SUPPORTING THE ANGOLAN MOH TO RESPOND TO YELLOW FEVER EPIDEMIC OUTBREAK
Luanda, February 15th to October 24th, 2016.

Enhancing Emergency Response Coordination to contain Yellow Fever outbreak in Angola project

UNDP CONSULTANCY CONSOLIDATED REPORT
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**Abbreviations**

CDC – Center of Disease Control and Prevention

FAA – Angolan Armed Forces

EPI – Expanded Programme on Immunization

CECOMA – Angolan Purchase Center for Medecins and Medical Supplies

GoA – Government of Angola

GOARN – Global Outbreak Alert and Response Network

ICG – International Coordinating Group on yellow fever vaccine

MoH – Angolan Ministry of Health

MSF - Medecins Sans Frontieres

NDPH - National Directorate of Public Health

NIPH – National Institute of Public Health

NIS - National Institute of Statistic

UNDP – United Nations Development Programme

UNICEF – United Nations Children Found

WHO – World Health Organization

Y.F. – Yellow Fever
1. Introduction

Since late December 2015, Angola has been undergoing one of the biggest urban yellow fever outbreak in Africa, which compromises the health and the lives of thousands of people. The outbreak initially detected in Luanda Province spread out gradually into 16/18 provinces of the Country and internationally, causing great concern in the country and worldwide for its unpredictable consequences, due to the wide distribution of vector *Aedes aegypti* mosquito, in several countries of Africa, Asia, Europe and America.

The World Health Organization graded the current Angolan yellow fever outbreak as emergency level 2 from 3 levels on the Emergency Response Framework grading scale. An incident manager has been appointed since February to July 2016 and experts of WHO, UNICEF, CDC, GOARN, MSF, UNDP and other partners have been deployed to provide technical support to the Country.

UNDP Crisis Response Unit approved to provide in-country direct support to the humanitarian community and the Government of Angola in the emergency phase, aiming at improving coordination, in particular in the area of needs assessment, strategic and operations planning and implementation. In this way, I was hired by UNDP-Angola for the period of two months, then given the severity of the problem, my contract was extended on 2 opportunities covering in total the period from February 15 to October 24, 2016. My duty station was Luanda, I work directly with the National Director of Public Health of the Angolan Ministry of Health.

2. Terms of Reference

The objective of Consultancy was to support the National Directorate of Public Health in the preparation and implementation of the current response to the Yellow Fever Outbreak in Angola and to extend the vaccination campaign to all districts in Luanda and eventually to other provinces in the country, focusing on coordination of response, and strategic and operations planning.

The main tasks were the following:

2.1 Emergency coordination

- Strengthen coordination for Yellow Fever outbreak emergency response and Information management.
- Support DNSP in the coordination, follow up and integration of the activities implemented by the technical, logistics, communication and social mobilization sub-commissions.
- Supervise in the field the organization and implementation of the campaign to ensure the application of technical requirement such as vaccine conservation, vaccination application techniques, information provided to users, registry and delivery of vaccination cards as well as the elimination of the vaccination waste.
- Support efforts for the strengthening of local capacities in terms of coordination, investigation and vaccination response, reporting, information management and resource mobilization.
- Support the elaboration of the provincial district micro-planning ensuring their adaptation to each context.
- Participate on follow up and assessment meetings.
- Elaborate reports on the situation.

2.2 Continuous needs assessment
- Support GoA and partners in preparing a comprehensive needs analysis for the affected districts to strengthen partners’ action in preventing further spreading to the other districts / provinces.
- Identify gaps in the implementation of the response activities and solutions to the needs.
- Prepare practical guidelines and deliver training of trainers.

2.3 Identification of lessons learnt
- Support the assessment of the campaign to identify main gaps and lessons learnt to be addressed future initiatives.
- Identify lessons learnt on the inter-sectorial emergency response management.

3. Main Activities Performed and Results

3.1 Strategic Planning & Monitoring of Activities

In February 2016, I supported the elaboration of the National Plan to Response to the Yellow Fever Outbreak, based on the inputs of the MoH technicians and partners of subcommittees. The plan comprised situation analysis, strategies, activities, budget and schedule for implementation of 5 components namely: Surveillance and Laboratory, Mass Vaccination, Integrated Vector Control, Clinical case management, Communication and Social Mobilization.

The plan are being implemented with adjustments. The main constrain for full implementation of the plan, were the impossibility to obtain all necessary vaccine to respond and prevent the spread of yellow fever and the insufficient Government resources for cover all components of the plan, particularly the expensive vector control. For this reason the MoH focus on mass vaccination component.

Anticipating the spread of epidemic from Luanda to other provinces of the country it was prepared in March a Contingency Plan to vaccinate 18 municipalities of 7 critical provinces. This plan was sent through WHO to ICG, requesting the provision of vaccines and respective injection supplies. The ICG approved vaccine only for 10 municipalities where indigenous transmission was confirmed not for the 8 district at risk.
In April 2016, the Angolan Government change the Minister of Health, and the new Minister request to update and adjust the National Plan of Response to Yellow Fever Epidemic. The new plan intended to expand gradually the vaccination from only districts with indigenous transmission of Yellow Fever, to all municipalities of the Country. The Ministry of Finance offer to make direct transfers of Government funds to municipalities within the decentralization process, for this purpose was prepared breakdown of national response plan by levels. The budget for the provinces and municipalities was made for each of them. At municipal level, resources were allocated for operational costs of vaccination campaign, active surveillance, brigades for vector control and for support social mobilization activists. The total amount requested was $ 7,895,861. This amount was fully approved and transferred directly to 162 municipalities.

In order to mobilize funds for purchasing yellow fever vaccine was prepared a proposal for submission to World Bank. The World Bank Washington authorized the use of 5 million dollars from Revitalization of the Municipal Health Services Project in Angola (credit IDA 4749AO) to purchase yellow fever vaccines. These resources allow the reimbursement to ICG the 50% of the cost of vaccines and injection supplies utilized for vaccinate 20 districts with local transmission. The remaining 50% was covered by GAVI Alliance.

