emmanuella Abassah	Ghana	Ministry of Health, Ghana
16	Erica Thomas		
17	Fajar Lestari	Thailand	Chulalongkorn University
18	Fausta Michael	Tanzania	Ministry Of Health, Tanzania
19	Felicia Dwamena	Ghana	Food and Drugs Authority, Ghana
20	Festus Korang	Ghana	Ministry of Health, Ghana
21	Francis Chiuma		
22	Fred Bedzrah	Ghana	Komfo Anokye Teaching Hospital
23	Fredrick Jovin Rwegerera	Tanzania	USAID
24	Geofrey Makenga	Tanzania	National Institute for Medical Research
25	George Hedidor	Ghana	WHO, Ghana
26	George Dennis Obeng	Ghana	Ghana Health Service
27	Gladys	Tanzania	Ministry of Health, Tanzania
28	Glover Asiedu	Ghana	University of Ghana
29	Godwin Gulbi		
30	Hussein Mohammed	Tanzania	Muhimbili University
31	Kwame Bonsaffoh	Ghana	University of Ghana
32	Lightwell Zomba	Malawi	Ministry of Health, Malawi
33	Maame Serwah Koranteng	Ghana	Food and Drugs Authority, Ghana
34	Masanja Mhezi	Tanzania	Maryland Global Initiatives
35	Mdaki Zilahulula	Tanzania	
36	Neema Rubaga	Tanzania	Maryland Global Initiatives
37	Nicholas Adjimani	Ghana	Ministry of Health, Ghana
38	Ofosuaa Asante		
39	Peggy Owusu Nyamaah	Ghana	Food and Drugs Authority, Ghana
40	Peter Darkwa Gyasi	Ghana	Ghana Health Service
41	Prince Osei Agyemang	Ghana	Food and Drugs Authority, Ghana
42	Princilla Kinyunyi	Tanzania	Ministry of Health, Tanzania
43	Ritha Willilo	Tanzania	WHO, Tanzania
44	Ruby Aileen Mensah	Ghana	National Health Insurance Authority, Ghana
45	Saleh Mlangwa		African Medical and Research Foundation
46	Saviour Yevutsey	Ghana	Ministry of Health, Ghana

No.	Name	Country	Organisation
47	Seth Frimpong		
48	Suma Jairo	Tanzania	Ministry of Health, Tanzania
49	Thomas Nettey	Ghana	Food and Drugs Authority, Ghana
50	Veronica	Tanzania	
51	Vito Baraka	Tanzania	National Institute for Medical Research, Tanzania
52	William O A	Ghana	National Health Insurance Authority, Ghana
53	William Reuben	Tanzania	Government of Tanzania the President's Office

Appendix 3. Communications materials



Highlighted Speakers

Prof. Mark Jit,
LSHTM, UK

Prof. Hannah Clapham,
NUS, SIngapore

Prof. David Heymann,
LSHTM, UK

Prof. Paul Fine,
LSHTM, UK

Prof. Peter Smith,
LSHTM, UK

Additional speakers will be announced closer to the workshop dates

Registration Information:

- You may register here or https://forms.gle/6eV3q9wG3zWzD3KQ6
  Space is limited to 30 participants and available on a first come first serve basis.
- This workshop is free of charge.
- An agenda and Zoom meeting details will be shared with participants closer to the workshop dates.
- Given the nature of this training, participants are expected to have at least basic statistical knowledge to engage with the teaching materials.
- Participants will need access to Microsoft Excel to engage with the practical activities.

For more information, please contact
vaccinology2021@hitap.net

HITAP | NUS Saw Swee Hock School of Public Health | THE ACCESS AND DELIVERY PARTNERSHIP | LONDON SCHOOL of HYGIENE &TROPICAL MEDICINE


Policy Plenary:
Vaccinology in the age of COVID-19 in Africa
Wednesday, 15th December 2021
10:30 AM - 12:00 PM (GMT)
Register now
Learn about
- Using COVID-19 vaccines: lessons from control of vaccine preventable diseases
- South Africa's COVID-19 Vaccination Programme
- Community engagement for vaccine acceptance in the region
Speakers
Prof. David Heymann
Infectious Disease and Policy Expert
Dr. Ijeoma Edoka
Health Economist
Robert Kanwagi
Public Health Specialist
Moderator
Cecilia Oh
Access and Delivery Partnership
HITAP
NUS
Saw Swee Hock School of Public Health
THE ACCESS AND DELIVERY PARTNERSHIP
LONDON SCHOOL of HYGIENE &TROPICAL MEDICINE

Appendix 4. Evaluation Data

Workshop

Number of respondents: 16

	Would you recommend this workshop to your colleagues?
Yes	16
No	0

Policy Plenary

Number of respondents: 17

	How did you find out about the Policy Plenary?
Shared by a colleague/friend	12
Website	2
Social media	0
Other	3