



**ENVIRONMENTAL SURVEILLANCE SWEEP, NIGERIA'S EXPERIENCE  
(MARCH-APRIL, 2017)**

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**ABSTRACT: Background:** Environmental Surveillance (ES) for polio is assuming a greater relevance as we move closer to a polio-free world. ES involves testing sewage, wastewater or other environmental samples for the presence of poliovirus. Environmental surveillance has been shown to confirm wild and vaccine derived polioviruses even in the absence of human case of paralysis. The resurgence of wild poliovirus (WPV) in Borno state of Nigeria in 2016 was related to insecurity; and Borno bore the most of the brunt of the Boko Haram insurgency in Nigeria. It has now been more than one and a half year since the last WPV was isolated in Borno and the pertinent question is whether poliovirus has been eliminated from Nigeria. Here, we piloted ES sweep, a one-time collection of sewage samples from ES collection sites in partially accessible and inaccessible areas in Borno state from the 15<sup>th</sup> of March to the 10<sup>th</sup> of April 2017 to determine whether poliovirus transmission is still ongoing in these areas. **Objectives:** The main objective of the environmental surveillance sweep is to ascertain whether poliovirus transmission is still ongoing in security compromised areas of Borno state. **Methods:** Using grab method, one litre of sewage sample was collected per site from 17 of the 27 Local Government Areas (LGAs) in Borno state by four sanitary technicians from the state Ministry of Environment from the 15<sup>th</sup> of March to the 10<sup>th</sup> of April 2017. Collected samples were transported in reverse cold chain to Ibadan National Polio laboratory where they were analyzed as per WHO standard operating procedure for environmental surveillance samples. A total of 47 samples were collected over the four weeks' period. **Results:** A total of 47 environmental sewage samples were collected from 47 sites in partially accessible and inaccessible areas distributed in 17 LGAs over a period of one month. A total of 35(74.5%) of the samples were negative, 6(12.8%) had Non Polio Enterovirus (NPENT) isolated and 4(8.5%) were Sabin3. We also noted that there was 1(2.1%) Non Enterovirus (NEV) and 1(2.1%) NPENT+ Sabin 3 isolates. Neither WPV nor cVDPV was isolated from the samples.

**KEYWORDS:** Environmental Surveillance, Poliovirus, Acute Flaccid Paralysis, Nigeria



## INTRODUCTION

The detection of persons with Acute Flaccid Paralysis (AFP) and testing of stool specimens from these patients in a WHO accredited polio laboratory is the surveillance standard for detection of poliovirus. As fewer WPVs are detected, the role of ES increases<sup>1</sup>. ES involves testing sewage, wastewater or other environmental samples for the presence of poliovirus. Indeed, ES has been shown to confirm wild and vaccine derived polioviruses even in the absence of human case of paralysis<sup>2-4</sup>. More than 99% of poliovirus infections are non-paralytic and therefore, not detected by AFP surveillance. ES can detect circulating polioviruses from sewage without relying on clinical presentation. Previous evidence from simulation models suggests that when the paralysis-to-infection ratio is low (<1:200), ES may be more efficient than AFP surveillance in detecting circulating poliovirus, especially in areas with high vaccination coverage with inactivated polio vaccine<sup>5</sup>. ES is usually restricted to selected populations where deficiencies in AFP surveillance are suspected and where conditions exist (e.g. low polio vaccination coverage or risk of poliovirus importation) that render the population at risk for poliovirus circulation<sup>6</sup>.

Nigeria started environmental surveillance in Kano state in 2011 following series of recommendations from the Expert Review Committee (ERC) and by the end of 2017, the country was implementing ES in 18 states and the Federal Capital Territory (FCT) in 35 LGAs and 70 collection sites<sup>7</sup>. The most recent WPV and cVDPV detected from the environment was in Kaduna state in 2014 and Borno state in 2016 respectively.

Insecurity remains a major challenge in the eradication of polio in Nigeria. In 2016, Nigeria experienced a resurgence of WPV. Four new cases were detected in inaccessible areas of Gwoza, Jere and Monguno LGAs of Borno State in July and August 2016, two years after the last case in July 2014. Circulating vaccine derived poliovirus type 2 (cVDPV2) was also detected from an environmental surveillance site in Maiduguri LGA with samples collected on 23 March 2016, and from 1 AFP case in Sokoto state. As a result, a robust emergency response plan was timely implemented with leadership and oversight by Nigerian Government and supported by partners<sup>8</sup>.

