How has the Stop Transmission of Polio Program consultants and Open Data Kit technology contributed towards polio eradication efforts in Kenya?

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Abstract

Background: Polio eradication efforts in Kenya include the development of a skilled local workforce and the application of innovative technologies. This paper describes the role of Stop Transmission of Polio Program (STOP) consultants and the use of Open Data Kit (ODK) technology in strengthening polio eradication efforts in Kenya.

Methods: Overview of the STOP program, deployment, and the modality of support is described. The application of innovative ODK technology was examined. Descriptive analysis was conducted on data collected by the STOP consultants during supportive supervisions using Statistical Package for Social Sciences (SPSS) (version 22) and maps were developed using Quantum Geographic Information System (GIS) (version 3.4.1).

Results: STOP consultants supportively supervised eight hundred seventy health facilities both on routine immunization (RI) and on Acute Flaccid Paralysis (AFP) surveillance system in 16 (34.1%) counties during the study period. Active surveillance for AFP was conducted in all health facilities supervised, and 11 unreported cases of AFP were detected and investigated. STOP consultants, as part of an outbreak response, provided technical support on five successive rounds of polio Supplementary Immunization Activities (SIAs) conducted during period studied. Moreover, addressing programmatic data needs, the STOP data manager has played a valuable role in enhancing the quality and use of data for evidence-based decision-making, both routine immunization and AFP surveillance. ODK technology was used in AFP surveillance, routine and supplementary immunization activities being a part of the package of electronic tools available in the country.

Conclusion: STOP consultants have contributed extensively to polio eradication efforts in Kenya, through enhancing active case search, supporting outbreak response, strengthening routine immunization program, training/ capacity building of Frontline Health Workers (FLW), data analysis, interpretation and supportive supervision. The application of ODK technology has contributed to generating real-time quality data for informed decision making including spatial data, even in resource-limited hard to reach settings where the likelihood of poliovirus transmission is higher. A national STOP program should be modeled to produce homegrown qualified personnel who are able to support eradication and response activities in Kenya.

Background

Poliomyelitis, commonly known as Polio, is a contagious disease caused by the poliovirus (1) that attacks the Central Nervous System (CNS) (2). Children younger than 5 years old are more likely to contract the virus than any other group (3). As a highly infectious disease, poliomyelitis is transmitted through contact with infected fecal matter entering the oral route (2). Sometimes it can be transmitted through sneezing or coughing, as the virus sometimes lives in the throat and intestines. The Wild Poliovirus (WPV) occurs in three serotypes, WPV 1, 2 and 3 (4). However, WPV 2 and 3 were last seen in

1999 in Aligarh, India and in Yobe, Nigeria in 2012 respectively. Currently only WPV 1 has been detected since 2012 (5) from the endemic countries of Pakistan and Afghanistan. Nigeria reported its last WPV1 case in August 2016.

In 1988, the World Health Assembly (WHA) established the Global Polio Eradication Initiative (GPEI), which consisted of a partnership among the World Health Organization (WHO), Rotary International (RI), the Centers for Disease Control and Prevention (CDC), the United Nations Children's Fund (UNICEF), and national governments aiming to achieve a polio-free world (6). Since then, GPEI efforts have led to reduction of the annual incidence of WPV cases by more than 99.0%; from an estimated 350,000 of WPV cases to only 33 cases by the end of 2018 (7, 8). The number of endemic countries that had never interrupted indigenous WPV transmission was reduced from 125 in 1988 to three; Pakistan, Afghanistan, and Nigeria remain the only countries with continuing endemic WPV1 transmission (9). Despite these progresses, persistent endemic WPV circulation in these countries led to repeated outbreaks in polio-free countries (10, 11).

