A WHO REPORT OF THE
Eliminate Yellow Fever Epidemics (EYE)
Strategy Partners’ Meeting

Geneva, Switzerland
May 9-10, 2017
This report was originally prepared by Ellen Rosskam PhD, MPH with further inputs from the EYE Secretariat within the Infectious Hazards Management (IHM) Department, WHO Health Emergencies (WHE).
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## Acronyms

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<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
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<tr>
<td>AFRO</td>
<td>WHO Regional Office for Africa</td>
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<tr>
<td>DFID</td>
<td>UK Department for International Development</td>
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<tr>
<td>EPI</td>
<td>Expanded Program on Immunization</td>
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<td>EYE</td>
<td>Eliminate Yellow Fever Epidemics</td>
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<tr>
<td>Gavi</td>
<td>Gavi, the Vaccine Alliance</td>
</tr>
<tr>
<td>ICG</td>
<td>International Coordinating Group (on Vaccine Provision)</td>
</tr>
<tr>
<td>ICVP</td>
<td>International Certificate of Vaccination or Prophylaxis</td>
</tr>
<tr>
<td>IMS</td>
<td>Integrated Management Systems</td>
</tr>
<tr>
<td>KAP</td>
<td>Knowledge, Attitudes and Practice</td>
</tr>
<tr>
<td>MoH</td>
<td>Ministry of Health</td>
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<tr>
<td>NGO</td>
<td>Non-governmental organization</td>
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<tr>
<td>PAHO</td>
<td>Pan American Health Organization</td>
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<tr>
<td>PMG</td>
<td>Programme Management Group</td>
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<td>TAG</td>
<td>Technical Advisory Group</td>
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<tr>
<td>UNICEF</td>
<td>United Nations International Children’s Emergency Fund</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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<td>YF</td>
<td>Yellow Fever</td>
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The comprehensive global strategy to Eliminate Yellow Fever Epidemics (EYE) was developed by WHO and partners to build a global coalition that will tackle by 2026 the increased risk of Yellow Fever (YF) epidemics in a coordinated manner.\(^1\)

The EYE strategy is an opportunity to demonstrate new ways of managing the complex world of immunization today. A meeting of partners held 9-10 May, 2017, in Geneva, brought together 65 participants representing agencies, individual experts, and other entities contributing to the efforts of eliminating YF epidemics. Core EYE partners include the World Health Organization (WHO), Gavi, the Vaccine Alliance, and the United Nations International Children’s Emergency Fund (UNICEF). The May meeting brought together the partners present for the same reason: the desire to eliminate yellow fever epidemics.

Four priority areas were identified for the next 12 months, each with activities, expected outcomes, and milestones proposed. These four areas are:

1. Development of a global prioritization matrix for vaccine allocation and implementation
2. Sustained vaccine supply
3. Increased capacity to diagnose YF quickly and accurately
4. Partners’ communication and engagement

A simplified multi-layered EYE governance structure was developed clarifying roles and punctuating the importance of accountability for Strategic Direction and Decision-Making, for the Contributing Partners, and for Implementation and Coordination. EYE’s new governance’s structure is expected to streamline and improve decision-making, implementation, monitoring and evaluation, and impact assessment of the strategy, through transparent concerted processes. The partners agreed that decisions will be made by the Leadership Group in order to allow the Programme Management Group (PMG) managed by the EYE Secretariat to move forward on strategy implementation. The partners further agreed on the means to improve communication, they outlined regional priorities through comprehensive work plans, and they identified technical priorities.

The immediate next steps identified by the EYE partners include finalizing a global prioritization matrix for vaccine allocation; preparing for endorsement of the EYE strategy by Member States at the regional level, through the Regional Committee at the WHO Regional Office for Africa (AFRO) and regional Technical Advisory Group at the Pan American Health Organization (PAHO) meetings; operationalizing the newly-simplified EYE governance structure; tackling technical priorities such as global risk evaluation with support from modelling; monitoring progress through an EYE portal with indicators and a quarterly report; and holding EYE annual meetings.

The partners closed the meeting with agreement on points achieved by consensus. They agreed that the need to implement the EYE strategy is urgent; that EYE has to respond to the demand for accountability; that regular and clear communication is essential; and that EYE partners have moved the needle to incorporate the emergency response aspects of YF to encompass market shaping and how to carry out mass vaccine campaigns. They further gave high importance to prioritising and developing a plan to move forward in the various technical areas.

The implementation of EYE will have moving parts that will need clarification on an ongoing basis; these can be addressed as the partners work. Finally, full support of EYE by all of its partners was expressed, as was their enthusiasm to work together to implement the strategy.
1. Background

‘All the elements needed to succeed are there. It is possible to provide additional resources for WHO’s needs.’

- Jason Lane, DFID

The EYE strategy partners’ meeting (9-10 May, 2017, held at Chateau de Penthes, Geneva) was fruitful and achieved the desired results: it brought together partners and experts, updated them on the current YF epidemiological and vaccine supply situation, and determined how the production of vaccines can be increased to meet growing vaccine demand. The opportunity was also used to refine regional work plans and to define the next steps for the EYE strategy.

The first day of the meeting consisted of presentations including an introduction, regional perspectives on the current YF situation in the Americas and Africa, and the vaccine supply outlook for 2017-2020. A roundtable discussion was held with manufacturers and vaccine experts on meeting the increased vaccine demand. The roundtable was followed by three parallel working groups which defined regional work plans with a role for each partner; identified technical questions that need to be addressed in the coming three years to better tackle the growing risk of yellow fever epidemics; and EYE governance wherein a new EYE governance structure was finalized, including defining the Terms of Reference for each group involved in the EYE strategy as well as operating procedures. During the second day of the meeting the EYE strategy for governance and implementation and feedback from group work were presented. There was a group discussion on opportunities and challenges and what would make the strategy a success before the wrap-up, defining the next steps, and preparing for the next EYE meeting (see Appendix II: Agenda).