For contribute to implementation of Response Plan, was supported the preparation of proposals to be submitted to WHO for funding Luanda vaccination campaign (rent cars and lunch), implementation of independent monitoring of campaign, active surveillance and laboratory material and reagents, having mobilized 50,9 million Kwanza equivalent to 320,000 USD.

With the objective of empower community activist to accelerate the interruption of indigenous transmission of yellow fever in the Province of Luanda, was prepared a project proposal “Community Training on Vector control Activities” on in order to mobilize fund of donors to limit the impact of the outbreak in the population health and reduce the spread of the epidemic to other provinces or internationally, it contributed also to the reduction of other diseases transmitted by Aedes aegypti mosquito. The proposal was not funded.

The process of support MoH on strategic and operational planning was continuous, having in coordination with WHO prepared various plans to justify request of vaccine to ICG. In this order were contributed to mobilize vaccine and material for 45 districts with documented local transmission. Likewise was prepared various risk analysis, prioritization of districts and operational plans to implement vaccination campaigns in bordering districts with DR-Congo, Namibia and other priority districts.

For the development of vaccination campaign micro plans at district level it was developed a simple instrument and a methodological guide. This instrument was gradually adjusted. The current version is flexible and can easily adapt to particular characteristics of each municipality. This instrument is being implemented throughout the country.

Since February 15th to October 23rd 2016, was supported the general campaign planning for 82 Districts. This activity was very demanding since the identification of districts to vaccinate and the definition of the dates of vaccination was not possible with enough
time, due to decision to vaccinate depends on detection of local transmission and the definition of vaccination date be determined by of the arrival date of vaccine and injections supplies, these dates were generally known only one to three days in advance. The distribution of vaccine and rest of logistic were in charge of CECOMA. For support CECOMA, was prepared regularly macro plans of distribution of vaccines and injection supplies by provinces.

In October 2016, was prepared detailed plan for vaccinate against yellow fever the population of remaining 82 districts of the country no yet vaccinated. The approach is to vaccinate in two phases. In the first phase, to be implemented in November 2016, it was intended to vaccinate 3.2 million people of 39 districts of 14 provinces, and in the second phase to vaccinate of remaining 2.5 million people of 44 districts of 11 provinces. The cost of vaccine, injection supplies and operational cost is USD 10.872.627. The GoA offers finance, only is pending the approval of deliver of vaccine by ICG.

To monitor and coordination the activities of the 5 components of the Plan of Response to the epidemic, the Ministry of Health organize meetings of the “National Yellow Fever Outbreak Response Commission”, these meetings were daily during the months of February to April, three times a week from May to June and from July to present once a week. The meetings were chaired by the Minister of Health until June and then by the National Director of Public Health. Minutes of the meetings are prepared and distributed to participants. Daily epidemiological bulletins were released until July and then weekly Bulletins. The monitoring of immunization activities were performed daily, submitting to the authorities summaries of situation for decision-making.

It was supported the technical team from WHO and CDC in the designing coverage surveys for validate the administrative data of 12 key districts, in coordination with the National Institute of Statistics technicians. These surveys were not yet implemented.

3.2 Emergency coordination

During the reporting period I supported NDPH Director in the coordination of MoH technical team and numerous international consultants. It was supported also the technical orientation and coordination with 18 Provincial Directors of Health. In April, 2016 the Director NDPH was changed and I contributed in the continuity of emergency coordination.

The coordination tasks were very challenging due to necessity to link multiple supportive missions to the provinces (WHO, GOARN, UNICEF, MSF) with national and provincial technician’s, inform to Provincial Directors of Health of activities and also prepare draft letters for Minister of Health to inform Provincial Governors about every national or international relevant mission.

The main mechanism of coordination of government institutions and partners as well as the integration of activities and resources was the “National Yellow Fever Outbreak Response Commission” meetings. This Commission meetings was chaired by the Minister of Health or eventually by the Secretary of State. Participated in the meetings the UN Resident coordinator, Representatives of WHO, UNICEF, CDC, delegates from
the Ministries of Interior, Defense and Social Communication besides MoH technicians and NGOs directors.

I supported the National Director of Public Health interventions preparing updated information on the situation, problems and proposed solutions.

The other mechanism of coordination was the “Technical Commission” meetings chaired by National Director of Public Health in which I act as secretariat, having among my responsibilities to prepare the agenda and minutes of technical meetings. In these meetings are discussed and coordinated the solution of operational issues.

The coordination with WHO was daily and fluent, through the Incident Manager Mechanism and WHO Representative in Angola. I participated in coordination meetings and prepared several proposals for WHO technical and financial support of activities, which were approved and implemented in the field of surveillance, vaccination and laboratory

To improve the integration of social mobilization in vaccination activities were maintained coordination meetings with Ministry of Health Communication officers, UNICEF, WHO, national and also with International Red Cross members who arrived in Luanda to support the intervention of the subsidiary in Angola. Red Cross contributed to control the epidemic of yellow fever through improved social mobilization.

Was elaborated weekly summary report for UNDP and shared with key partners

3.3 Continuous needs assessment

At the beginning of the consultancy it was developed exhaustive need assessment for human, material and financial resources for vaccination against yellow fever for each of the 17 provinces still unvaccinated. These estimates were prepared considering available resources in every level. The Minister of Health sent to Provincial Governors in order to be prepared for possible yellow fever outbreak expansion that affect their province.

The needs assessment was a critical task performed continuously utilizing the information provided by consultants, provincial authorities, field visits and supervision reports. The needs assessment allowed to have feedback for better planning, introduce adjustments and for improve the deployment of technical assistant according perceived needs or particularities of the districts under emergency.