The security-challenged state of Borno bore most of the brunt of the Boko Haram insurgency in Nigeria. The security challenge has led to the killing of health workers, destruction of health facilities, and displacement of huge populations<sup>9</sup>. Although the country mounted a robust response following the 2016 polio outbreak, and it has now been more than one and a half year since the last WPV was isolated in Borno, the pertinent question is whether poliovirus has been eliminated from Nigeria. This question is difficult to answer as long as large areas in Borno are still partially or completely inaccessible.

In the light of the foregoing, the country is implementing novel strategies to indirectly obtain information from these inaccessible areas where health workers cannot go on the ground to implement polio eradication strategies.

One of the innovative methods, recommended by the ERC to the Nigeria Polio Eradication program in its session of January 2017 was to implement ES sweep in inaccessible and partially inaccessible areas of Borno state. ES sweep involves a one-time collection of sewage sample from many sites in many cities, preferably security challenged settings, around internally Displaced Persons (IDPs) camps and in cities where ES is not presently being undertaken



within a short time interval. The progressive liberation of new areas and new arrivals of populations to safer places was used as an opportunity.

## **METHODS**

### **Study Area and Population**

Borno is one of the 36 states in Nigeria and is located in the Northeastern geopolitical zone of the country. The state has a total population of 26.2 million and is sub-divided into 27 LGAs of which the main urban LGAs are Maiduguri and Jere. Borno is bordered in its western half by Yobe state, the Republic of Niger to the north, Lake Chad (and the Republic of Chad) to the northeast, and Cameroon to the east; on the south and west it borders the Nigerian states of Adamawa, Gombe, and Yobe.

### **Selection and Validation of Site**

There was initial identification of 30 sites with geo-coordinates in November 2016. In March 2017 a team set up by Borno State Emergency Operations Center (SEOC) visited the initially selected sites so as to determine if they were still viable for sewage collection. During this process only 7 of the initial 30 sites were validated. These were Kidisa (Askira-Uba LGA, Uba ward), Lawanti (Gubio LGA, Gunio 1-2 ward), Mandarari (Konduga LGA, Konduga ward), Doron Baga (Kukuwa LGA, Doro ward), Balamari (Nganzai LGA, Gajiram ward), Galdimari (Biu LGA, Galdimari ward). The same team proceeded with the identification of new sites in LGAs other than Jere and MMC especially in security challenged areas (partially accessible or inaccessible areas). At the end of the initial selection, only 25 sites were selected for specimen collection but the identification process continued with the initiation of sample collection as new areas were being liberated by the Nigerian Military. Geo-coordinates were collected for the 30 initial selected sites while for the newly selected sites, geo-coordinates were collected alongside sample collection.

### **What was considered a site:**

Flowing or stagnant water contaminated with household sewage essentially faeces in cities which are inaccessible or partially accessible or close to LGA known to have reported a WPV/cVDPC case during the 2016 outbreak or formal or informal IDP camps excluding Jere or MMC where routine surveillance is ongoing

### **Logistics**

The logistics necessary for the collection of sewage samples from the identified sites as well as the transportation of these to the Ibadan National polio laboratory was provided by WHO. This included transport cost for site identification, selection and validation, materials for sample collection and transportation and allowances for transporters.

### **Capacity Building**

Four sample collectors different from those involved in routine ES were identified from the Ministry of the Environment and trained by the SEOC. They were responsible for all the sample collection irrespective of the LGAs. The identified sites were shared amongst them and



they were asked to continue with new identification and selection as they proceed with specimen collection.

### **Specimen Collection**

The grab method was used to collect specimen from selected sites by trained personnel from the Ministry of environment. One specimen was collected per validated site. The very first sample was collected of the 15<sup>th</sup> of March 2017 and the last specimen on the 10<sup>th</sup> of April 2017. We initially planned to collect 3 to 4 samples from Tuesdays to Friday per week for four weeks, this was influenced by the availability of sites, the security situation and availability of transport and escort to and from the cities where sites were found. It was difficult to respect the planned collection frequency due to security challenges. From each site, 1 litre of sewage sample was collected, stored in an appropriate container, transported in a specimen carrier with frozen ice packs to the WHO state office. One person was designated each week to transport specimen to Ibadan National Polio laboratory. The first 33 samples were batched at the WHO state office before being sent to the lab, transported by two collectors whereas the next samples were sent on weekly basis. A total of 47 samples were collected from 47 sites distributed in 17 LGAs in Borno state.