The meeting brought together a critical mass of partners with different expertise that provided the needed dynamic to take the EYE strategy to its next level of implementation, with a collective sense of urgency. The EYE strategy aims to innovate, test how the strategy is implemented, and make rapid course corrections as needed.

One and a half days of informed discussion led the group to reach consensus on all points addressed. All partners and donors expressed their deep appreciation and satisfaction at the end of the meeting, stating they were leaving feeling confident in moving forward with near and long term goals.
The EYE strategy consists of 3 objectives:

1. To **protect** at risk populations;
2. To **prevent** the international spread of yellow fever; and
3. To **control** outbreaks rapidly.

Dr. Seth Berkley, Gavi, the Vaccine Alliance, and Dr. Sylvie Briand, WHO, opened the meeting with several key statements. A strong governance mechanism is needed to eliminate YF as well as coordinated technical and financial commitment to achieve the EYE strategy. Gavi’s forecasted expenditure on YF vaccine support in the period 2017-20 will increase by approximately up to US$ 150 million (http://www.gavi.org/about/governance/gavi-board/minutes/2016/7-dec/) indicating there are sufficient funds to allow the EYE strategy to be implemented successfully. The United Kingdom’s vaccine contribution goes to Gavi and others, with The Department for International Development (DIFID) using a multilateral approach.
Challenges to eliminating YF include unreliable data from many countries and country projections of the need for vaccines typically underestimating the actual need, both of which obfuscate efforts. Key unknown factors are whether there will be more cases due to population growth and growing urbanisation, population movements, and the changing global climate. Africa and the Americas are the two endemic regions, each with specificities with regard to YF. The need to prevent the spread of YF to other regions such as Asia was emphasized (http://www.who.int/wer/2017/wer9216/en/).

Defining the criteria for selecting and prioritizing countries to supply with vaccines is a difficult process. As such, decision-making needs to be evidence-based. The International Coordinating Group (on Vaccine Provision) (ICG) (http://www.who.int/csr/disease/icg/yellow-fever/en/) is the body that makes decisions regarding the global YF vaccine stockpile set up for emergency response. The global emergency stockpile is 6 million doses. Since the outbreak in Brazil began in December 2016, Brazil has been forced to request 3.5 million doses from the ICG, because its own country stockpile has been depleted.

Drs. Berkley and Briand also put forward a number of key questions for the participants to reflect upon and attempt to respond to during the meeting:

1. How can sufficient vaccines be obtained so that enough population immunity will be achieved as well as enough vaccines to respond to emergencies, taking into account new cases of YF in Brazil and Peru have put a strain on supply?

2. Do we need to take additional actions in order to step up vaccine production?

3. How should we decide how to use the doses we have, knowing they are not enough? Supplying limited vaccines only for emergencies may not be the best way to go if it means populations are not getting vaccinated.

4. How do YF and measles vaccine coverage relate given in most countries the differentials in coverage can be explained by defined criteria?
2. Regional summaries

A. PAHO: Situation Summary of yellow fever in the Americas

Thirteen countries in the Americas have endemic YF areas, covering a huge area of territory. Some 187 million people live in YF risk areas, 16 million people living in an area of 400,000 square kilometers in Brazil are a new population at risk, and more than 600,000 children need vaccination in Colombia. In addition to these challenges, there is the additional need to think about jungle YF in the Americas.

The period 2015-2017 saw sporadic cases in Colombia, an upsurge in cases in the Amazon part of Peru, and an upsurge in cases in southeast Brazil, raising concern in the past 4 months. Risk assessment and risk mapping are effective and take into account altitude, temperature, ecosystem, rain, as well as other factors. The YF vaccine has been introduced into the regular Expanded Program on Immunization (EPI) schedule in endemic countries in the Americas, however, EPI schedules differ among countries, for example, Bolivia has good control of YF vaccinations, Peru’s strategy is to vaccinate in stages, and routine immunization is still under discussion in Chile.

Different approaches to the number of vaccine doses are used in different regions, however, the EYE strategy is to use 1 dose. In March 2017 the PAHO Technical Advisory Group (TAG) reiterated its previous recommendations of using a single dose of the YF vaccine while endorsing WHO’s current recommendation of using fractional doses in urban outbreaks in case of vaccine shortage. During the period 2007-2017 Venezuela, Colombia, Peru, Ecuador, and Bolivia accounted for 78.9% of the demand from the PAHO YF Vaccine Revolving Fund.

Figure 1. Vaccine rationing in situations of limited availability

<table>
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<tr>
<th>Priority I</th>
<th>Priority II</th>
<th>Priority III</th>
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<tr>
<td>• Vaccination of susceptible populations residing in enzootic areas and neighboring municipalities (avoiding revaccination)</td>
<td>• Routine vaccination of children aged 1 year</td>
<td>• Continuing with vaccination in stages, by vaccinating in regions or departments where migration originates or according to levels of Aedes aegypti infestation in order to prevent reurbanization</td>
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<tr>
<td>• Vaccination of people travelling to those areas</td>
<td></td>
<td></td>
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<tr>
<td>• Rapid outbreak control &amp; monitoring of vaccination coverage</td>
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B. Brazil: Situation Summary of yellow fever in Brazil

Brazil’s YF outbreak has been on-going since December 2016 and today affects nine states. No new cases were reported in the five weeks prior to the EYE strategy partners’ meeting.

Brazil has YF endemic regions and the current outbreak shows that there are also affected areas outside of the established endemic regions. From 2014-2016, 51 cases were identified in non-human epizootics in primates as well as human cases. 3660 epizootic cases were identified in non-human primates in 2017, all in areas where the Ministry of Health (MoH) had already recommended vaccination. The significant increase in the number of cases has made the situation one of serious concern.