In the area of human resources was contributed to cover the gaps identifying professionals of other health programmes and including them into field missions. In this manner were included Cuban doctors working at central level and Angolan graduates on field epidemiology many of them working out of NDPH. In logistic was identified gaps in cold chain, cotton and registration forms, trying to mobilize or finding suitable substitutes of resources needed. In this order the UNDP donate 732 vaccine carriers, 104 long range cold boxes 27,864 ice packs and 5,808 cotton rolls. These equipment and supplies cover critical gaps for yellow fever immunization campaigns, securing proper equipment for storage, vaccine management, and contribute for safe injections with the cotton rolls. The Ministry of Health recognizes the contribution during the Response Commission Meeting.

It was performed gaps analysis of in the implementation of the final phase of Luanda downtown vaccination campaign and discussed the findings with the authorities and technicians of Provincial Directorate of Health and WHO consultants. The main problems identified for the low performance were the fatigued staff due to a campaign of very long
duration (more than one month), the fact that only 38% of the vaccination team planned were in the field and the teams were reduced in number and did not have mobilizers of the same community. Using these information and areas of distribution of YF cases the provincial team organized mop up vaccination given vaccinated around 170,000 people in 5 days.

The tracking of the status of implementation the actions to overcome the gaps it was introduced in the weekly technical meeting and performed in a participatory. In these meetings were discussed every one of the interventions of the plan namely; surveillance, laboratory, vaccination, vector control (implemented by a Cuban company contracted by the Ministry of Health), clinical case management, social communication and logistics.

It was also contributed in the identification of technical gaps in epidemiological investigation of suspected cases in this order, the form of case investigation was adjusted and improved. The gaps in performance of the national officers who travel to provinces was analyzed and adjusted the training and terms of reference. A check list for verify the gaps in preparation of activities were introduced and utilized.

4. Vulnerabilities that determine the yellow fever outbreak and it spread

Angola is a developing country that is subject to occurrence of various epidemics that compromise health and life of large segments of the population and posed risks of international spread for its central location on the African continent. In this way suffered the epidemic of Marburg that affected the Province of Uige in 2005, causing more than 400 cases and 300 deaths, the cholera epidemic that in 2006, compromise 11 of the 18 provinces of Angola, causing more than 35,000 cases and 1,200 reported dead’s.

The current Angolan epidemic of yellow fever is one of the largest epidemics of urban yellow fever in Africa, appeared in Angola after 27 years, with greater severity and extent as in 1988 when only 33 cases were reported.

The occurrence and spread of the epidemic of urban yellow fever in Angola, was the result of a set of vulnerabilities in the country including environment and population characteristics, health system development, economy and external factors, which concurred to determine the course and duration of the epidemic.

4.1 Environmental and population behaviour vulnerabilities

As well as 41 tropical countries of Central and West Africa, Angola is considered yellow fever endemic because is vulnerable to cyclic epizootic outbreaks of sylvatic yellow fever that affecting monkeys and occasionally transmitted to humans that enter into their habitats, through bites of mosquitos of several jungle species. Possibly in the course of the years occur not detected, sylvatic yellow fever cases in the country because the lack of suspicion by local clinicians and the difficulty of diagnoses, so surely possible cases were diagnosed as malaria, the most common acute febrile endemic disease.

During recent epidemiological investigations performed in Angola, were identified cases of presumably sylvatic yellow fever in peasants of Negage, Quipungo and Ebo districts. This means that any case of these municipalities or others that travel to Luanda for health
assistance or business, could be behind the origin of the urban yellow fever outbreak detected in Luanda Province at the end of 2015.

In this way, provably was initiated one of the largest African urban yellow fever outbreak, when infected people introduced the virus in the densely populated capital City of Luanda that has around 6.9 million inhabitants in continuous growing by internal and external migration, and with large numbers of non-immune people accumulated since the last outbreak occurred more than 27 years ago and because the yellow fever routine immunization coverage in children under one was only around 60% in the last 15 years that vaccine was available.

The mosquito *Aedes aegypti*, vector of urban yellow fever is extensively distributed in Angola and at the beginning of the epidemic had high levels of infestation of households in the districts of Luanda Province (57% - 90% of Breteau index) and other districts of the County. The great mobility of the population and intense communication that maintain Luanda City with other provinces and countries by road, air and see characterized Luanda and explain the rapid spread of disease to other provinces and internationally.

The recent weather changes observed in the Country, particularly in the Province of Luanda, with increased rainfall intensity and frequency, added with high temperature and humidity during December 2015 and the first quarter of 2016 create favorable conditions for growth breeding sites by backwaters in streets and existence of multiple containers and discarded car tires abandoned by poor sanitation, increase the level of mosquito *Aedes aegypti* infestation in the country. The other factor that facilitate the *Aedes aegypti* presence and their high density is the habit of the population of storing water in various containers many of them uncovered due to lack of intra-home drinking water functional system. All these circumstances caused increase in potential breeding grounds for mosquitoes and the possibility of wider transmission of the yellow fever and other mosquito borne diseases.

### 4.2 Health system vulnerabilities

However in the last decade, the GoA made significant efforts for the rehabilitation, building health infrastructure, staffing, installation of medical equipment and trained human resources in health sciences, the public health services continue to be scarce and unevenly distributed.

The Health Development Plan of the Ministry of Health estimates that about 20 to 30% of the population does not have geographic access to basic health services. The public health system suffers quantitative and qualitative limitations in human resources at all levels, also observed unequal distribution of them. One characteristic of the Angolan public health system is the largest shortage of doctors attaining only 0.7 doctors per 10.00 inhabitants according to the 2015 statistical report of the Ministry of Health.

The National Epidemiological Surveillance System has specific technicians at each level of health system to perform surveillance activities. However it has constraints for active surveillance or for performing investigations due to lack of means of transport requiring support from other organizations or institutions to travel to other locations out their
capital, reason why it is not usually possible to perform routinely effective surveillance outside the provincial and municipal headquarters.

The scarce human resources in health facilities, limit also the capacity to organize mass response vaccination in short periods of time in order to protect population at immediate risk of yellow fever in many districts of the Country. To try to cover these gaps, the MoH mobilize technicians from nurse’s schools, armed forces and the police that played a leading role in vaccination against yellow fever particularly in Luanda.