### **Laboratory Analysis**

The laboratory was informed during the planning of the sweep and their request in terms of chest freezers to accommodate the samples were granted before onset. On arrival at the Ibadan polio lab, samples were received by lab teams and treated in the same way as routine environmental surveillance samples are analyzed as per WHO standard operating procedure for environmental surveillance samples. The final results presented in this report were shared by the Ibadan Polio lab, the only polio lab in the country with a WHO accreditation to do environmental sample testing.

### **Data Collection and Analysis**

The routine environmental surveillance data collection tool was used to document information for the sweep. The same procedure for the allocation of EPID numbers by LGA was used for the sweep except for the fact that “SW” for SWEEP was added to the EPID Code. All hard copies of forms were kept in a folder at the WHO state office. At the level of the lab, a separate Microsoft Excel sheet was used to document results for subsequent data analysis. The results were analyzed using frequency tables as per epidemiologic information, lab results and mapping of geo-coordinates.

### **Results**

A total of 47 samples were collected from 17 LGAs of the state. Of the 47 samples neither WPV nor cVDPV was detected. A total of 35(74.5%) of the samples were negative, 6(12.8%) Non Polio Enterovirus (NPENT) and 4(8.5%) Sabin3. We also noted that there was 1(2.1%) Non Enterovirus (NEV) and 1(2.1%) NPENT+ Sabin 3



## DISCUSSION

In all, 47 sewage samples were collected from 47 partially accessible or inaccessible areas from 17 LGAs and analyzed in Ibadan Polio laboratory. A total of 5 Sabin 3, 7 NPENT and 1 Non-Enterovirus were detected. No WPV or VDPV was found in the samples. The 5 LGAs with Sabin virus were Bama, Dikwa, Askira Uba, Konduga and Kwaya Kusar.

The first and last sweep samples were collected on the 15<sup>th</sup> of March 2017 and the 10<sup>th</sup> of April 2017. Sample collection started 18 days after the February SIA held from the 25<sup>th</sup> to the 28<sup>th</sup>. From January to April there has been a monthly polio campaign with the oral polio vaccine in Borno state covering the entire state with respect to accessibility. Apart from the January campaign that was done with mOPV2, the other three campaigns were done with bOPV. The March campaign was done from the 25<sup>th</sup> to the 28<sup>th</sup> (10 days after the onset of sweep sample collection) while the April campaign from the 22<sup>nd</sup> to 25<sup>th</sup> (12 days after the last sample collection). It is worth mentioning that polio campaigns in most of the LGAs usually starts 1 or 2 days before the official date with Directly Observed OPV administration.

Only one of the 14 samples collected from the 24<sup>th</sup> of March to the end of sweep sample collection had Sabin. Three samples were collected from Guzamala LGA [Mairari (2) and Guaram wards] on the 24<sup>th</sup> of March, one of which had NPENT and the others Negative, two samples collected on the 27<sup>th</sup> of March from Konduga LGA (Konduga and Mandarari wards) both negative, one sample with NPENT from Nganzai LGA (Gajiram ward) on the 30<sup>th</sup> of March, four negative samples from Ngala LGA [Gamboru A, Gamboru B and Gamboru C (2) wards] on the 30<sup>th</sup> of March, two samples from Bama LGA [Shehuri(2) ward] on the 7<sup>th</sup> of April: one NPENT and one Sabin 3 and lastly two samples from Gwoza LGA (Gwoza Wakani ward) on the 10<sup>th</sup> of April both negative. It is therefore likely that the campaign did not influence the outcome of collected samples.

Over the same period of time, routine environmental surveillance in Maiduguri Municipal Council LGA (5 sites) and Jere LGA (2 sites) was ongoing. The frequency of collection of samples from these sites is weekly. A total of 22 samples were collected from the 15<sup>th</sup> of March to the 10<sup>th</sup> of April 2017. The results show 16(73%) Sabin (combinations of Sabin 1, 2, 3 and Npent) and 6 (27%) negatives. Hence, 73% of Sabin in routine environmental surveillance compared to 10.6% in sweep samples over the same time interval, in different geographic areas in the same state under different conditions. Several factors might explain the low detection rate of Sabin from the sweep samples: quality of the site identified by the collectors (sewage or non-sewage water, peak of dry season, stagnant or flowing, stool contaminated water or not), number of persons living around the area where the samples were collected, quality of the cold chain from point of collection bearing in mind that collectors had to stay with samples at times for as much as three days to get to Maiduguri because of accessibility issues and the absence of supportive supervision during most of the collection.