By early May 2017, there were 410 deaths reported in 116 municipalities in the 2016/17 outbreak – all among non-vaccinated people. Most of the human YF cases have occurred in 31-46 year old men. These cases are thought to be related to areas where people are going to endemic areas for ecological trips or work. From January 13-16, 2017, 54 deaths occurred in non-human primates. Since Brazil is entering the winter season, the MoH is confident to not see more cases after early June.

Brazil’s YF surveillance system is built on laboratory diagnosis and immunization, and is on-going in Salvador, Sao Paulo, Rio de Janeiro, and Belo Horizonte - all of which are now recommended areas for vaccine coverage. Brazil has approximately 6 million doses in its stockpile. Approximately 30 million doses have been dispensed in this present outbreak, yet there are 180 municipalities with more than 40 million people still in need of vaccination. The overall vaccine coverage in the general population is 55-60% although some vaccine-recommended areas are improving their coverage rates.

Vaccination campaign implementation and vector control is the responsibility of municipal authorities in their respective municipalities. This de-centralisation sometimes creates complications. Brazil’s MoH is 99% confident that all cases have been through sylvatic transmission and not Aedes aegypti vectors since vector control has intensified since 2016 following outbreaks of Dengue, Zika, and Chikungunya.

There are numerous challenges in YF surveillance in Brazil and a Ministry of Health situation room working group is in charge of these efforts. Epidemiological surveillance is a challenge because there is low sensitivity for early detection in humans due to an inadequate flow of information from health care services - in Brazil, many doctors have never seen a case of YF before, presenting difficulties in diagnosis. Epizootic cases in non-human primates present challenges and health care providers need more sensitization about non-human primate deaths. There is a need for an integrated policy on basic sanitation and risk of YF re-urbanisation for effective entomologic surveillance. It is important to note that in Brazil there are jungles with monkeys next to urban settings, which creates a risk of sylvatic transmission in urban areas.

There are untapped opportunities for early diagnosis through laboratory diagnosis. The MoH is working on a fractional dose plan coordinated with states where there are areas now-recommended for vaccines. For now, the MoH is not using fractional doses but they are prepared to do so if this is needed. The MoH has yet to decide if they will use 1 dose in children. 1754 “events” are presently under investigation by the MoH because adverse events are preventable.
The adverse events reported in the vaccination response to date in the 2016/17 outbreak (December 2016-May 2017) included:

- 306 severe adverse events resulting in 24 deaths, and
- 1448 non severe adverse events.

There were also 471 errors recorded, such as errors of immunization dosage, 17 of which resulted in adverse events.

*The working group on the Americas developed a plan of action for the following activities:*

- YF risk profile and scaling up of preventive vaccination strategies;
- emergency stockpile and outbreak response;
- surveillance and laboratory;
- vaccine supply, forecast, and market shaping; and
- public health research and product development.

Based on this plan of action, the points for consideration identified for the present and future include:

- ensuring more vaccine to cover gaps in PAHO YF endemic countries: 50 million doses are needed over five years;
- prioritization of countries: Peru, Venezuela, Colombia;
- long term planning for vaccine procurement such as bid solicitation for three years minimum;
- global coordination between Procurement Agencies (PAHO Revolving Fund and UNICEF supply);
- including the PAHO Revolving Fund in EYE Governance;
- universal vaccination in children: in Brazil this will start in 2018 while Panama is having on-going discussions about this issue;
- addressing vaccine shortages – Knowledge, Attitude, and Practice (KAP) studies are needed in order to characterize operational issues;
- strengthening the laboratory network;
- having discussions with individual countries and regions including through the regional TAG and Regional Committee (European Council);
- AFRO and PAHO meetings to include participants from each other’s groups to share technical expertise; and
- investing in epizootic surveillance to link surveillance of human and non-human cases - this can be run by different groups in different countries, such as NGOs, Ministries of Health, regional offices, etc.
Finally, it was noted that all 13 at-risk countries have already introduced YF vaccine into routine activities. In the Latin American region, non-governmental organizations (NGOs) do not participate in vaccination interventions. Workers at high risk include those in the agriculture, tourism, and mining industries. Under the International Health Regulations, the International Certificate of Vaccination or Prophylaxis (ICVP) requirements have been updated by PAHO and are available on the Web. EWARS is an arbovirus integrated surveillance and laboratory network at national, department, and provincial levels which can be of assistance. The regional YF guidelines will be updated during the second half of 2017.

C. AFRO: Situation Summary of yellow fever in the African region

Yellow fever remains a major challenge for public health in Africa, despite vaccine availability since the early 1930s. Frequent outbreaks in West Africa in the early 2000s led to the 2005 launch of the yellow fever Initiative, with the support of Gavi, to reduce the risk of epidemics.

Outbreaks continue to occur in Africa through a sylvatic cycle involving monkeys as a natural reservoir. The unprecedented YF outbreak in Angola in 2016 and its spread to the Democratic Republic of Congo prompted the WHO to develop a global strategy.

In Africa, YF risk determinants include climate, vector, social vulnerability, weak health systems, and rapid urbanisation. Thirty-five countries, including approximately 500 million people, remain at risk. Few countries in the region have achieved their 80% vaccination rate; the regional coverage was recently estimated as 41% (2017)².

Good surveillance at country level requires appropriate laboratory diagnostic capacity, and AFRO is ready to invest in improved surveillance. Countries in the region mostly use the polio surveillance network, a problem which needs to be addressed. It took more than 6 months to stop the outbreaks in Angola and the Democratic Republic of Congo, an effort through which more than 20 million people were vaccinated. However, this “firefighting” approach is not efficient and a more preventive approach is envisioned for the future in the region. Following the outbreak in Angola, WHO AFRO moved to using fractional doses in Kinshasa, a city of 10-15 million people, due to concerns about supply, and using fractional doses resulted in successful implementation of the vaccination campaign.