The GPEI underlined four proven strategies to eradicate polio worldwide (12). These were: 1) maintaining high population immunity using Oral Polio Vaccine (OPV) and Inactivated Polio Vaccine (IPV) through the Expanded Programme on Immunization (EPI), 2) detect and interrupt circulation of all suspected cases of Poliomyelitis through sensitive Acute Flaccid Paralysis (AFP) surveillance, 3) Supplemental Immunization Activities (SIAs), and 4) mop-up campaigns (7, 12). Usually, paralytic polio cases present as AFP, which is defined as a sudden onset of paralysis/ weakness in any part of the body of a child below 15 years of age (1) in the case of polio surveillance. This makes AFP surveillance a primary means of detecting and reporting circulation of poliovirus (9) and, thus an important component of the eradication strategies (13). AFP surveillance includes the testing of two adequate stool specimens for the presence of WPV and vaccine-derived polioviruses (VDPVs) in WHO - accredited laboratories of the Global Polio Laboratory Network (GPLN) (14). Based on the characteristic poliovirus excretion pattern (15), AFP surveillance is supplemented by environmental surveillance for polioviruses in sewage at selected locations (9, 15).

In Kenya, under the Ministry of Health (MOH), the department of Disease Surveillance and Response (DDSR) in partnership with the National Vaccine and Immunization Program (NVIP) collaborate to implement polio eradication activities. These activities aim to ensure the certification of the country free from indigenous WPV in the shortest possible time and maintain the polio free status of the country. The last case of WPV in Kenya was detected in 2013. This case was an importation from neighboring Somalia and had a date of onset of paralysis on 14 July 2013. The most recent outbreak was a vaccine derived polio virus type 2 (VDPV2) isolation from environmental site Kamukunji site 2, Eastleigh area of Nairobi. The sample was collected on the 21st March 2018. Sequencing results received on 11th April 2018 confirmed it was a cVDPV 2 with 47 nucleotide differences from parent Sabin 2 strain. This strain was genetically linked to environmental sample isolates detected in Benadir, Somalia in October and November 2017. Consequently, on 11th April 2018, the Eradication & Outbreak Management Group (EOMG) classified the outbreak as grade 3 cVDPV2 outbreak and a response was initiated. This recurrent importation of poliovirus was most likely due to constant movement of populations from neighboring

Somalia. Suboptimal RI coverage and AFP surveillance performance and insecurity and insurgency, especially in cross-border areas and movement of special population subgroups, allowed for circulation of the poliovirus without being detected in the inaccessible areas. Implementation of successive SIAs, including national immunization days and mop-up campaigns, strengthening routine immunization, and deployment of Stop Transmission of Polio (STOP) consultants are a part of outbreak preparedness and response efforts in Kenya. This paper aims to share experience of the role of WHO STOP consultants in strengthening polio eradication activities, Vaccine Preventable Disease (VPDs) surveillance and RI, and VPDs and RI data management in Kenya from July 2018 to September 2019.

Methods

Overview of STOP program

The STOP program is one key component of the GPEI (16). CDC conceived the program in collaboration with WHO and its implementation started in 1999. The main aim of the program was to fill human resource gaps by providing technical assistance in strengthening polio eradication initiatives in polio endemic countries (17). However, the program was expanded to include other VPDs surveillance, RI, communication, and data management for program improvement (16, 17). In 1998, the first cohort of STOP team (STOP 1) was assigned to a three-month field mission in six different countries and 25 experts were members of the team (18). Later, CDC started a recruitment process that allowed volunteer public health experts from around the world to gain useful experience and contribute to polio eradication efforts (16, 19).

The STOP program recruits volunteers, and as such does not pay salaries. However, each volunteer is provided with airline tickets, and a daily living allowance to cover accommodations.

Deployment of STOP 52 team in Kenya

In July 2018, four consultants from STOP 52 team were deployed to support polio eradication efforts in Kenya. The team comprised of three field epidemiologists and one data manager, who passed the recruitment process and successfully completed a general two-weeks pre-deployment training that was conducted in Entebbe, Uganda. The two weeks training focused on AFP Surveillance, RI, and SIAs. However, the data manager received an extra week's training mainly on Health Information Systems (HIS) and data management, data quality and information use for RI and VPDs surveillance programs.