The health facility network in the Province of Luanda, is insufficient to meet the needs of the population especially of the new urban settlements of rapid population growth located on the slumps of the municipalities of Viana, Cacuaco and Belas that have very few health services and supporting continued immigration. Health services in the provinces are thronged by large routine demand of the population. Yellow fever epidemic virtually collapse services of referral hospitals in affected provinces, situation that contributed overlaying with malaria outbreaks.

The lack of essential drugs and reagents for rapid tests that allow a differential diagnosis, increases the risk of dying from the disease. On the other hand there are many people who for cultural or economic reasons are attended by traditional healers and do not demand services Western medicine or do very late.

The lack capacity of national laboratory to confirm yellow fever suspected cases, at the beginning of the epidemic contributes too to delay and eective response. The development of national capacity to confirm cases of yellow fever from blood samples of suspected cases take about three months to laboratory of the National Institute of Public Health of Angola, having intensive external support from WHO, CDC and Dakar Laboratory.

Another vulnerability in the containment and prevention of exportation of cases outside the country are the deficiencies and limitations in controlling international vaccination card against yellow fever to people leaving the country. At border health personnel and Border/Migration Police prioritize the control of valid vaccination card at arrival of passengers and less during the departure, this latter situation involves risk to export cases.

On the other hand it was informed that in many situations this activity was not done systematically particularly on night flights. The control of international yellow fever vaccination card at land borders with high local population movement it is impracticable when no vaccine is available to vaccinate the entire border area population or by the existence of many unofficial passageways in the extensive land and sea border of the country

4.3 Economic and social vulnerabilities

The context of Angolan national economy in which stormed the yellow-fever outbreak was the great restrictions of financial resources at government level and depreciation of more than 70% of the value of the national currency. Angola's economy is based primarily on oil revenues, which in 2013 were estimated at 80% of GDP. During 2014 and 2015, the Angolan economy slowed due to the dramatic fall in international oil prices. Financial constraints in 2016 continued to be very large in all sectors. Since the Ministry of Health
does not have a budget line for emergency response, it was not possible mobilize fast financial resources.

The crisis affect deeply the health sector in which prevailed severe financial restrictions, not having been possible to mobilize government funds to cover essential operating expenses for the implementation of vaccination campaigns during the first 3 months of the year. Just in the month of April the government paid 50% of the costs of 4 from 6 vaccine shipments received from ICG, and at the end of the month had transferred 7.9 million of operating funds from central level to the 166 districts of the country. In May the Government with resources of a loan of World Bank loan reimburse 5 million Dollars to ICG to cover 50% of costs of vaccine and injection supplies. The other 50% was covered by GAVI Alliance.

The effect of the financial constraints was very critical and reduced motivation and participation of front line health staff who did not have snacks and had very few cars to implement vaccination campaigns at the beginning of epidemic delaying the progress of vaccinations em Luanda. The lack of operational resources also caused the defection of vector control brigades. With the funds transferred by the central government and locally mobilized resources after were implemented in 73 districts of the country successive vaccination campaigns with good results.

The impact of the crisis at the household level with respect to vaccination was make evident in surveys implemented in poor suburbs. In this places where mentioned among other causes of non-vaccination great distances to vaccination posts and high costs of transport to go there. The crisis also affected the opportunity to demand medical care, causing delays of attention with increasing severity of clinical symptoms and reduce the chances of survival.

One of the critical factors increase social vulnerability of individuals and communities to emergencies is the level of general education and information, particularly in societies with strong traditional influence that have the fear and distrust of interventions as defense mechanisms. In Angola, there are important segments of the poor population that had little or none access to school or drop it before completing their basic education. It is estimated that about 30% of the population is functionally illiterate which makes it more vulnerable and limits the ability to participate effectively in reducing risks or demand the vaccine for the prevention of disease.

4.4 External vulnerabilities that influence the control of outbreak

The global production of yellow fever vaccine for public health programs is insufficient because is limited to 4 producing laboratories: Chumakov in Russia, Sanofi Pasteur in France, Sanofi Dakar in Senegal and Fiocruz in Brazil with annual production as a whole barely about 70-80 million doses, enough to meet the needs of routine vaccination and insufficient to deal with big urban yellow fever outbreak of and for extensive prevention campaigns.

The contingency stock maintained by Independent Global Strategic Response Coordination Group (ICG) stockpiled 6 million doses, which proved to be insufficient to respond to outbreaks of Angola and other developments growing in Democratic Republic of Congo and other countries. The announced increase in global production of vaccine
was not effective during the first 8 months of the year which create a great constraint for control of outbreak and implement preemptive vaccination.

In order to rationalize the use of the limited available yellow fever vaccine, the ICG provide vaccine once when local transmission where proven. Over this scope the authorized vaccination were only at the district level area, which in most of the cases is insufficient particularly in densely urban contexts like the case of Luanda where the city is divided in several districts. The decision to implement gradually the vaccination of Luanda contributed to rapid expansion of outbreak inside and outside the province.

This epidemiological rigid and restrictive approach is also inadequate in other geographic contexts, because the delay of 3 to 6 weeks that occurs in practice since the detection of the outbreak, their notification, confirmation, documentation, the length of time until receive the vaccine and the period to start of vaccination response, allowing the outbreak spreads more widely to other areas, consequently control efforts will always be behind the epidemic. Limitations on access to vaccines and rigid rules and mechanisms for obtaining the vaccine including the impossibility to have an contingency stock, had a restrictive role for a more effective customized approach to prevent the control and spread of the epidemic. At the end of July 2016 the ICG has eased its position, allowing the preemptive vaccination of populations of bordering districts with DR-Congo, Congo and Namibia and other districts considered at high-risk without local transmission demonstration.

