Situation assessment - 20 October 2014 - The lines on the tabular situation reports, sent to WHO headquarters each day by its country office in Nigeria, have now been full of zeros for 42 days.

WHO officially declares that Nigeria is now free of Ebola virus transmission.

This is a spectacular success story that shows that Ebola can be contained. The story of how Nigeria ended what many believed to be potentially the most explosive Ebola outbreak imaginable is worth telling in detail.

Such a story can help the many other developing countries that are deeply worried by the prospect of an imported Ebola case and eager to improve their preparedness plans. Many wealthy countries, with outstanding health systems, may have something to learn as well.

The complete story also illustrates how Nigeria has come so close to the successful interruption of wild poliovirus transmission from its vast and densely-populated territory.

As sometimes fortunately happens in public health, one success breeds others when lessons and best practices are collected and applied.

Earlier this year, WHO confirmed that Nigeria had eradicated guinea-worm disease – another spectacular success story. When the eradication initiative was launched, Nigeria was the epicentre of this disease, with more than 650 000 cases reported each year.

## A shocked public health community – worldwide

When laboratory confirmation of the country's first Ebola case, in Lagos, was announced on 23 July, the news rocked public health communities all around the world.

Nigeria is Africa's most populous country and its newest economic powerhouse. For a disease outbreak, it is also a powder keg. The number of people living in Lagos – around 21 million – is almost as large as the populations of Guinea, Liberia and Sierra Leone combined.

Lagos, Africa's largest city, is also characterized by a large population living in crowded and unsanitary conditions in many slums.

Thousands of people move in and out of Lagos every day, constantly looking for work or markets for their products in a busy metropolis with frequent gridlocks of vehicle traffic.

"How can contact tracing be done under such conditions?" This was the main concern raised at the beginning, shortly after the first confirmed case was announced.

As the United States Consul General in Nigeria, Jeffrey Hawkins, said at the time, "The last thing anyone in the world wants to hear is the 2 words, 'Ebola' and 'Lagos' in the same sentence. " As he noted, that single juxtaposition conjured up images of an "apocalyptic urban outbreak".

That never happened. With assistance from WHO, the US Centers for Disease Control and Prevention (CDC), and others, government health officials reached 100% of known contacts in Lagos and 99.8% at the second outbreak site, in Port Harcourt, Nigeria's oil hub.

Federal and State governments in Nigeria provided ample financial and material resources, as well as well-trained and experienced national staff.

Isolation wards were immediately constructed, as were designated Ebola treatment facilities, though more slowly. Vehicles and mobile phones, with specially adapted programmes, were made available to aid real-time reporting as the investigations moved forward.

Unlike the situation in Guinea, Liberia and Sierra Leone, all identified contacts were physically monitored on a daily basis for 21 days. The few contacts who attempted to escape the monitoring system were all diligently tracked, using special intervention teams, and returned to medical observation to complete the requisite monitoring period of 21 days.

## The “index” case: how it all started

The Ebola virus entered Lagos on 20 July via an infected Liberian air traveller, who died 5 days later. At the departure airport, he was visibly very ill, lying on the floor of the waiting room while awaiting the flight.

He vomited during the flight, on arrival and, yet again, in the private car that drove him to a private hospital. The protocol officer who escorted him later died of Ebola.

At the hospital, he told staff that he had malaria and denied any contact with an Ebola patient. As was learned later, his sister was a confirmed case who had died from the disease in Liberia. The traveller visited his sister while in hospital and attended her traditional funeral and burial ceremony.

As malaria is not transmitted from person to person, no staff at the hospital took protective precautions. Over the coming days, 9 doctors and nurses became infected and 4 of them died.

## The second outbreak site: Port Harcourt

The virus entered the country’s oil hub, Port Harcourt, on 1 August, when a close contact of the index case flew there seeking care from a private physician. That doctor developed symptoms on 10 August and died of Ebola on 23 August. Laboratory tests confirmed the city’s first case on 27 August.

An investigation undertaken by a team of epidemiologists from the Nigerian Centre for Disease Control (NCDC), the Nigeria Field Epidemiology and Laboratory Training Programme and the State Ministry of Health, assisted by WHO, revealed an alarming number of high-risk and very high-risk exposures for hundreds of people.

Again, all the ingredients for an explosion of new cases were in place. Dr Rui Vaz, the head of WHO's country office in Nigeria, visited Rivers State (where Port Harcourt is located) to assess the situation there. He informed the State's Governor of the potentially explosive situation and made his advice crystal clear: "All required resources must be immediately mobilized to stop this outbreak."

Fortunately, the State's Governor heeded WHO's advice and that "explosive situation did not happen.

Today, exactly 42 days (twice the maximum incubation period for Ebola virus disease) after the country's last infectious contact with a confirmed or probable case occurred, the chains of transmission have been broken.

The virus is gone – for now. The outbreak in Nigeria has been defeated.