Upon arrival, WHO Kenya country representative office organized an orientation meeting for the STOP 52 consultants where they were welcomed and briefed on the country office's overall working structure. During that meeting, WHO field Officers and the data manager who would later become immediate supervisors of the STOP consultants made short presentations on the VPDs surveillance system and the RI program in Kenya. This helped the STOP consultants to understand how the various systems operate, progresses and gaps to fill. Part of the discussion was on the Terms of Reference (TOR) for STOP consultants (both the field epidemiologists and the data manager) that guide their deployment. The TOR

was useful and gave the flexibility to decide on the type of support STOPers want to make in their bi-weekly plans as long as the activities they intend to do are within the TOR. STOP consultants with their TOR were presented to key stakeholders including the MOH, CDC, Kenyan Field Epidemiology Training Program (FELTP) and UNICEF to improve stakeholder engagement and coordination towards the shared goal.

Modality of support by STOP 52 team

After the detailed orientation of STOP consultants in Nairobi, each consultant was given a vehicle with a driver, deployed to a county, and assigned a field supervisor (WHO field staff). The data manager from the STOP team was deployed to the WHO country representative office under the supervision of the EPI Unit's data manager. In addition to his work at the country office, the STOP data manager also worked closely with the MOH, laboratory, and various polio committees. Prior to the deployment of the STOP consultants, all counties to be supported were communicated to about the STOP team. The form of communication varied - signed letter, phone call and email – with the most appropriate for each county. The WHO data manager provided each STOP member a brief power point presentation that explained recent performance of the county of deployment. The STOP data manager also served as a contact point between the country office and field STOP consultants where necessary. Each STOP consultant was required to submit a biweekly activity plan and a biweekly report during each deployment, and a county debriefing report at the end of each deployment to the WHO field officers and identified persons at the WHO country Office.

Open Data Kit (ODK) technology

The application of Information Systems (IS) in the domain of health, including public health surveillance, is increasingly becoming popular and advantageous (20, 21). In the context of polio eradication, a functional immunization HIS that ensures the availability of quality case-based and laboratory surveillance data are crucial components of the GPEI (22). Thus this will ensure evidence based practices in decision making for planning and response at all levels of the public health system, from health facilities, to national programs, and to global partners (22, 23).

The application of HIS in the perspective of improving data quality and enhancing information use for prompt case detection and subsequent case management was found to be crucial (24). However, challenges in the quality and use of RI and VPDs surveillance data, including polio data, have been persistent (25, 26). Errors introduced during data collection and collation, especially paper-based, are among the critical challenges and hindered program performance. The growing application of Information technology (IT) in public health surveillance has ensured that most countries were able to develop standardized electronic data collection and reporting tools for real-time data reporting (23). This solved some of the challenges encountered during paper-based data collection and reporting (27). Among the various electronic data collection platforms, the Open Data Kit (ODK) application have been the most reliable and cost-effective for AFP surveillance (28). ODK is a free and open source set of tools to build a data collection form or survey, collect the data on a mobile/ android device, synchronizes,

submit and aggregates collected data to a centrally managed server automatically, analyzes and visualizes the data in various formats (29). In addition, increased popularity and accessibility of mobile android phones, improved infrastructure, and the development of user-friendly applications made ODK most preferred platform (30) not only in disease surveillance also other public health programs (28).

In 2010, Nigeria paved the way on using ODK for monitoring polio eradication activities. A pilot survey was implemented where data collected from field submitted to the server in real time (30). ODK was introduced to the AFP surveillance system in Kenya in August 2017. The tool was primarily used to collect and transfer real-time data on activities conducted in the field related to AFP surveillance. Currently, the tool is used to collect data on various AFP programmatic aspects including Integrated Supportive Supervision (ISS), AFP case investigation and validation, geocoding of AFP cases, environmental surveillance, and 60 days follow up. Moreover, the tool was used to collect SIAs data relating to administrative coverage, Independent Monitoring (IM), Lots Quality Assurance Sampling (LQAS) and vaccine management.

Integrated Supportive Supervision (ISS) tool in ODK

Supervision is an excellent opportunity and effective strategy to identify knowledge gaps and provide further training to the health workforce to consistently improve performance, share knowledge and skills, and solve other systematic problems that contribute to suboptimal programmatic performance (31). Supportive supervisions are found to be effective tools in improving not only AFP surveillance system, but also other public health programs (29). However, there is scarce evidence on the application of real-time electronic data collection tools for quality supervision (29, 32).

