Environmental surveillance in Kenya

Kenya introduced a phased environmental surveillance for poliovirus in October 2013, initially with three sites in Nairobi; this was later increased to five. The decision was informed by potential WPV importation to these areas associated with the movement of people from high-risk and outbreak areas.

Methodology

Three initial sampling sites chosen were based on being high risk for WPV occurrence: one in the Eastleigh area of Kamukunji sub-county and two in the locality of Kibera which is an informal settlement in Langata sub-county. In March 2014, an additional two sites were selected in Nairobi: a second site in Eastleigh and one in Mathare of Starehe sub-county. The sampling sites (manholes on main trunk sewers) were identified through sewage infrastructure maps obtained from the Nairobi Water and Sewerage Company.

Environmental samples were collected using the grab sampling methodology, which involves getting a one-time scoop of sample using a one-litre container. The samples are collected on a bi-weekly or monthly basis. Samples were concentrated at Kenya Medical Research Institute (KEMRI) using the standard WHO protocol on two-phase concentration using 22% dextran and 29% polyethylene glycol (PEG). The concentrates were referred to the Centers for Disease Control and Prevention (CDC), USA, for poliovirus isolation.

Sewage concentrates were inoculated onto RD (human rhabdomyosarcoma) and L20B (mouse L cells expressing the human poliovirus receptor, CD-155) cell lines to isolate poliovirus in culture. Cultures exhibiting viral cytopathic effect were tested by real-time polymerase chain reaction (rRT-PCR) to detect polioviruses and determine whether they were vaccine (Sabin-like) or non-Sabin-like (NSL). For viruses that were NSL or those with discordant PCR Sabin results, the sequence of the VP1 capsid region was determined, to genotype the virus as wild, vaccine-like or vaccine-derived (drifted). Procedures for rRT-PCR and sequencing followed previously published standardized procedures.

Results

A total of 28 samples were collected from all sites during 11 visits made between October 2013 and July 2014. WPV1 was detected in the first sample collected on 12 October 2013 from Eastleigh. The detected WPV was most closely linked genetically to a virus that was circulating in Mogadishu in July 2013. The remaining 27 samples collected from the sites in subsequent months were negative for WPV, and only yielded Sabin (vaccine type) viruses or non-polio enteroviruses (Figure 1).

Discussion

The detection of one WPV1 in the environmental sample in the absence of AFP cases is programmatically significant as it represented silent transmission of the virus. WHO guidelines on responding to WPV detected in environmental samples include: enhanced AFP case search, supplementary immunization activities (SIAs) to reach susceptible children in the population, and strengthened routine immunization.
The Kenyan Ministry of Health, working with WHO and other partners, promptly responded to the confirmation of WPV in the environmental sample in Nairobi. Enhanced case search and surveillance did not reveal WPV from AFP cases in Eastleigh or in any other areas of Nairobi, although surveillance gaps were clearly documented. Over this period, the Ministry of Health implemented SIAs that had been scheduled as part of the broader response to the WPV1 outbreak in Dadaab refugee camps and host communities.

The detection of Sabin viruses and non-polio enteroviruses in all samples collected from November 2013 to July 2014 validated the sampling methodology and subsequent procedures for sample processing. It indicates that the system was sensitive enough to pick WPVs if they were present in sampling sites and was a complementary confirmation that indeed outbreak response activities in Nairobi were sufficient to stop further transmission of WPV.

**Conclusion**

The WPV in the environmental sample may have been a result of virus shedding by an on-transit or resident asymptomatic visitor to the area and demonstrates the real dangers of WPV importation to uninfected areas. The absence of WPV detection since then gives an added assurance on Kenya’s polio free status, but it will be prudent for environmental surveillance to continue in Nairobi and other epidemiologically high-risk areas for WPV importation.

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