Concerning routine immunization, apart from Mungono with 1<sup>st</sup> trimester 2017 OPV 3 coverage of 98%, all the other LGAs from which sweep samples were collected have OPV 3 coverage < 50% (11 LGAs) or above 100% (5 LGAs) over the same period. LGAs with coverage >100% OPV 3 coverage from January to March 2017 are Askira Uba, Damboa, Konduga, Kwaya Kusar and Shani. Sabin 3 virus was detected in 3 LGAs with > 100% OPV 3 (Askira Uba, Konduga and Kwaya Kusar) and two with OPV 3 coverage < 50% (Bama and Dikwa).



Sweep samples were batched in a chest freezer at the WHO state office Borno and transported to the lab on 4 trips: The very first batch of 33 samples arrived the Ibadan polio lab on the 25<sup>th</sup> of March 2017, two to ten days after they were collected. Of these samples, 26 were negative, 4 Sabin 3 and 4 NPENT. The second batch of 5 samples arrived the lab on the 29<sup>th</sup> of March, 2 to 5 days after samples were collected, the 3<sup>rd</sup> batch arrived the lab on the 3<sup>rd</sup> of April, three days after collection and the last batch on the 12<sup>th</sup> of April 2017, two to five days after collection. Results of the samples from the 2<sup>nd</sup> to the 4<sup>th</sup> batch (14 samples) that arrived the lab relatively early showed that 9 were negative, 3 NPENT, 1 NEV and 1 Sabin 3. It is therefore unlikely that batching might have affected the lab results.

The results did vary with respect to collectors. Four collectors were used for the process each collecting 9 samples (from 3 LGAs: Monguno, Mobbar and Bayo), 12 samples (from 5 LGAs: Nganzai, Bui, Konduga, Shani and Dikwa), 13 samples (from 4 LGAs: Ngala, Damboa, Guzamala and Kwaya Kusar) and 13 samples (from 5 LGAs: Bama, Gwoza, Kukawa, Gubio and Askira Uba). All 9 samples collected by the collector from Monguno, Mobbar and Bayo were negative whereas NPENT, Sabin 3 and NEV results were distributed amongst the other collectors. It is likely that the collector with 9 negative results might have had some issues with sample collection as even his geo-coordinates for Bayo LGA were outside the state when initially mapped.

We conclude that a total of 47 environmental sewage samples were collected from 47 sites in partially accessible and inaccessible areas distributed in 17 LGAs with geo-coordinates captured over a period of one month. From the lab analysis, Sabin, Non-Enterovirus and non-polio enterovirus were detected but no WPV nor cVDPV were identified. This pilot result however doesn't prove the absence of poliovirus transmission in Borno state as "absence of evidence is not evidence of absence"<sup>10</sup>. ES results should be interpreted with caution. While isolation of WPV from an environmental sample indicates poliovirus transmission, negative results on the other hand are difficult to interpret and may indicate the absence of circulating virus, or test negative for a range of other reasons including deficiencies in site selection, poor adherence to guidelines during sample collection, transportation, storage and handling in the laboratory among others<sup>11</sup>. We advocate continuation of ES sweep with heightened attention to site selection and training of sample collectors.

### **Contributions of the Paper**

- This is the first documentation of Environmental Surveillance Sweep experience
- Some form of Environmental Surveillance is possible even in security challenged areas
- Results of Environmental Surveillance Sweep has to be interpreted with caution in the absence of poliovirus detection.

### **Conflicts of Interest**

The authors declare no conflict of interest.