5. Epidemiological situation

The first cases of the current urban yellow fever outbreak, were detected in Viana District of Luanda Province at the end of December 2015. Subsequently the progression of the Yellow Fever epidemic was very fast; the retrospective analysis of the data showed that in January 2016, 7 of the 12 Districts of Luanda had confirmed cases, and until the end of February all districts of Luanda except the rural districts of Icole e Bengo and Quissama had confirmed cases, as well as other 10 provinces of the country. Until May were confirmed cases of Yellow Fever in 78 districts (47%of Districts) of 15 provinces of the Country.

In the period from December 30, 2015 to October 20, 2016 were reported by the 18 provinces of the Country, 4,306 suspected cases of Yellow Fever including 376 deaths. Of these suspected cases after final classification were confirmed by laboratory 884 cases from 80 Districts of 16 Provinces of the country. They were classified as probable, 710 cases and discarded as Yellow fever 2,712 cases. Two probable YF cases currently are under investigation. Only the provinces of Moxico and Lunda Sul no confirmed cases of Yellow Fever.

Considering only the confirmed cases, the most affected provinces were: Luanda with 488 cases (55% of cases), Huambo 128 cases (15%) and Benguela 117 cases (12%). The most affected age group was 10 to 19 years of age that concentrated 44.3% of the confirmed cases. The Yellow Fever affected 2.3 times more men than women. The case fatality rate registered among confirmed cases was 13.6%.

The evolution of the epidemic in the province of Luanda has shown rapid growth in the number of cases reaching the peak between February and March 2016, then descend gradually there have been no more cases confirmed after May 27, 2016. The pattern of
the epidemic in the other provinces was slow increase the number of cases achieving the highest peak in April and May and then gradually down with no more cases notified countrywide after June 23, 2016.

Epidemiological surveillance of suspected cases are maintained in all the country, enhanced by active search in health units and community linked to the acute flaccid paralysis active surveillance activities that have logistical and communication facilities. There has been observed a reduction in the number of suspected cases reported at central level after the second half of June (from an average of 120 cases per week reported in the period of greatest incidence of the disease for an average of 39 cases in the last 4 weeks).

6. National Plan of response to Yellow Fever Outbreak and Results

6.1 National Response Plan

The Minister of Health with support of partners prepared a National Response Plan to Epidemic of yellow fever at the beginning of the epidemic. This Plan has been updated in two opportunities. The objective of the plan was to stop the transmission of yellow fever virus in Angola, in order to mitigate the negative impact on public health and the international spread of disease. The National Response Plan established five components or pillars of action: epidemiological surveillance/laboratory, mass vaccination, integrated vector control, clinical case management and communication and social mobilization. Logistics constituted a transverse component that supports all pillars. The core of the strategy to interrupt transmission of Yellow Fever in Angola was the mass vaccination of the entire national population from 6 months old, supported with the other pillars synergistically.

6.2 Organization of the Response

The National Response Commission to the Yellow Fever outbreak was organized at the beginning of the epidemic to create conditions for coordinated interagency response, with common strategies and technical guidelines, under the leadership of the Minister of Health. The Commission was supported by representatives of the National Civil Protection Commission, Armed Forces, Police Health Services, Ministry of Communications and representatives of partner organizations such as WHO, UNICEF, UNDP, technicians from the US Center of Disease Control and Prevention (CDC), Medecins sans Frontier, Red Cross, besides the MINSA technicians in charge of the 5 pillars of the response strategy and CECOMA in charge of Logistic. Commission meetings were important to recognize the problems, possible solutions and to provide guidance and demand specific task to technical groups. The international technical cooperation including WHO, UNICEF, CDC, GOARN and NGOs were coordinated by WHO through a mechanism called Incident Manager. The UNDP support directly the National Directorate of Public health with a consultant positioned in the MoH.

The UNDP support in response to the outbreak was in the overall management of the epidemic with the participation of Representative of the United Nations in the National Response Commission. The direct support to the National Directorate of Public Health was though a consultant who works in the MoH supporting the coordination the subcommittees, the Provincial Health Directors of the affected provinces, as well as in strategic planning and monitoring of key activities. UNDP support also part of the logistic
for epidemic control, purchasing of additional cold chain equipment, vaccination material and given per diem for field supervision. OCHA consultant support field activities in the border with DR-Congo for two months.

Provincial Response Commissions were coordinated by the Provincial Governors, they functioned only in the most affected provinces with varying degrees of involvement of members. The organizational functional structure of the provincial commissions were similar to the national but with available Partners and technicians for every pillar. Some municipalities in the affected provinces structured Response Commissions coordinated by Municipal Administrators.

6.3 Epidemiological surveillance and laboratory

In the area of epidemiological surveillance, the country has a system of mandatory notification of epidemic prone diseases (including yellow fever) and diseases of national importance. The system, establish passive weekly reporting of public and private health services. This activity is monitored by surveillance technicians of municipal, provincial and national levels. The system has limitations of integrity and timeliness of notifications. In parallel maintains an active system of surveillance with periodic visits to health facilities and community focal points in the context of the Polio Eradication Initiative. Case to case epidemiological surveillance of yellow fever was inserted into this system using all available resources reinforced by WHO, CDC and GOARN technical support for field missions, establishment and management of databases, information analysis, publication and dissemination of daily and weekly epidemiological bulletins. Technical assistance allowed better knowledge of epidemiological situation and cover the gaps of the system.

The epidemiological surveillance was the critical element to guide epidemic control measures. To timely detect cases of YF and document local transmission was necessary to investigate every suspected cases and take blood samples, for subsequent laboratory confirmation. The laboratory of the National Institute of Public Health is the reference laboratory of the country and integral part of national epidemiological surveillance system, has adequate infrastructure and received significant equipment during the outbreak of Marburg, Influenza A Pandemic, measles surveillance and environmental monitoring of Polio Virus.

The NIPH laboratory has small qualified technical staff that never processed samples of suspected cases of yellow fever before the current epidemic, because the complexity of confirmatory tests. During the first months of the epidemic was developed the national capacity to process blood samples of suspected cases of yellow fever. This effort required intensive process of in-service training, definition of protocols and algorithms and provision of reagents done by support of CDC, Laboratory Pasteur Dakar and WHO lab technicians.