WHO developed an ISS tool for supervising health facilities on AFP surveillance including those health facilities that provide RI services. National surveillance officers from MOH, WHO field officers including STOP 52 consultants, and partners administer the tool during field supervisions. Later, the tool was designed using ODK technology that replaced the paper-based data collection method (33). The data collected is submitted online to the WHO central server. The data is downloaded at the WHO Kenya country representative office in real-time, analyzed and feedback provided in regular basis to MOH, field officers and other data consumers. For this study, ISS data for the period of July 2018 to September 2019 were downloaded from the server and supervisions by the STOP team were extracted and analyzed.

Results And Discussion

Enhancing active case search using ISS tool in ODK

STOP 52 consultants between July 2018 and September 2019 supported sixteen (30.7%) counties (Figure 1) and supervised 870 health facilities at least once. Of the total health facilities supervised, 27 (31.4%) were health centers, 215 (24.7%) were dispensaries, 164 (18.8%) hospitals, 117 (13.4%) were clinics and remaining 11.7% were other health facility types (military, bonesetters, traditional healers). By ownership, majority (85.8%) of the health facilities were government health facilities.

Of the health facilities where active case search was conducted, 430 (49.4%) were High priority facilities for AFP surveillance. Two hundred sixty one (30.0%) were medium and 131 (15.1%) were low; the remaining 5.5% health facilities were not prioritized for AFP surveillance. Eleven unreported AFP cases were detected during active case search. Geo-coordinates for all health facilities were captured during active case search (Figure 2). The average precision of the geo-coordinates was within 10 meters radius of the actual health facility.

Seven hundred and eighty-three (90.0%) supervisions were conducted jointly with government counterparts. Only 368 (42.3%) surveillance focal persons conduct active case search in the health facilities visited. Eight hundred and seven (92.7%) surveillance focal persons were supervised by their immediate supervisor, while 391 (44.9%) of them received a training on VPDs surveillance that focused on AFP, measles, Neonatal Tetanus (NNT) and yellow fever, in less than a year from period studied. Sixth hundred and twenty-five (71.8%) surveillance focal persons knew the case definition for AFP and 523 (71.8%) know specimen collection procedures for suspected AFP case. Of the supervised health facilities, 561 (64.5%) have communication materials including posters and standard case definitions on AFP. About a quarter (224) of the health facilities supervised had surveillance guidelines at the time of supervision visits. Seven hundred and five (81.0%) surveillance focal persons had a list of community informants, but in 147 (16.9%) of health facilities with a list of community informants, community informants were not sensitized on AFP surveillance.

Strengthening Routine Immunization (RI) program using ISS tool in ODK

Of the total 870 supervised health facilities during the study period, 792 (91.4%) were RI implementing facilities. As depicted in Table 1, of the total RI sessions planned, 93.2% fixed and 67.5% outreach sessions were implemented. RI sessions were interrupted in 219 (27.6%) of the supervised health facilities. Nonfunctional fridge, inadequate supplies, and engagement of health workers in other priorities contributed half of the interrupted sessions. Expired vaccines, Vaccine Vial Monitoring (VVM) beyond stage 2, and reconstituted freeze-dried vaccines were found in 12 (1.5%), 19 (2.4%) and 8 (1.1%) of the health facilities supervised respectively. OPV stock-out was reported in 69 (8.7%) health facilities, and Adverse Effects Following Immunization (AEFI) was reported in fourteen health facilities (Table 1).

Strengthening AFP surveillance system

STOP 52 consultants contributed in increasing AFP case detection using active and passive surveillance techniques. Applying ISS tool in ODK, the team was able to detect unreported cases of AFP from health facilities supervised during an active case search. In addition, most of the supervisions by the team were conducted with County Disease Surveillance Coordinators (CDSCs) and Sub county Disease Surveillance Coordinators (SCDSCs) which paved a way for skill transfer and foster local capacity that will enhance the basics of AFP surveillance. The STOP 52 consultants supported the local staff in mapping under-served populations and inaccessible areas to reach children who are not reached by the AFP surveillance system or SIAs. This activity in parallel to other strategies such as Community Based Surveillance (CBS) where Community Health Volunteers (CHVs) report suspected cases of AFP thereby enhancing the

capacity of the AFP surveillance system in detecting more AFP cases. On this regard, STOP 52 consultants played a key role in sensitizing CHVs on AFP and VPDs surveillance, and data management.