### **Acknowledgement**

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APPENDIX

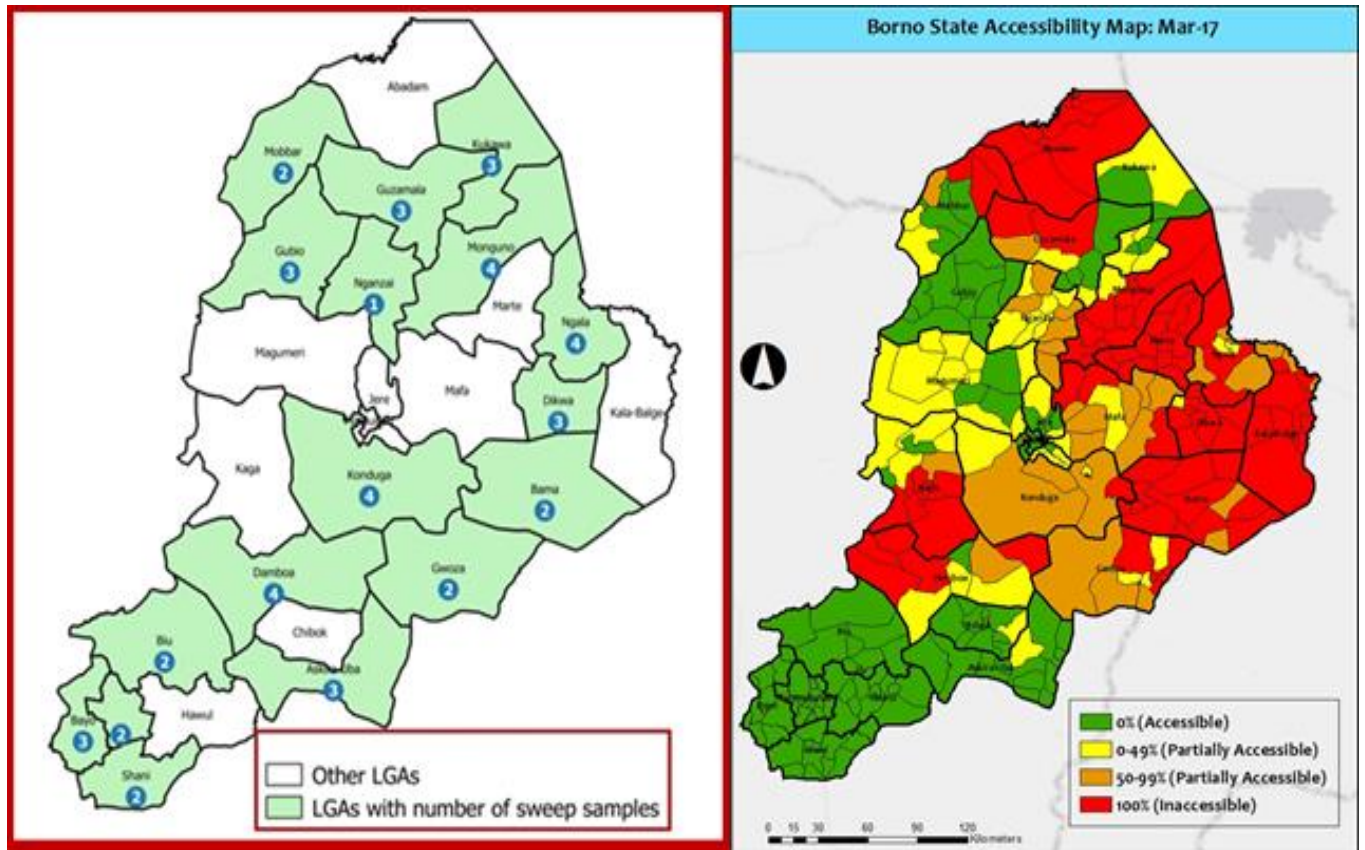
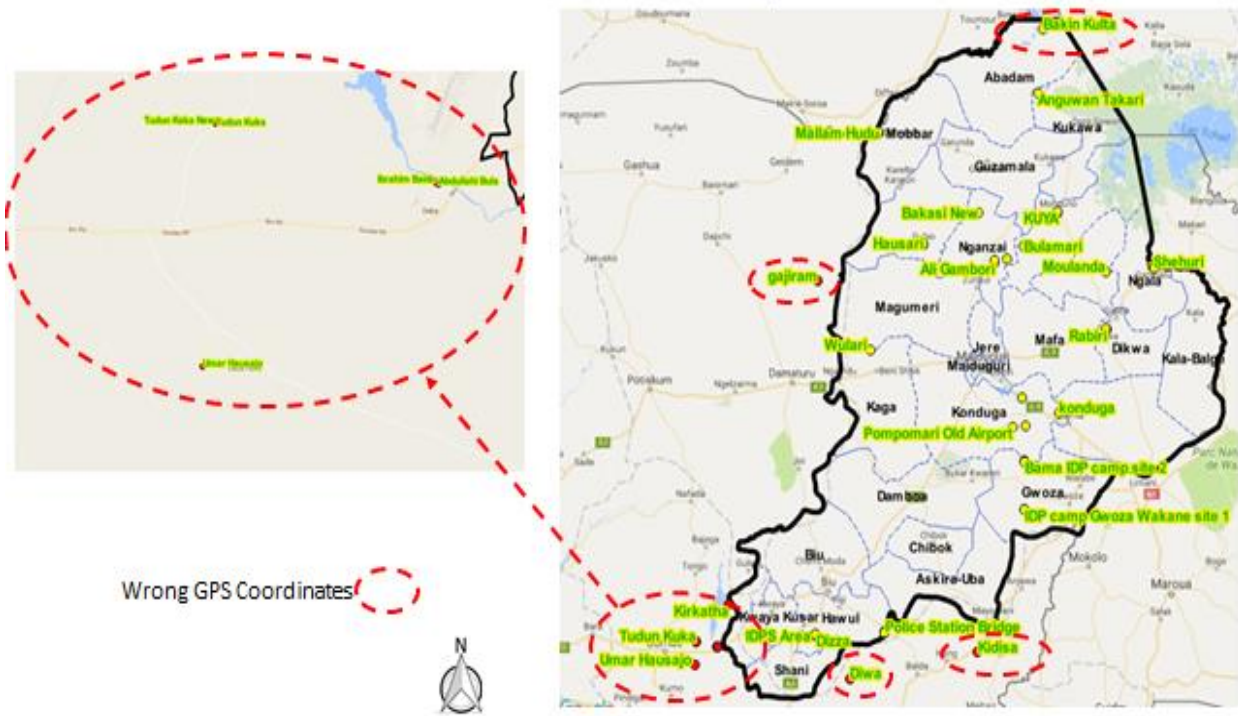