It is clearly and widely understood that people who travel need a certificate that is issued only after vaccination with a full dose, although it is still under discussion in the Democratic Republic of Congo, whether people who received the fractional dose will be offered a full dose once the vaccine supply situation allows it. The data about using fractional doses are encouraging. Study results from the US Centers for Disease Control showed 98% seroconversion after 28 days, indicating a good immune response. The Centers for Disease Control are working with the Democratic Republic of Congo and Brazil applying the results of their studies on fractional doses.

² For more details see: http://www.who.int/immunization/monitoring_surveillance/data/gs_afrprofile.pdf?ua=1
The WHO AFRO region has learned a number of valuable lessons from its recent responses to YF outbreaks. For example, progress in the region has been made in a number of areas including early detection of risks; the systematic use of Integrated Management Systems (IMS); access to contingency funds and vaccines; pre-positioned prevention and control mechanisms; the importance of strong collaboration with technical programmes, such as maternal and child health, research and development, non-communicable diseases, vector control, polio, etc.; and the importance of using a preventive rather than reactive approach. The region has also identified a number of challenges based on recent experience responding to YF outbreaks. These include challenges presented by multiple competing demands; persistent capacity gaps; challenges in applying a WHO country business model; the context for a new IMS system; limited and/or delayed funding; challenges replenishing the contingency fund; challenges resulting from applying a reactive approach rather than a preventive approach and the difficulties presented in introducing a transition strategy to resolve this.

The vision of AFRO’s Implementation Framework for EYE is for the WHO African region to be free of yellow fever epidemics. Its goal is to eliminate the risk of YF epidemics in the African Region by 2026. Its objectives are:

a. To protect at populations in all 35 countries at risk, through preventive and routine vaccination.

b. To prevent the international spread of YF through vaccination of travelers and robust screening and onsite vaccination for people not vaccinated at major points of entry.

c. To detect, confirm, and contain outbreaks rapidly.

The established targets are that all high-risk countries will have completed national preventive mass vaccination campaigns, and that at least 440 million people will have been vaccinated in the African Region.

The WHO AFRO Implementation Framework for EYE has set milestones for 2017, 2018, 2019, 2020, 2021, 2022, and 2024, and by the end of 2017, AFRO intends to have adopted the EYE strategy implementation framework with ten priority interventions:

1. Undertaking risk assessment and catch-up campaigns.
2. Applying the International Health Regulations (IHRs).
3. Vaccinating everyone in areas or countries at high risk of YF.
4. Improving routine immunization and vaccinating every child.
5. Protecting high risk workers.
6. Building resilient urban centers and establishing readiness plans.
7. Sustaining vector surveillance and control programmes in cities.
8. Strengthening surveillance and diagnosis for early detection.
10. Fostering rapid outbreak response.
3. Yellow fever vaccine supply in 2017

The outlook on global YF vaccine production today looks favourable for the EYE strategy, however, if an emergency occurs that exceeds the stockpile, an additional supply will be needed. The partners agreed that better preparation and an alternative capacity are needed but also recognition that it is unrealistic that anyone will stock 30 million doses.

A. Supply projection for 2017 presented by UNICEF

- The yearly demand to UNICEF is approximately 30 million doses.
- From January 1, 2017 - May 9, 2017 UNICEF delivered 15.3 million doses.
- 13.2 million doses are presently available with suppliers.
- The projected additional availability of vaccines for the rest of 2017 is 33.3 million doses.
- The total projected availability for the year 2017 is 61.8 million doses.

For routine vaccination, generally countries are self-funding. For campaigns, different countries are moving in various directions to meet their vaccine needs.

B. Opportunity to accelerate vaccine release

Participants discussed whether it is possible to accelerate the release of vaccines, and discussion with vaccine manufacturers made clear that indeed it is possible, albeit a number of challenges were noted.

Producing the YF vaccine takes 3-9 months but procuring the eggs alone can take 6-12 months. YF vaccine production delays are not uncommon and can be due to various factors such as regulators’ testing requirements, regulators’ specifications for shelf life, and the lengthy lead time to procure the eggs required to produce the vaccine.

After discussion, all partners agreed that improved research capacity is needed to know what options would be best to eliminate production delays, such as extending shelf life or improving technology to shorten production time to three months. Furthermore, there was full agreement that research is needed to identify what figures would help manufacturers improve modelling.

The YF vaccine’s shelf life can be extended but regulatory bodies make this difficult to implement in Europe. All partners agreed that regulators should be included in these kinds of discussions to agree on accepted changes to shorten vaccine production time. For this to happen, the manufacturers need to work technically with the regulatory bodies and WHO to see how they can do these things in practical terms.
Figure 2. The yellow fever vaccine manufacturing process:

- Transport & delivery of eggs
- Unpacking & counting of broken eggs
- Quality control (certificate of critical analysis & proof)
- Entrance to controlled area
- Incubation (12 days)
- Inspection (embryo needs to be alive)
- Entrance to controlled area
- Incubation (post infection 9-12 days)
- Inspection (check that embryos are dead)
- Bottling of the pulp
- Homogenization of the pulp
- Harvesting
- Sanitization
- Inspection (check that embryos are dead)
- Incubation (post infection 9-12 days)
- Sanitization
- Incineration
- Dead eggs are discarded
- Drilling
- Inoculation
- Sealing
- Sanitization
- Bottling of the pulp
- Filling of the vials
- Freeze dryer (2 days)
- Capping & labelling
- Packing
- Distribution
- Storage (6-12 months possible)
- Clarification by centrifugation
- Testing of pulp batches
- Pooling, formulation & stabilization
- Filtering

Figure 2. The yellow fever vaccine manufacturing process
Four YF vaccine manufacturers participated in the meeting all of whom said they are able to increase the production quantity.