The development of the Laboratory YF confirmatory capacity of the National Institute of Public Health to process tests to confirm the diagnosis of yellow fever was the turning point in response to the epidemic. This has reduced the delay from 7-30 days registered by WHO Dakar Reference Laboratory for 1-2 days by the laboratory of the NIPH of the MoH in this way was prioritized better the districts to vaccinate and was possible to know in “real time” the evolution of disease transmission. On other hand this improvement facilitated the confirmation of local transmission of YF in 45 of 166 Districts of 13 provinces of the country.
Relating of technical assistance, multiple the epidemiologists and date managers of WHO, CDC, and GOARN support at central level of MoH the updating and analyses of epidemiological and laboratory data, production of bulletins and technical reports and to perform many field missions to investigate suspected cases, outbreaks, suspected local transmission and epidemiological situation in silent districts. The laboratory technicians of Dakar, CDC and WHO train in service to MoH lab technicians.

6.4 Yellow Fever Mass Vaccination

The Ministry of Health of Angola, has extensive experience organizing vaccination campaigns against Polio (oral vaccine), with broad community involvement and also in the organization of Measles National Campaigns (injectable vaccine) conducted by health personnel with community participation. In this area there are human resources trained with large experience in vaccination and cold chain management at central, provincial and municipal levels. The cold chain of provincial and many municipal levels has insufficient storage capacity and lack maintenance in several places. The implementation of yellow fever emergency campaigns there are much more complex, because it covers 5 times more population than previous campaigns in a very short period. The management of large volumes of vaccine, cold chain, injection supplies and the proper immunization waste disposal, were supported by WHO logisticians.

The mass vaccination against yellow fever was the main intervention to protect the Angolan population and stop the transmission of this disease. The overall MoH vaccination strategy was to gradually vaccinate the whole country according to priorities established by risk criteria. The first priority were the municipalities with proven local transmission of yellow fever, the second priority border municipalities with neighbouring countries and municipalities with imported cases with large urban population and the third priority other municipalities. The countrywide vaccination was not possible because the vaccine shortage on the world market, which is only supplied by 4 laboratories, whose production is barely sufficient for routine vaccination and for global stock contingency pile.

The police of ICG was to authorize vaccine only for districts with yellow fever local transmission proven and not for preventive campaigns. One consequence of this policy was that always be behind the epidemic and does not have a national contingency stock pile to allow immediate reaction to new outbreak in the provinces. These restriction were a major constraint to control the epidemic and protection of the national population. In late July 2016, the ICG change its position, allowing preventive vaccination of districts bordering DR-Congo and others high risk districts.

The operational strategy was the vaccination by concentration in health services, outreach vaccination teams in neighbourhoods and mobile teams to vaccinate rural villages. Each vaccination team consisted of vaccinator’s vaccine preparers, registers and mobilizers. The number of members of each team varied from 6 to 12 people. In densely populated areas they was assembled 3 to 10 vaccination teams together to optimize performance, facilitate logistics and supervision.

The vaccination campaigns of the population began in the District of Viana on February 2nd, 2016 seven weeks after the date of onset of index yellow fever case. The approach to outbreak control was to vaccinate district by district not all districts in simultaneous that
it would have been desirable to accelerate interruption of YF transmission. This situation occurred in great part because the vaccine provided by the ICG arrives in 5 tranches between February 2\textsuperscript{nd} to March 26\textsuperscript{th}, 2016, which not allow synchronized vaccination in all districts of Luanda Province, or the immediate extension of the vaccination campaign to other provinces already affected.

On other hand the Luanda Province campaign, progressed to slow. The Viana District finalize the vaccination campaign in near to 30 days against the 10 to 15 days recommended by WHO. This delay was due to scarce health technicians involved in the vaccination and insufficient logistical support to attend the populous district of Viana (1.6 million inhabitants). The vaccination of the other peripheral districts of Luanda run better, but was observed large deferral to vaccinate of 6 districts in the downtown of the City, because of delay in vaccine arrival.

Using the lessons learned in the Luanda campaign, better guides for micro planning, organization and logistic were prepared, communication and social mobilization improved linking it to the field activities, were improved also technical assistance, central level and Luanda technicians were deployed to help in the organization and implementation of campaigns in the districts out of Luanda. The districts achieved $\geq 80\%$ of coverage between 8 to 15 days of implementation.

Since February 2\textsuperscript{nd}, 2016 to October 22\textsuperscript{th} 2016, were conducted Six Phases of yellow fever vaccination campaigns. During the first phase were vaccinated the 12 districts of Luanda Province and in the other 5 phases 73 Districts of 13 Provinces. The grouping the districts in every phase depends of the confirmation local transmission and the arrival of vaccine. The average administrative coverage in the districts covered was $90\%$. In 54 of them the coverage was higher than $80\%$ which allowed to stop yellow fever virus transmission. Currently is ongoing vaccination campaigns in 12 districts that include 3 new provinces, totalling 85 districts of 16 provinces. Still remain 82 districts of the Country with their population unvaccinated. The target population of these district is 5.8 million people.

The total number of people vaccinated in the country to date was 17,294,994 persons, reaching 67\% of the national target population estimated at 25,955,620 people. In relation to areas covered have been already protected populations of capitals of 16 provinces, including 12 districts of Luanda. Nineteen districts bordering Democratic Republic of Congo, 5 districts bordering with Namibia Republic and other 29 districts were even now vaccinated.

To accomplish this enormous task participated directly about 45,400 people for periods between 10 to 18 days among health technicians from MoH, FAA, National Police, NGOs and community volunteers. The engagement and support of the Provincial Governments, Municipal Administrations and communal and traditional authorities (Sobas), volunteers from churches, local grassroots organizations and some business owners, was crucial to the success of vaccination. Supervision was provided by the technical team of the National Directorate of Public Health and partners.