Figure 1: Map showing LGAs where sweep samples were collected, with number of samples indicated therein (left) and March, 2017 accessibility status for Borno state (right)





**Figure 2: Map showing geo-coordinates of sweep sample collection sites**  
*\*Some geo-coordinates wrongly mapped by sample collector due to training gap*

**Table 1: Sweep sample collection results by collection site**

| SN           | LGA         | WARD          | Name of site                     | Date specimen collected | Date specimen arrived lab | Number of days from collection to arrival at lab | Results   |          |          |          |                 |          |          |
|--------------|-------------|---------------|----------------------------------|-------------------------|---------------------------|--|-----------|----------|----------|----------|-----------------|----------|----------|
|              |             |               |                                  |                         |                           |  | Negative  | NPENT    | NEV      | Sabin 3  | Sabin 3 + NPENT | WPVc     | VDPV     |
| 1            | Konduga     | Konduga       | Ahmod Jaha Mosque                | 27-Mar-17               | 29-Mar-17                 | 2  | 1         |          |          |          |                 |          |          |
| 2            | Konduga     | Konduga       | Boarding Primary School IDP Camp | 23-Mar-17               | 25-Mar-17                 | 2  |           | 1        |          |          |                 |          |          |
| 3            | Konduga     | Mandarari     | Maina Maji Street                | 27-Mar-17               | 29-Mar-17                 | 2  | 1         |          |          |          |                 |          |          |
| 4            | Konduga     | Auno          | Mandarari Bulamkali Borehole     | 23-Mar-17               | 25-Mar-17                 | 2  |           |          |          | 1        |                 |          |          |
| 5            | Shani       | Shani         | Diwa                             | 16-Mar-17               | 25-Mar-17                 | 9  | 1         |          |          |          |                 |          |          |
| 6            | Shani       | Burgu         | Kirkatha                         | 16-Mar-17               | 25-Mar-17                 | 9  | 1         |          |          |          |                 |          |          |
| 7            | Biu         | Galtimari     | Dizza                            | 15-Mar-17               | 25-Mar-17                 | 10   | 1         |          |          |          |                 |          |          |
| 8            | Biu         | Dugja         | Zonal Edu. Int Duplex camp       | 15-Mar-17               | 25-Mar-17                 | 10   | 1         |          |          |          |                 |          |          |
| 9            | Dikwa       | Dikwa         | Alhaji Gimba Bohole              | 22-Mar-17               | 25-Mar-17                 | 3  |           | 1        |          |          |                 |          |          |
| 10           | Dikwa       | Dikwa         | Mauland                          | 22-Mar-17               | 25-Mar-17                 | 3  | 1         |          |          |          |                 |          |          |
| 11           | Dikwa       | Dikwa         | Rabiri Bohole                    | 22-Mar-17               | 25-Mar-17                 | 3  |           |          |          |          | 1               |          |          |
| 12           | Nganzai     | Gajiram       | LG Staff Quarter Borehole        | 30-Mar-17               | 02-Apr-17                 | 3  |           | 1        |          |          |                 |          |          |
| 13           | Bayo        | Fikayel       | MCH                              | 16-Mar-17               | 25-Mar-17                 | 9  | 1         |          |          |          |                 |          |          |
| 14           | Bayo        | Fikayel       | Tundun Kaka New                  | 15-Mar-17               | 25-Mar-17                 | 10   | 1         |          |          |          |                 |          |          |
| 15           | Bayo        | Briyel        | Tundun Kuka                      | 15-Mar-17               | 25-Mar-17                 | 10   | 1         |          |          |          |                 |          |          |
| 16           | Mobbar      | Damasak       | Fulatari                         | 21-Mar-17               | 25-Mar-17                 | 4  | 1         |          |          |          |                 |          |          |
| 17           | Mobbar      | Damasak       | Mallam Hudu                      | 21-Mar-17               | 25-Mar-17                 | 4  | 1         |          |          |          |                 |          |          |
| 18           | Monguno     | Monguno       | Ajari                            | 23-Mar-17               | 25-Mar-17                 | 2  | 1         |          |          |          |                 |          |          |
| 19           | Monguno     | Monguno       | Bakasi                           | 23-Mar-17               | 25-Mar-17                 | 2  | 1         |          |          |          |                 |          |          |
| 20           | Monguno     | Monguno       | Chasala                          | 23-Mar-17               | 25-Mar-17                 | 2  | 1         |          |          |          |                 |          |          |
| 21           | Monguno     | Monguno       | Kuya                             | 23-Mar-17               | 25-Mar-17                 | 2  | 1         |          |          |          |                 |          |          |
| 22           | Kwaya Kusar | Kwaya Kusar   | Abdullahi bula                   | 15-Mar-17               | 25-Mar-17                 | 10   | 1         |          |          |          |                 |          |          |