**Bio Manguinhos (Brazil)** delivered 35 million doses in the past three months due to the outbreak in Brazil. Sixty-five million doses are needed by December 2017, which is a realistic production plan for the company. For export in the international market the company needs flexibility with regard to labels. They maintain a stockpile of 2 million doses in packages labeled in English and Spanish. In reality, the company is able to produce the vaccines in two weeks but not within the current regulatory testing framework.

**Chumakov (Russia)** produces approximately 20 million doses per year and they plan to produce more than 65 million doses. Their YF vaccine production doubled in the past five years. Their biggest challenge in scaling up has been finding suppliers - Russia has its own suppliers but the production capacity is not high enough. The company finds it challenging to locate investors to scale up the YF vaccine production. As there is no YF in Russia, all of the company’s YF vaccine production is for export. Production gets delayed because Russia’s national regulatory system does not prioritize YF batch testing and all vaccines must pass through the regulatory system.

**Sanofi Pasteur (France)** produces two YF vaccines. One is produced in the USA for markets in the USA, Canada, and Japan. The second one, produced in France, is available for other markets such as PAHO and UNICEF markets. The company was able to produce 14 million doses quickly during the Angola outbreak and has made a key decision to invest largely in their YF vaccine production capacity.

A lack of SPF egg suppliers in Africa is a critical difficulty affecting YF vaccine production by the **Institut Pasteur de Dakar (Senegal)**. This could be solved through an increase in the production of eggs from suppliers outside Africa. They are building a new YF vaccine facility which should be operational in 2020 and they aim to secure the vaccine production up to 2020 while they build. From 2020 onwards the vaccine production is expected to increase significantly.

All of the manufacturers emphasized the need for a bridge between discussions about investments and what is taking place in short term production. The long lead time to procure SPF eggs is problematic for all manufacturers and it was suggested that solving this may require a collective consultation together with WHO in a forum where regulators can engage with the manufacturers to resolve regulatory barriers.

### C. Need for long-term demand forecasting

The manufacturers all stated that information about the demand for the YF vaccine is not clear and that they need to know the product demand and how they can improve stockpiling. The top priorities for the four manufacturers are their need for technological and regulatory leadership, and to know what are the realistic market demands.
The partners’ discussion revealed that outbreaks in the Americas and Africa have taken a heavy toll on the global YF vaccine supply, leading to limited global vaccine availability. At present, 12.6 million doses are available with suppliers, of which 6 million are reserved for the global emergency stockpile. The global YF vaccine production today is sufficient for the EYE strategy however, if an emergency occurs that exceeds the stockpile, an additional supply will be needed. In response, manufacturers are stepping up on capacity and development.

The order of prioritization for the use of vaccine supplies is (1) outbreak response, followed by (2) routine immunisation, and (3) preventive mass campaigns. The priorities for vaccine allocation for the next three months include:

- Outbreak response - maintain six million vaccine doses for the global emergency stockpile.
- Routine immunization.
- Maintain a two month minimum stock to avoid stock-outs in high-risk countries.
- Replenish UNICEF’s vaccine supply one month prior to stock-out.
- Distribute approximately three million doses.

Assuming no further ICG requests, approximately 23 million doses are needed for preventive mass campaigns. For such campaigns, the vaccines will be allocated when sufficient quantities are available. It was pointed out that this decision will be taken towards the end of 2017. In order to move forward, a number of identified elements are required. These include:

- Continued close monitoring of the global epidemic and supply situations.
- Providing regular updates to EYE partners.
- Informing countries at risk for YF of the YF vaccine supply situation and prioritization for vaccine allocation.
- Characterising the highest risk areas to set priorities for preventive mass campaigns and routine immunization.
- Understanding the vaccine supply for the next twelve months.
- Understanding the opportunities to increase vaccine production in the short, medium, and long terms.
4. Governance

The working group on Governance agreed that a clear process is needed and discussed the mechanics of establishing 1) decision-making that provides direction and which is accountable; 2) coordination and information synthesis that facilitates EYE implementation; and 3) technical expertise that provides guidance and advice.

The working group developed, by consensus, a simplified EYE strategy and governance structure that will closely link with existing technical forums, advisory groups, and coordinating bodies to leverage expertise and partners to support the implementation of the strategy, to address high-level political and strategic questions, to engage with regions and countries, and to resolve vaccine supply and demand challenges.

The simplified governance approach is based on five fundamental premises:

1. **EYE** is global and comprehensive;
2. requires multi-layered commitment at all levels;
3. is based on strong partnerships;
4. is well-orchestrated in collaboration and communication with partners; and
5. is streamlined in its decision-making, implementation, and monitoring and evaluation.
EYE’s new governance’s structure – shown below - is expected to streamline and improve decision-making, implementation, monitoring and evaluation, and impact assessment of the strategy, through transparent concerted processes.

Figure 3. EYE governance structure
The structure relies on strong participative governance with robust monitoring which needs to be:

a. Inclusive and comprehensive, through a multi-partner and multi-component configuration.

b. Transparent, with clearly-defined roles and responsibilities against which all partners are held accountable for respective activities.

c. Outcome-driven, ensuring alignment with EYE vision, objectives, and timelines and enabling integration with existing programmes.

d. Country- and region-oriented, with close record-tracking of progress against targets.

e. Strong enough to sustain EYE’s guiding principles throughout its implementation, while being flexible to account for evolving stakeholders’ landscapes and priorities.

Four key decisions were arrived at by consensus with all of the partners:

1. The Leadership Group will be responsible for all decision-making and will be held accountable.

2. The PAHO Revolving Fund group will be brought into the Leadership Group.

3. WHO, Gavi, and UNICEF are the three core agencies of EYE.

4. Technical implementation will be at Programme Management Group (PMG) level with Work Streams that include vaccine supply and market shaping, and laboratory and surveillance.