STOP 52 consultants provided a technical support to SCDSCs on AFP case investigation, geo-coding, 60 days follow up, contact sampling, and validation. They also supported the investigation of AFP cases with zero OPV doses, missing age, and unknown immunization status. Such support helped prevent costs related to contact sampling and 60 days follow up that would have been incurred if appropriate investigations with complete information were not carried out.

CDSCs were able to monitor their performance of the AFP surveillance system on regular basis. This included tracking of silent sub counties that did not reported an AFP case in a period varying from six month up to twelve months or more, depending on their target population. On this regard, STOP 52 team backed up CDSCs in mapping and developing appropriate strategies to enhance AFP surveillance implemented in silent sub counties. All strategies followed GPEI procedures including rapid assessment on potential surveillance gaps, triggering active case search, strengthening CBS, and sensitization of CHVs to strengthen the surveillance network.

Outbreak response including polio Supplementary Immunization Activities (SIAs)

Five successive rounds of polio SIAs were carried from July 2018 up to September 2019. The SIAs were targeted to respond to the cVDPV2 outbreak in Kamukunji Sub County, Nairobi County. The STOP 52 consultants has played an important role during implementation of all those SIAs. They supported microplanning with special focus on mapping underserved population sub-groups, training of team supervisors and vaccination teams on demarcation of team catchment areas, developing team movement plans, on polio vaccine administering procedures, cold chain management including VVM, and data recording and reporting using tally and summary sheets. The STOP 52 consultants, liaising with GPEI collaborates, provided supervision to team supervisors and vaccination teams on daily basis. The daily supervision incorporated pre-campaign and intra-campaign monitoring, which helped to identify gaps and implement immediate corrective actions while the campaign was underway. In the perspective of assessing the quality of SIAs implementation, STOP 52 team participated in IM and Lots Quality Assurance Sampling LQAS exercises. The STOP consultants trained IM monitors and LQAS surveyors on procedures how to conduct the exercises per agreed standards. Furthermore, the consultants conducted supportive supervisory visits during field implementation. The STOP 52 team participated in national SIAs review meetings, presented challenges and ways forward, and provided constructive feedback.

AFP surveillance data management

The STOP data management assignment was designed based on a systems-focused approach to enhance RI and VPDs surveillance data quality, and build local capacity for information use, and strengthen immunization and surveillance HIS (22). On this regard, the STOP 52 consultants provided technical assistance and capacity building in the field of immunization and AFP surveillance data

management to optimize program performance. Most of the activities geared towards data quality assurance, data visualization and improving information use for evidence-based decision-making.

One of the key deliverables by the STOP 52 consultants was active participation in the preparation and dissemination of the Kenya polio weekly bulletin. The bulletin generated evidence on key AFP surveillance programmatic and laboratory performance indicators. Key information including in the bulletin include classification flow chart of AFP cases, epidemiological curve of cases, non-polio AFP rate, stool adequacy rate, and Non-polio Entero-Virus (NPENT) isolation rate. Performance was presented by different geographical strata, for high-risk counties for polio transmission with hard-to-reach and underserved population sub-groups; performance was monitored at the lowest administrative unit. To this end, the STOP 52 consultants applied extensive data management and visualization including spatial data analysis techniques. The national AFP surveillance focal person at the Emergency Operations Center (EOC), MOH disseminates the bulletin on a weekly basis to 306 SCDSCs, 47 CDSCs, and other stakeholders. Similarly, the data manager at the WHO country representative office was responsible for sharing the bulletin with WHO staffs including Africa Regional Office (AFRO), and other stakeholders such as CDC, UNICEF, Core Group.

During period reviewed, the STOP 52 consultants conducted regular quarterly polio risk assessments by county and sub-county. Extensive data analysis was done using the WHO risk assessment standard template Generally, findings from the quarterly risk assessments provided evidence on risk of poliovirus transmission in Kenya and what could be done in the future in strengthening AFP surveillance in various counties and sub counties. Similarly, the team carried out one risk assessment for measles.