| 23           | Kwaya Kusar | Kwaya Kusar   | Ibrahim Baidu                    | 15-Mar-17               | 25-Mar-17                 | 10   |           |          |          | 1        |                 |          |          |
| 24           | Guzamala    | Mairari Ajari | Ali Gamboru Kasula               | 24-Mar-17               | 29-Mar-17                 | 5  |           |          | 1        |          |                 |          |          |
| 25           | Guzamala    | Mairari       | Lingir Lawanti                   | 24-Mar-17               | 29-Mar-17                 | 5  | 1         |          |          |          |                 |          |          |
| 26           | Guzamala    | Guaram        | Mairari Ajari                    | 24-Mar-17               | 29-Mar-17                 | 5  |           | 1        |          |          |                 |          |          |
| 27           | Dambo       | Nzuda/W       | Bakin Croos                      | 17-Mar-17               | 25-Mar-17                 | 8  | 1         |          |          |          |                 |          |          |
| 28           | Dambo       | Nzuda         | MOH'D Tijie Street               | 17-Mar-17               | 25-Mar-17                 | 8  | 1         |          |          |          |                 |          |          |
| 29           | Dambo       | Dambo Centra  | Samgaya Baburwa                  | 17-Mar-17               | 25-Mar-17                 | 8  | 1         |          |          |          |                 |          |          |
| 30           | Dambo       | Dambo Centra  | Wulari Anda                      | 17-Mar-17               | 25-Mar-17                 | 8  | 1         |          |          |          |                 |          |          |
| 31           | Ngala       | Gamboru C     | Bayan Gidan Mairiga              | 30-Mar-17               | 02-Apr-17                 | 3  | 1         |          |          |          |                 |          |          |
| 32           | Ngala       | Gamboru C     | Dr Kaks                          | 30-Mar-17               | 02-Apr-17                 | 3  | 1         |          |          |          |                 |          |          |
| 33           | Ngala       | Gamboru B     | Goni Gidoni Gidau Borehole       | 30-Mar-17               | 02-Apr-17                 | 3  | 1         |          |          |          |                 |          |          |
| 34           | Ngala       | Gamboru A     | Lawan Mustapha                   | 30-Mar-17               | 02-Apr-17                 | 3  | 1         |          |          |          |                 |          |          |
| 35           | Askira Uba  | Askira East   | Bayan Disp                       | 16-Mar-17               | 25-Mar-17                 | 9  |           |          |          | 1        |                 |          |          |
| 36           | Askira Uba  | Zadawa        | Kidisa                           | 16-Mar-17               | 25-Mar-17                 | 9  |           | 1        |          |          |                 |          |          |
| 37           | Askira Uba  | Uba           | Police Station Bridge            | 16-Mar-17               | 25-Mar-17                 | 9  | 1         |          |          |          |                 |          |          |
| 38           | Gubio       | Gubio 1       | Gubio Lawanti                    | 21-Mar-17               | 25-Mar-17                 | 4  | 1         |          |          |          |                 |          |          |
| 39           | Gubio       | Gubio Lawanti | Hausari                          | 21-Mar-17               | 25-Mar-17                 | 4  | 1         |          |          |          |                 |          |          |
| 40           | Gubio       | Gubio Lawanti | Motor Park                       | 21-Mar-17               | 25-Mar-17                 | 4  | 1         |          |          |          |                 |          |          |
| 41           | Kukawa      | Doro          | Bakin Kulta                      | 23-Mar-17               | 25-Mar-17                 | 2  | 1         |          |          |          |                 |          |          |
| 42           | Kukawa      | Baga          | Anguwan Takari                   | 23-Mar-17               | 25-Mar-17                 | 2  | 1         |          |          |          |                 |          |          |
| 43           | Kukawa      | Barwati       | Bulamari                         | 23-Mar-17               | 25-Mar-17                 | 2  | 1         |          |          |          |                 |          |          |
| 44           | Gwoza       | Gwoza wakani  | IDP Camp Gwola Wakani 1          | 10-Apr-17               | 12-Apr-17                 | 2  | 1         |          |          |          |                 |          |          |
| 45           | Gwoza       | Gwoza wakani  | IDP Camp Gwola Wakani 2          | 10-Apr-17               | 12-Apr-17                 | 2  | 1         |          |          |          |                 |          |          |
| 46           | Bama        | Shehuri       | IDP Camp Site 1                  | 07-Apr-17               | 12-Apr-17                 | 5  |           |          |          | 1        |                 |          |          |
| 47           | Bama        | Shehuri       | IDP Camp Site 2                  | 07-Apr-17               | 12-Apr-17                 | 5  |           | 1        |          |          |                 |          |          |
| <b>Total</b> |             |               |                                  |                         |                           |  | <b>35</b> | <b>6</b> | <b>1</b> | <b>4</b> | <b>1</b>        | <b>0</b> | <b>0</b> |