## What accounts for this great news?

To a large extent, the answer is straightforward: the country's strong leadership and effective coordination of the response. The Nigerian response to the outbreak was greatly aided by the rapid utilization of a national public institution (NCDC) and the prompt establishment of an Emergency Operations Centre, supported by the Disease Prevention and Control Cluster within the WHO country office.

Another key asset was the country's first-rate virology laboratory affiliated with the Lagos University Teaching Hospital. That laboratory was staffed and equipped to quickly and reliably diagnose a case of Ebola virus disease, which ensured that containment measures could begin with the shortest possible delay.

In addition, high-quality contact tracing by experienced epidemiologists expedited the early detection of cases and their rapid movement to an isolation ward, thereby greatly diminishing opportunities for further transmission.

## How a highly contagious virus was stopped dead in its tracks

Dr Rui Vaz and the WHO country team of epidemiologists, clinicians, logisticians and administrators have identified a number of specific lessons that may be useful for other countries facing their first imported Ebola case or preparing for one. They have also carefully documented a large number of "best practices" for containing an Ebola outbreak quickly.

The most critical factor is leadership and engagement from the head of state and the Minister of Health. Generous allocation of government funds and their quick disbursement helped as well. Partnership with the private sector was yet another asset that brought in substantial resources to help scale up control measures that would eventually stop the Ebola virus dead in its tracks.

Health and government officials fully appreciated the importance of communication with the general public. They rallied communities to support containment measures.

House-to-house information campaigns and messages on local radio stations, in local dialects, were used to explain the level of risk, effective personal preventive measures and the actions being taken for control. On his part, the President reassured the country's vast and diversified population through appearances on nationally televised newscasts.

The full range of media opportunities was exploited – from social media to televised facts about the disease delivered by well-known "Nollywood" movie stars.

## Polio strategies "repurposed" for Ebola control

For some time now, with dedicated and enthusiastic support from President Goodluck Jonathan, Nigeria has been running one of the world's most innovative polio eradication campaigns, using the very latest satellite-based cutting-edge GPS technologies to ensure that no child misses out on polio vaccination.

The country, which passed through the high-transmission season with only 1 single case of polio detected by a finely-tuned and sensitive surveillance system, is on track to interrupt wild poliovirus transmission from its borders before the end of this year.

When the first Ebola case was confirmed in July, health officials immediately repurposed polio technologies and infrastructures to conduct Ebola case-finding and contact-tracing.

The use of cutting-edge technologies, developed with guidance from the WHO polio programme, put GPS systems to work as support for real-time contact tracing and daily mapping of links between identified chains of transmission.

This is a good public health story with an unusual twist at the end. As part of preparedness for an imported case, several advanced countries with good health systems are now studying technologies “made in Nigeria”, with WHO support, to improve their own contact tracing capacities.

The story has another very clear message, as noted by Dr Margaret Chan, the WHO Director-General. “If a country like Nigeria, hampered by serious security problems, can do this – that is, make significant progress towards interrupting polio transmission, eradicate guinea-worm disease and contain Ebola, all at the same time – any country in the world experiencing an imported case can hold onward transmission to just a handful of cases.”

World-class epidemiological detective work would eventually link every single one of the country’s 19 confirmed cases back to direct or indirect contact with that 20 July air traveller from Liberia.

In another strategy, traditional, religious and community leaders were engaged early on and played a critical role in sensitizing the public. Like many others, the strategy drew on successful experiences in the polio programme.

The awareness campaigns that worked so well to create public acceptance of polio immunization were likewise repurposed to encourage early reporting of symptoms, backed by the message that early detection and supportive care greatly increase an Ebola patient’s prospects of survival.

All of these efforts were supported by social mobilization experts from UNICEF, CDC and

Médecins sans Frontières, while the staff from the WHO Nigeria office, the Regional Office for Africa and headquarters boosted outbreak investigation, risk assessment, contact tracing and clinical care.

In the end, Nigeria confirmed a total of 19 cases, of whom 7 died and 12 survived, giving the country an enviable case fatality rate of 40% – much lower than the 70% and higher seen elsewhere.

Finally, to help maintain the confidence of citizens and foreign companies and investors alike, the government undertook the screening of all arriving and departing travellers by air and by sea in Lagos and Rivers State. The average number of travellers screened each day rose to more than 16 000.

## Vigilance remains high

Nigerian government and health officials, including staff in the WHO country office, are well aware that the country will remain vulnerable to another imported case as long as intense transmission continues in other parts of West Africa.

The surveillance system remains on guard, at a level of high alert. Moreover, the country's success, including its low fatality rate, has created another problem that calls for a high level of alert.

Many desperate people in heavily affected countries believe that Nigeria must have some especially good – maybe even "magical" – treatments to offer.

WHO's Dr Vaz and others see a real risk that patients and their families from elsewhere will come to Nigeria in their quest for first-rate, live-saving care.

Based on the experience gained from the response in the 2 affected States, the national preparedness and response plan has also been revised and refined.

This strengthened response plan further boosts confidence that Nigeria's well-oiled machinery has a good chance of working miracles again should another traveller – by land, air or sea – carry the Ebola virus across its borders again.