STOP 52 consultants played a key role in review and development of data recording and reporting tools for SIAs. The STOP 52 team provided training on administering the tools in ODK; supervised teams during field implementation; assisted in data management in the server; analyzed pre-campaign, intra-campaign, and post-campaign monitoring data; and provided daily feedback and during review meetings. In addition, administrative, IM and LQAS data were further analyzed and coverages reported to the WHO headquarters using a standard template provided by WHO AFRO.

Timely and regular feedback in the form of line list was provided to CDSCs, SCDSC, WHO, and STOP 52 field epidemiologists. The feedback was generated on quarterly basis from the AFP database and mainly focused on AFP cases with zero-dose, unknown vaccination status, those due for 60 days follow up, and cases that require contact sampling. CDSCs, SCDSCs, WHO and STOP field epidemiologists used these line lists to trace AFP cases requiring further action.

Document preparations, training and capacity building

The STOP 52 team participated in development of various guidelines, tools, and training materials. These documents included data recording and reporting tools such as tally and summary sheets for SIAs, national training materials and manuals on Integrated Disease Surveillance and Response (IDSR) including AFP and measles surveillance systems, SIAs training materials for vaccination team and team

supervisors. In addition, STOP 52 collaborated in various national and county level trainings including On-the-Job trainings (OJT). Majority of trainings aimed on IDSR focused on AFP, measles, NNT and yellow fever, surveillance data management, SIAs and EPI.

Conclusion

STOP 52 consultants have contributed extensively to the polio eradication efforts in Kenya, through enhancing active case search, outbreak response, strengthening routine immunization program, training and supportive supervision. The consultants have played a valuable role in sharing skills and knowledge, and building the capacity of the local staffs at different levels of the health system. The application of ODK technology during active case search, supportive supervision and other key surveillance programmatic activities has contributed to generating real-time quality data including spatial data, even in resource-limited hard to reach settings where the likelihood of poliovirus transmission is high. The use of this mobile technology aided planning, implementation and evaluation of polio eradication SIAs. Generally, the technology improved polio and routine immunization data quality, availability, and enhanced information use for evidence-based planning and decision making towards polio eradication activities in Kenya.

A national STOP program should be modeled to produce homegrown qualified personnel who are able to support eradication and response activities in their country of origin and make use of the availability of electronic tools to improve the implementation of public health programs. Supportive supervision of health workers applying ODK technology should be strengthened especially in high priority sites for AFP surveillance.

Abbreviations

AFP: Acute Flaccid Paralysis; cVDPV2: circulative Vaccine-derived Poliovirus type 2; ISS: Integrated Supportive Supervision; ODK: Open Data Kit; RI: Routine Immunization; SIAs: Supplementary Immunization Activities; VDPV2: Vaccine-derived Poliovirus type 2; VPDs: Vaccine Preventable Disease; WPV: Wild Poliovirus.

Declarations

Ethics approval and consent to participate

Justifiable request was submitted to use the data and approval was sought from the WHO Kenya country representative office.

Consent for publication

Not applicable.

Availability of data and material

The data used for this study can be accessed with justifiable request.

Competing interests

The authors declare that they have no competing interests.

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Author's contributions

BT conceptualized the idea (in consultation with the other authors), analyzed the data and drafted the manuscript. AS contributed in writing and reviewing the manuscript. JKM reviewed versions of the manuscript. All authors have read and approved final version of the manuscript.

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Table

Table 1. Findings on Routine Immunization (RI) supportive supervision using ISS tool in ODK, Kenya, July 2018 – September 2019.

Characteristics	Yes		No	
	N	%	N	%
Availability of updated schedule for RI sessions	686	86.6%	106	13.4%
Fixed RI sessions implemented	738	93.2%	54	6.8%
Outreach RI sessions implemented	535	67.5%	257	32.5%
Interrupted RI sessions	219	27.6%	573	72.4%
Availability of updated RI monitoring chart	422	53.3%	370	46.7%
Availability of immunization related Information Education and Communication (IEC) materials	68	8.6%	724	91.4%
Availability of functional fridge	765	96.6%	27	3.4%
OPV in good condition (VVM stage 1 and 2)	703	88.7%	89	11.3%
Knowledge on VVM reading	728	91.9%	64	8.1%
knowledge on vaccine shake test	264	33.3%	528	66.7%
OPV stock out	546	69.0%	246	31.0%
AEFI reporting	111	14.0%	681	86.0%
Availability of vaccine ledger book	732	92.4%	60	7.6%
Availability of funds for strengthening RI for last one year	339	42.8%	453	57.2%