The forthcoming governance document will detail the particular roles and areas of work for the Programme Management Group, for Monitoring and Evaluation, for Communication and Knowledge Dissemination, the EYE Secretariat, the contributing Partners and the mechanisms for coordination, the Advisory Groups, the Working Groups for Vaccine Implementation, the Working Groups for Vaccine Supply and Market Shaping, the Working Groups for Epidemiology Surveillance and Laboratory, the Working Groups for Research and Modelling, and for Ad hoc Working Groups.

It was agreed that the ICG should inform the future governance structure based on evaluation results which are forthcoming. The evaluation process is getting started now and there is opportunity for partners to insert pointed questions that can feed into the governance structure. The role of regional focal points is critical and this needs to be emphasized within the Programme Management Group. It was further noted that Regional focal points are needed at all levels in the structure.
The core competencies needed for a successful EYE strategy were identified as including programme synergies that ensure implementation of the EYE strategy and are integrated with existing programmes and initiatives, and mapping of a cross-cutting agenda to identify and articulate common ground for multi-programme coordination; vaccine availability and sustainability; information management and communication which includes sending a report to partners after each Leadership Group meeting, monitoring report on a quarterly basis, and ad hoc communication when necessary; research and development; technical priorities that include global risk evaluation, the prioritization of YF vaccine allocation through the use of a matrix, as well as long-term comprehensive multi-criteria analysis modelling; and the capacity to diagnose YF quickly and accurately.

**EYE annual partners’ meeting**

The partners agreed there will be an annual EYE meeting whose purpose will be multi-fold. The meeting will:

- Bring together a critical mass of ideas and expertise.
- Review progress, report against targets and indicators at global, regional, and country levels.
- Identify gaps and needs.
- Characterize lessons learned.
- Update priorities based on annual risk evaluation.
- Review innovations that can serve the EYE strategy.
- Validate the annual work plan for following year reported through the EYE portal.
5. Technical questions

The discussion on technical questions revealed that while it is unclear whether there is a lack of vaccine supply or not, vaccine distribution should be focused on large urban areas to prevent outbreaks, such as in Nigeria. Partners need to move forward with the preventive campaigns that were already committed to by Gavi eligible countries but to also apply them in non Gavi eligible countries. For now, the evidence shows that fractional dosing is sufficient and this was accepted by all. However, a supply chain is lacking and further action is required.

In order to implement the strategy, EYE’s needs must align with manufacturer capacity. For effective implementation, model scenarios need to be built for EYE members and manufacturers to know how to respond in case of outbreaks. Africa’s experience in modelling scenarios can be helpful in this regard.

Both private and public manufacturers, such as the Institut Pasteur, need market certainty to be able to respond as outbreaks occur. To respond to these needs, EYE partners need to take action to address the annual market demand as well as demand during outbreaks. Some suggestions were made to ensure vaccine readiness such as stockpiling based on modelling projections. This method is expensive but makes vaccines ready to release upon need rather than ordering the eggs and producing vaccines, which takes nine months. There are two risks associated with stockpiling: contamination, and the virus becoming inactive over time. Regulators were identified as a major problem in vaccine availability due to the testing phase, which has the greatest risk of failure. A number of solutions to this problem were proposed including: obtaining consensus among manufacturers along with WHO involvement, to discuss types of testing and where it should be done to be able to speed up the process of manufacturer testing which currently takes a long time; working with manufacturers and regulators so that unformulated bulk is prepared with testing completed which can then be formulated and produced as needed (this change alone could reduce vaccine production from six to three months); and obtaining agreements among manufacturers about predictability of vaccine needs.

Country commitment is essential in order for the EYE strategy to be successful. All countries in West Africa have carried out mass campaigns to bring YF under control and these are the kinds of successes that should be made widely known through advocacy and messaging.
In dealing with the question of prioritization of YF vaccine allocation, PAHO countries as well as Gavi ineligible and eligible countries should be included. To help with vaccine allocation prioritization, it was suggested that a more comprehensive multi-criteria analysis be used, including modelling and other methodologies (such as multivariate analysis in addition to additive scoring), to determine how to allocate vaccines for the long term. It was noted that such analyses should take into consideration:

- population movements (migration);
- limitations to the data and model;
- quality public health system indicator;
- immunization rate as a proxy;
- time to diagnosis;
- the One Health approach (vector and nonhuman primates); and
- a focus on EPI coverage.

In order to control yellow fever, capacity building is needed for laboratories. In particular, more reference labs are needed as well as an improved molecular diagnostic platform. Similarly there is a need to improve medical services for picking up suspected cases and to emphasize sampling transport. Community surveillance can be useful with the latter.

Finally, the discussion on technical questions emphasized the importance of focusing on EPI coverage, promoting research in answering the question as to why YF has not seeded in Asia (improved laboratory capacity is needed for detection), and using a swab test for suspected cases of yellow fever for confirmation.
6. Next steps

The immediate next steps for EYE, which were agreed upon by consensus, are:

- finalize a prioritization matrix for vaccine allocation;
- prepare for endorsement of the EYE strategy by Member States at regional level, through the AFRO Regional Committee and PAHO Regional Technical Advisory Group meetings;
- operationalize the EYE governance structure;
- tackle technical priorities such as global risk evaluation with support from modelling;
- monitor progress through an EYE portal with indicators and a quarterly report;
- organize an annual EYE meeting to bring together a critical mass of ideas and expertise and to review progress against targets;
- produce and circulate rapidly a meeting report capturing the discussions, achievements, and next steps - the EYE secretariat will contact the partners to follow up on these next steps; and
- circulate a governance document.