To implement the vaccination campaigns were mobilized 20,014,570 doses of vaccine against yellow fever, injection supplies and cold chain equipment. The vaccine mobilized allowed the implementation of campaign and to maintain routine immunization of
children under one years old. The overall estimated YF wastage rate during campaigns was estimated in 8.1% of doses.

The objective of the Angolan Ministry of Health is to complete the protection of Angola people against yellow fever implementing preentive vaccination of 5.8 million people living in 82 remaining districts. The strategy is to vaccinate them in three phases conducted until end of February 2017. The additional needs of vaccine required was estimated in 6.5 million doses. Is pending the ICG approval for GoA purchase the vaccine though UNICEF supply system.

The main contribution of WHO for the implementation of yellow fever campaigns was in the area of logistic of vaccine, injection supplies and cars for supervision and transport of vaccination teams. Many logisticians were deployed at provincial levels to guarantee the quality of vaccine management and waste disposal. At provincial level the WHO surveillance antennas facilitate them process of microplanning and the daily notification of population vaccinated and vaccine stock control.

6.5 Integrated vector control

In the field of vector control Cuban Cooperation in contract with the MoH through the company ANTEX, support Aedes aegypti control conducting training of trainers, supervising in the field the use of bio-larvicides and spraying with pyrethroid insecticides at small-scale focusing on the neighbourhoods most affected od Luanda and Huambo.

The main task realized was to update the geographic distribution and infestation index of Aedes aegypti in the country jointly WHO entomologists. The confirmation of presence and density of Aedes Aegypti mosquito in districts with probable indigenous cases of yellow fever was critical to confirm the local transmission of the disease and was conducted in 45 municipalities and over 600 sites of capture of larvae or adult mosquitoes.

6.6 Case management

The management of suspected cases of yellow fever was a big challenge because the network of public health services was already burdened by the regular influx of patients and because during the outbreak of yellow fever occurred in parallel outbreak of malaria, for this reasons reference hospitals were overloaded of patients overpassing its installed capacity. On other hand due to the economic crisis, the supply of basic medicines and reagents for differential diagnosis of acute febrile illnesses was not suitable having lack of them in many hospitals and health services in the primary network.

To improve the quality of care of suspected cases of yellow fever the Ministry of Health developed a practical guide containing a protocol dealing the cases according to severity of the disease. This guide was revised with contributions of physicians of major referral hospitals of the country that handled the cases of yellow fever referred by primary health network, participated also specialists of private clinics of Luanda and Benguela. The new revised guide and improved care protocol will be printed for distribution in the network of health services for improve the overall care of fever and bleeding disorders.

In order to upgrade the care of yellow fever suspected cases Ministry of Health conducted numerous training workshops for clinical staff, having established referral hospitals for acute care and it was developed a practical manual of case management widely
distributed. MSF teams supported in the organization and operation of treatment units of severe cases, donating drugs and reagents in Luanda, Huambo and Benguela. The NGO Medicos del Mundo support clinical training at primary health network.

6.7 Social Communication and Community Participation

The participation of the different strata of the Angolan society in the response to the epidemic of yellow fever, was broad and was marked by the fear of disease and in many cases by suspicion of adverse effects of the vaccine. There were no community efforts to improve sanitation and reduction of Aedes aegypti mosquito breeding sites.

The participation of community organizations for vaccination activities was promoted by government authorities and health personnel who encouraged traditional and religious leaders, neighborhood responsible and some private entrepreneurs to contribute in organizing and conducting mass vaccination activities.

In Luanda, during the initial phase of the epidemic and partly because vaccination was not offered in simultaneous in all districts of the city, the population demand of vaccine was massive, imperative and anxious forcing to seek police involvement for safeguard all vaccination posts. Contrary vaccination of downtown districts of Luanda that left for the end, the demand was very low, partly influenced by negative rumors that grew about the vaccine.

With the experience of Luanda, communication and social mobilization activities in the other provinces were improved by strengthening interpersonal communication of community networks at municipalities, communes and villages. Many of the selected municipalities have large rural areas where the key actors were the sobas and seculos (traditional authorities) those who supported the concentration of village’s population in agreed vaccination places. In municipalities bordering the Democratic Republic of Congo in particular in the areas of diamond mining without community organization, the mobilization of population was difficult.

Risk communication at the beginning of the epidemic in Luanda was insufficient or absent and did not provide the information necessary to people to avoid panic or modify misconceptions regarding yellow fever mode of transmission and prevention. It was notorious lack of information on vaccination in part due to insufficient amount of vaccine available and the fear of creating unmet demand.

Some isolated people of districts and some small religious sects rejected vaccination alleging religious reasons or fear that the vaccine causes death, having been in general overcome the rejection with the support of local authorities. Local radio stations were important for informing the public in local languages, helping to clarify doubts and misconceptions of the population. Television played a minor role to disseminate information spots. Because vaccination campaigns were not carried out simultaneously but in groups of districts scattered in the Country, television was not an appropriate mean to call for vaccination in urban contexts.

UNICEF, Red Cross and WHO social communication specialists work together technical and Health promotion teams of MoH supporting the preparation of promotional and
educative material, production of radio and TV spots and programmes, and supervising in the field social mobilization activities.

7. Lesson learned

7.1 Methodology

The methodology used to capture the lessons learned was mainly post-facto and in lesser degree integrated in the management process of the YF epidemic outbreak response, due to rapid development of the facts and work overload. The lesson learned are based on the observation of processes in the field, interviews with the participants, reading reports and participation em monitoring and evaluation meetings.

The primary audience for which they were identified lessons learned are the authorities of the Ministry of Health with decision-making and intended to consider aspects of strategy and methodology in emergency situations. To contextualize the main lessons learned the general context of the country is presented and after brief descriptions of each component for which the lesson learned was selected.

7.2 Lessons learned on the organization of the response

The routine organizational structure of health sector and its resources are not sufficiently efficient or capable of rapid response capacity to face an epidemic, requiring functional organizational structure pre-established for rapid response in epidemics or other emergencies, with defined protocols of action, logistical capacity and easy mobilization of financial resources. The lack of this structure impact negatively to rapid and effective response to the epidemic/emergencies.