Figures

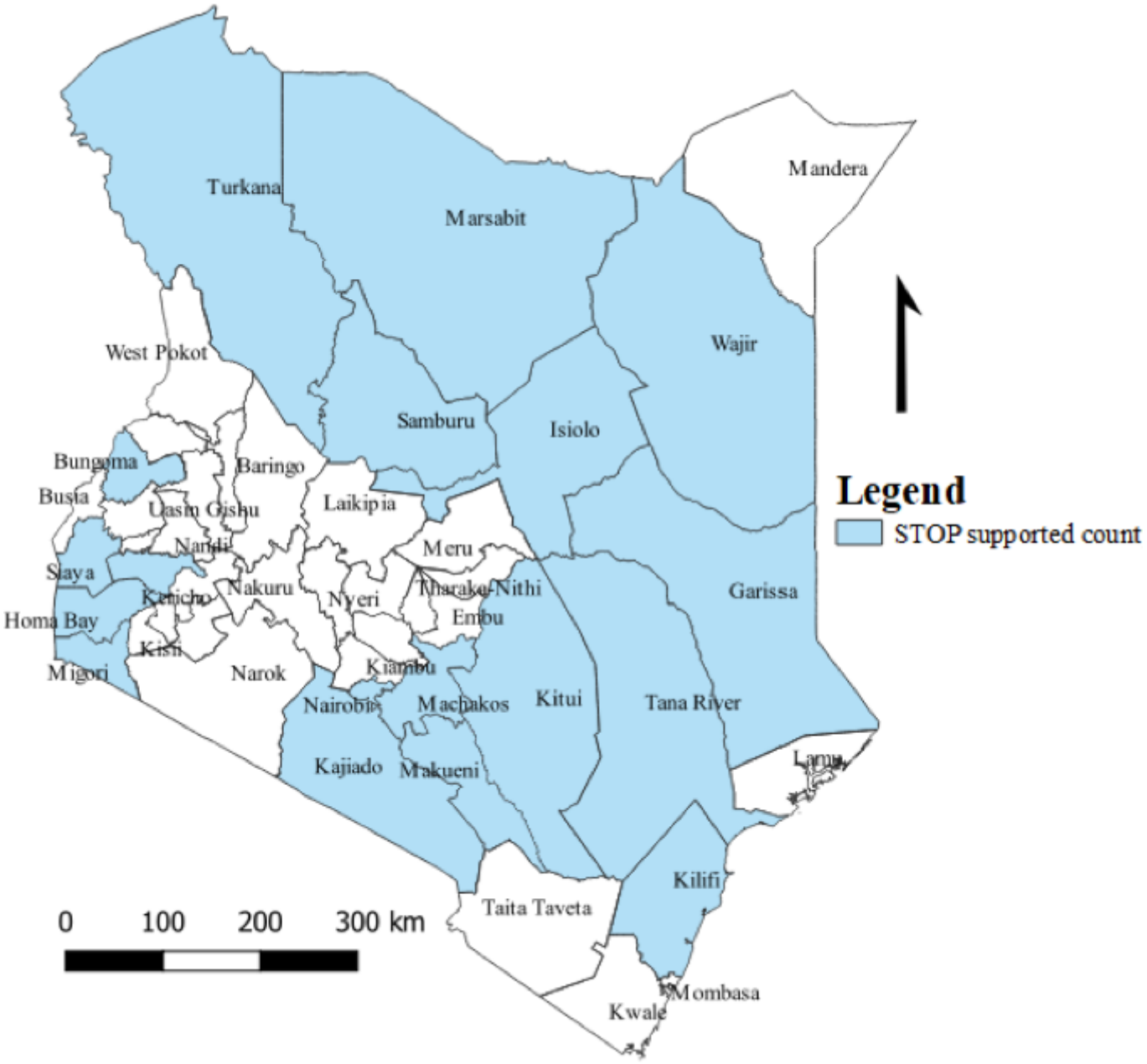

Figure 1

Counties supported by Stop Transmission of Polio program (STOP) 52 consultants, Kenya, July 2018 – September 2019.