For the next 12 months, four priority areas were identified and for each priority area, activities, expected outcomes, and milestones have been proposed. The four priority areas are:

1. Global prioritization of a matrix for vaccine allocation and implementation;
2. Sustained vaccine supply;
3. Increased capacity to diagnose YF quickly and accurately; and
For the longer term, partners agreed that:

- Countries will be engaged in the EYE strategy.
- The Leadership Group will make decisions so that the PMG can move in the right direction.
- All partners must be involved in order to deliver on the EYE strategy.
- Member States will be engaged to endorse the strategy. For the Americas, the Technical Advisory Group will be the first contact with Member States to obtain regional representation for the campaign.
- PAHO will channel the EYE strategy to individuals in the countries who will be responsible for its implementation.
- The simpler governance structure will provide clarity on who is doing what and who is accountable.
- The new governance structure outlines how the partners will communicate better among themselves.
- A four-year work plan (2017–2020) and regional implementation frameworks will be finalized.
- EYE focal points will be identified to contribute specific technical expertise to priority countries as needed.
- On-going global risk evaluation will be conducted.

Finally, a number of keys to the success of the EYE strategy were identified, including the importance of political commitment for sustainable national and/or regional YF control strategies. Political commitment and leadership are of particular importance in YF at-risk countries to prevent epidemics and to embrace the need to provide expertise and resources to work with EYE. Governance and partnerships are essential for coordinating the implementation of EYE activities with continuous Monitoring and Evaluation of implementation. Accessible, affordable vaccines in a sustained vaccine market (vaccine demand and supply) must be aligned for a timely and effective risk reduction strategy, and sustainable efficient disease surveillance is fundamental.
## Annex I: List of participants

<table>
<thead>
<tr>
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<th>Email Address</th>
<th>Institution</th>
<th>Address</th>
</tr>
</thead>
<tbody>
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# Annex II: Meeting agenda

## DAY 1 – Tuesday 9 May

### Session I: Introduction

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Chair</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30 – 9:00</td>
<td>Registration and coffee</td>
<td>Sylvie Briand, WHO</td>
</tr>
<tr>
<td>9:00 – 9:15</td>
<td>Opening remarks</td>
<td>Sylvie Briand, WHO; Seth Berkley, Gavi</td>
</tr>
<tr>
<td>9:15 – 9:20</td>
<td>Objectives and expected outcome of the meeting</td>
<td>Sylvie Briand, WHO</td>
</tr>
<tr>
<td>9:20 – 9:30</td>
<td>Participants presentation</td>
<td>All</td>
</tr>
</tbody>
</table>

### Session II: Current YF epidemiological and vaccine supply situations

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Chair</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:30 – 10:00</td>
<td>YF in the Americas:</td>
<td>Sylvain Aldighieri, PAHO/WHO</td>
</tr>
<tr>
<td>9:30 – 9:40</td>
<td>Regional perspective</td>
<td></td>
</tr>
<tr>
<td>9:40 – 10:00</td>
<td>Brazilian perspective</td>
<td>Joao Toledo, FMoH, Brazil</td>
</tr>
<tr>
<td>10:00 – 10:15</td>
<td>YF in Africa: regional perspective</td>
<td>Socé Fall, AFRO</td>
</tr>
<tr>
<td>10:15 – 10:45</td>
<td>Group photo &amp; tea/coffee break</td>
<td></td>
</tr>
<tr>
<td>10:45 – 11:00</td>
<td>Vaccine allocation for the next 3 months</td>
<td>EYE Leadership group</td>
</tr>
<tr>
<td>11:00 – 11:15</td>
<td>Outlook on vaccine supply 2017-2020</td>
<td>Joao Toledo, FMoH, Brazil</td>
</tr>
<tr>
<td>11:15 – 12:15</td>
<td>Manufacturers and vaccine experts roundtable: meeting the increased vaccine demand.</td>
<td>Socé Fall, AFRO</td>
</tr>
</tbody>
</table>

**Facilitator:** Heather Deehan, UNICEF

1) 5-minute short visual/engaging overview of the yellow fever vaccine production process, highlighting all steps of vaccine production

2) discussion on improvement options for each of these production steps as described in the EYE document

3) how can we achieve an increased vaccine production

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Chair</th>
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</thead>
<tbody>
<tr>
<td>12:15 – 13:30</td>
<td>Lunch</td>
<td></td>
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</tbody>
</table>
### Session III: Parallel working groups

**Working group 1: Regional work plans (two sub-groups: 1a AFRO, 1b PAHO)**

**Objective:** Define regional work plans with a role for each partner, to be presented back to the plenary on the second day of the meeting.

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Facilitator</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:30 – 13:35</td>
<td>Introduction</td>
<td>Socé Fall (Africa), Sylvain Aldighieri (Americas)</td>
</tr>
<tr>
<td>13:45 – 15:00</td>
<td>Put together a work plan for each region, with objectives, targets, indicators, responsibilities for each partner (who will do what by when)</td>
<td>Facilitators</td>
</tr>
<tr>
<td><strong>15:00 – 15:30</strong></td>
<td><strong>Tea/coffee break</strong></td>
<td></td>
</tr>
<tr>
<td>15:30 – 16:45</td>
<td>Work plan discussion continued</td>
<td>All</td>
</tr>
<tr>
<td>16:45 – 17:00</td>
<td>Summary of discussion and next steps</td>
<td>Facilitators</td>
</tr>
</tbody>
</table>

**Working group 2: Technical questions**

**Objective:** Identify the technical questions that need to be addressed in the coming 3 years to better tackle the growing risk of yellow fever epidemics.