Laboratory results show sewage samples from 5(29.4%) LGAs (Bama, Dikwa, Askira Uba, Konduga and Kwaya Kusar) had Sabin 3 virus



**Table 2: Number of samples collected, processed and outcome by LGA with results**

| SN           | LGA         | Number collected | Number processed | Results   |          |          |          |                 |          |          |
|--------------|-------------|------------------|------------------|-----------|----------|----------|----------|-----------------|----------|----------|
|              |             |                  |                  | Negative  | NPENT    | NEV      | Sabin 3  | Sabin 3 + NPENT | WPV      | cVDPV    |
| 1            | Askira/Uba  | 3                | 3                | 1         | 1        |          | 1        |                 |          |          |
| 2            | Bama        | 2                | 2                | 0         | 1        |          | 1        |                 |          |          |
| 3            | Gwoza       | 2                | 2                | 2         |          |          |          |                 |          |          |
| 4            | Bayo        | 3                | 3                | 3         |          |          |          |                 |          |          |
| 5            | Biu         | 2                | 2                | 2         |          |          |          |                 |          |          |
| 6            | Dambo       | 4                | 4                | 4         |          |          |          |                 |          |          |
| 7            | Dikwa       | 3                | 3                | 1         | 1        |          |          | 1               |          |          |
| 8            | Gubio       | 3                | 3                | 3         |          |          |          |                 |          |          |
| 9            | Guzamala    | 3                | 3                | 1         | 1        | 1        |          |                 |          |          |
| 10           | Konduga     | 4                | 4                | 2         | 1        |          | 1        |                 |          |          |
| 11           | Kukawa      | 3                | 3                | 3         |          |          |          |                 |          |          |
| 12           | Kwaya Kusar | 2                | 2                | 1         |          |          | 1        |                 |          |          |
| 13           | Mobbar      | 2                | 2                | 2         |          |          |          |                 |          |          |
| 14           | Monguno     | 4                | 4                | 4         |          |          |          |                 |          |          |
| 15           | Ngala       | 4                | 4                | 4         |          |          |          |                 |          |          |
| 16           | Nganzai     | 1                | 1                | 0         | 1        |          |          |                 |          |          |
| 17           | Shani       | 2                | 2                | 2         |          |          |          |                 |          |          |
| <b>TOTAL</b> |             | <b>47</b>        | <b>47</b>        | <b>35</b> | <b>6</b> | <b>1</b> | <b>4</b> | <b>1</b>        | <b>0</b> | <b>0</b> |

*A total of 47 samples from 17 LGAs processed. No WPV or cVDPV isolated.*