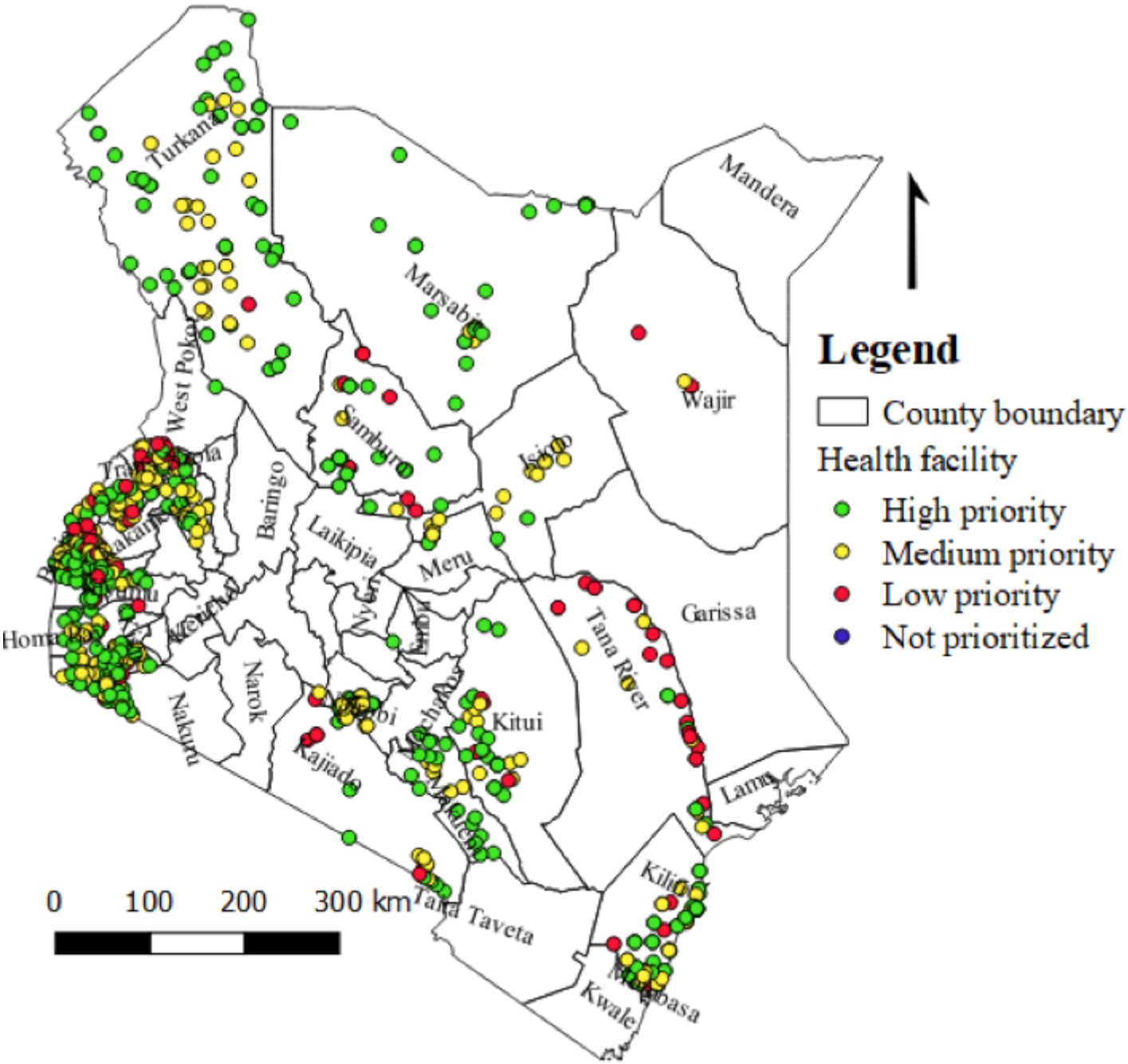

Figure 2

Geo-coordinates of supervised health facilities by STOP 52 consultants by AFP surveillance priority status, Kenya, July 2018 – September, 2019.