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Facilitator</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:30 – 13:35</td>
<td>Introduction</td>
<td></td>
</tr>
<tr>
<td>13:45 – 14:00</td>
<td>Modelling in support of the EYE strategy</td>
<td>Tini Garske, Imperial College</td>
</tr>
<tr>
<td>14:00 – 15:00</td>
<td>Guided discussion</td>
<td>All</td>
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<tr>
<td><strong>15:00 – 15:30</strong></td>
<td><strong>Tea/coffee break</strong></td>
<td></td>
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<tr>
<td>15:30 – 16:45</td>
<td>Guided discussion continued</td>
<td>All</td>
</tr>
<tr>
<td>16:45 – 17:00</td>
<td>Summary of discussion and next steps</td>
<td>Facilitator</td>
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</table>

**Working group 3: EYE Governance** (location: WHO, M205)

**Objective:** Finalize EYE governance, groups’ TORs and operating procedures.

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Facilitator</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:45 – 15:00</td>
<td>EYE governance and ways of working, EYE-ICG interactions</td>
<td></td>
</tr>
<tr>
<td><strong>15:00 – 15:30</strong></td>
<td><strong>Tea/coffee break</strong></td>
<td></td>
</tr>
<tr>
<td>15:30 – 16:45</td>
<td>Group work continued</td>
<td>All</td>
</tr>
<tr>
<td>16:45 – 17:00</td>
<td>Summary of discussion and next steps</td>
<td>Facilitator</td>
</tr>
<tr>
<td><strong>17:15 – 19:00</strong></td>
<td><strong>Cocktail</strong> (on-site)</td>
<td></td>
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</tbody>
</table>
### DAY 2 – Wednesday 10 May

<table>
<thead>
<tr>
<th><strong>Session IV:</strong></th>
<th><strong>Chair:</strong> Socé Fall, WHO</th>
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</thead>
<tbody>
<tr>
<td>8:30 – 9:00</td>
<td>Welcome coffee</td>
</tr>
<tr>
<td>9:00 – 9:15</td>
<td>Governance</td>
</tr>
<tr>
<td>9:15 – 9:20</td>
<td>Discussion</td>
</tr>
<tr>
<td>9:20 – 9:40</td>
<td>AFRO Regional work plan</td>
</tr>
<tr>
<td>9:40 – 10:00</td>
<td>PAHO Regional work plan</td>
</tr>
<tr>
<td>10:00 – 10:20</td>
<td>Technical questions and modelling</td>
</tr>
<tr>
<td>10:20 – 10:40</td>
<td>Discussion on opportunities and challenges; what would make the strategy a success</td>
</tr>
<tr>
<td><strong>10:40 – 11:00</strong></td>
<td><strong>Tea/coffee break</strong></td>
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<table>
<thead>
<tr>
<th><strong>Session V:</strong></th>
<th><strong>Chair:</strong> Oyewale Tomori, Nigerian Academy of Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:00 – 11:15</td>
<td>Summary of key discussion points</td>
</tr>
<tr>
<td>11:15 – 11:30</td>
<td>The way forward in Africa and in the Americas</td>
</tr>
<tr>
<td>11:30 – 11:45</td>
<td>Preparing for the next EYE partners meeting: when, what will be expected, how</td>
</tr>
<tr>
<td>11:45 – 12:00</td>
<td>Closing remarks</td>
</tr>
<tr>
<td><strong>12:00</strong></td>
<td><strong>Meeting adjourned</strong></td>
</tr>
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Annex III: Factsheet on eliminating yellow fever epidemics by 2026

The Eliminating Yellow fever Epidemics (EYE) strategy is a global and comprehensive long term (2017-2026) strategy targeting the most vulnerable countries, while addressing global risk by building resilience in urban centres, and preparedness in areas with potential for outbreaks and ensuring reliable vaccine supply by forming a global coalition of partners to predict needs and shape vaccine production. The strategy consists of three strategic objectives built on lessons learned and is supported by five cross-cutting competencies to ensure its roll-out and success.

OUR VISION
A world without yellow fever epidemics.

OUR MISSION
Coordinate international action and help at-risk countries to prevent yellow fever outbreaks and to prepare for those which might still occur. We aim to minimize suffering, damage and spread by early and reliable detection and a rapid and appropriate response.

Key competencies for success

- Affordable vaccines and sustained vaccine market.
- Strong political commitment at global, regional and country levels.
- High level governance with long-term partnerships.
- Synergies with other health programmes and sectors.
- Research and development for better tools and practices.

Photo credit: WHO/Yoshi Shimizu
STRATEGIC OBJECTIVE 1: Protect at-risk populations: no epidemic

- Where risk is high, vaccinate everyone
  - Quickly raise population immunity levels through mass vaccination campaigns.
- Reach every child
  - Sustain high yellow fever vaccine coverage in all districts through childhood routine immunization.
- Risk assessments
  - Assess the risk of yellow fever epidemics in at risk countries to set priority for interventions.

STRATEGIC OBJECTIVE 2: Prevent international spread: no exportation

- Protect high-risk workers
  - Engage private sector to protect unimmunized workers with sylvatic exposure (e.g., oil and mining industry, agro business).
- Apply International Health Regulations (IHR)
  - Develop innovative approaches to strengthen IHR application in countries at risk or potential for yellow fever.
- Build resilient urban centers
  - Develop and implement urban readiness plans to enable urban coping with epidemics.

STRATEGIC OBJECTIVE 3: Contain outbreaks rapidly: no sustained transmission

- Detect early
  - Strengthen surveillance and laboratory capacities.
- Vaccine supply is ready at all times
  - Ensure permanent availability of yellow fever vaccines worldwide for rapid intervention.
- Respond immediately
  - Launch coordinated control interventions including reactive immunization, community mobilization, vector control and case management.

FOR MORE INFORMATION
www.who.int/csr/disease/yellowfev/en

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For further information
www.who.int/csr/disease/yellowfev/eye-strategy/en/