The rapid establishment of response committee to the yellow fever outbreak was very helpful for coordinate and integrate activities and actors under a common orientation, avoiding duplication of efforts, facilitating the mobilization of resources, sharing information and monitoring of key activities. Ideally should be established at the three levels of the government administration at the beginning of any outbreak of medium or large size.

The establishment of subcommittees divide the work and operationalize interventions, giving general responsibilities, however, due to the complexity of some components such as surveillance, immunization or social communication, detailed internal accountability structure is required to optimize the performance of human resources.

Human resources in the public health system are insufficient to implement themselves the actions in response to outbreaks of large magnitude or other catastrophes in a timely and effective manner, therefore an isolated sectoral action is not effective, requiring the concerted mobilization of other sectors with rapid response capacity such as the armed forces and national police and other sector resources.

7.3 Lesson Learned on Yellow Fever Outbreak Control Strategy

The long delay to start the mass vaccination has great consequences in human lives and geometric rising in costs of response due to the increase the number of cases, geographic
dispersion, and consequently the needs of vaccine, means for sick care, logistic and other costs of response.

The response to urban yellow fever outbreak, particularly in overcrowded urban areas, with the presence of high density of *Aedes aegypti* cannot be restricted to small area and not to be conducted in phases, but should cover simultaneously throughout the urban area affected. The duration of the campaign should be less than 2 weeks.

In densely populated areas, the vaccination in few places with numerous well-organized vaccination teams facilitates logistics and supervision, improving the performance and productivity, but has the problem of leave pockets of unvaccinated population in peripheral distant areas, for this reason is necessary to complement with vaccination posts strategically placed to ensure not leaving large gaps.

Mass vaccination of large populations is highly stressful for health personnel and many of them will not be able to vaccinate for longer 7-10 days, consequently it should have replacement staff to cover possible absences after a week of vaccination campaigns.

The missing of compressive and consistent vector control interventions in highly populated area with high levels of *Aedes Aegypti* reduce the speed and effectiveness of control of epidemic utilizing the vaccination as isolated intervention.

### 7.4 Lessons learned in communication and community participation

The proper risk communication at the beginning of epidemic is critical to reduce panic and misconceptions, it should be done however under conditions of uncertainty because rumors and misconceptions spread quickly across the country and become the source of information being very difficult to overcome also in the educated population.

The lack of periodic official information about the course of the epidemic leads to the media to perform their own analysis, which often was wrong, increasing uncertainty and reducing the credibility of the ongoing health interventions.

Local radio stations are an essential complementary partners for implement mass interventions due to it great coverage and because allow to involve credible community members using the languages spoken locally.

Social mobilization for vaccination campaigns is most effective when mobilizers are linked to vaccination posts and provide concrete information to promote the demand of the population.

The informative generic social communication even if broadcasted by multiple means, if not accompanied and supported with specific field communication or activities no value added to improve the demand or participation of people.

The engagement of Provincial Governors and Municipal administrators was critical for the success of the campaigns, having been observed better results in the municipalities that had a broad involvement of them.

### 7.5 Lesson learned in technical assistance

A big epidemic cause serious disturbances in the functioning of communities including the health sector and in general is beyond the capacities of resolution of health system
alone, requiring multisector and multidisciplinary skills and external support under centralized coordination.

International technical assistance during the Angola yellow fever outbreak cover a need was reasonably effective, timely and consistent, that allowed to strengthen national capacities to respond to the outbreak of yellow fever and beyond.

The technical support recruitment must obey to local analysis of critical areas together government authorities in order to define the profile including reasonable domain of local language, practical skills to enter immediately into action, information of specific organizational structure in which will be inserted.

The incident manager system was very useful to coordinate the actions of multiple consultants who are constantly renewed, which entails a specific logistics and individual monitoring would not be possible done from the Ministry of Health.

Integration and coordination of Incident Manager System team of external consultants, with the structure and technical counterpart of the Ministry of Health was facilitated by the consultant UNDP working in direct continuous support to the National Directorate of Public Health, which avoided an isolated and independent action of the external equipment.

The epidemic or emergencies are an opportunity to train national technical staff, taken in advantage the experienced high level consultants that arrived to the country. In this order is necessary to organize mixed national/international teams for all missions and relevant tasks as possible.

8. Conclusions

Urban Yellow Fever epidemic detected in Luanda province at the end of December 2015, which was spread to 16 of 18 provinces of the Country, affecting the health and lives of thousands of people, now is under control, but there is still the risk of resurgence due to the increased density of the Aedes aegypti mosquito during the rainy season and the existence of around 7 million susceptible people in 82 municipalities no yet vaccinated.

The wide dispersion of the mosquito Aedes aegypti in Angola constitutes a permanent threat because this mosquito is also the vector of other diseases like Dengue, Chikungunya, Zika virus, West Nile fever for which there are no vaccines.

9. Recommendations

- Maintain active epidemiological surveillance of Yellow Fever at public and private health facilities and communities.

- Mobilize 6.5 million additional doses of vaccine against Yellow Fever vaccination and corresponding injection supplies to complete the vaccination of the target population of the 82 municipalities still unvaccinated.

- Strengthen countrywide sustainable routine immunization against yellow fever integrated by other antigens in children under one year’s old.
- Strengthen the accomplishment of the Minister of Health Circular on the control of YF international vaccination card at all border entry points; land, sea as well as international airports, in coordination with the border police.

- Implement a long-term sustainable plan for the Aedes aegypti mosquito control with broad community participation.

- In coordination with Provincial Governments and Municipal Administrations strengthen hygiene and sanitation, avoiding waste accumulation in the neighborhoods and different locations of the country.

10. **Financial Status**

   **Implementation rate (2) / (1) X 100:** 100 % in 2016

   Source: Project Number 00084416 / Output 00092430 / Activity 6

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