Int. j. adv. multidisc. res. stud. 2023; 3(4):868-872

Received: 26-06-2023
Accepted: 06-08-2023

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

Outbreak Investigation of Two Human Wild Polio Cases: District Dera Ghazi Khan, Punjab, Pakistan, January-2020

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Abstract
Since the inception of environmental site in DG Khan, intermittently Wild Polio Virus (WPV) was isolated but since 2018 it is observed that though still intermittent, but the frequency of positive isolates has been raised as compared with past. Now 02 Human Wild Polio Virus type-1 (WPV1) cases are confirmed by Regional Reference Laboratory. Sample collected on 12 Sept, 2018 was positive for WPV1. Objectives of the study were to find out that whether the recently emerged situation is due to the WPV circulation in various regions of Pakistan especially against backdrop that some areas among them are now heavily flooded with virus or there are some programmatic and/or performance gaps responsible for it. The assessment was conducted from 10-13 January 2020. Activities conducted were EPI desk review supplemented with quick 30 HH cluster surveys in selected UCs of Tehsil DG Khan, verification of HR&MP registration, Zero Reporting and AFP case validation, retrospective active case search in selected health to detect and timely report AFP cases using traditional RRU assessment Tools. It was found that WPV1 introduction to DG Khan might have been through high presence of semi to permanently settled HR&MP (High Risk Migrant& Mobile Population) but traveling and returning originally from Districts with ongoing/intermittent WPV1 circulation. Vanished herd immunity due to long time with no Campaign and worsened by deteriorating of RI service delivery and specially missed opportunities to provide high number of due OPV doses in 2019 played incremental role to widen the gap. It was concluded that Emergency Immunization activities should be carried out in terms of quality Crash Programs with regular frequencies of 1 every 2.5 months from January 2020 onward till minimum of 1-year period in all priority UCs. All NEAP (National Emergency Action Plan) areas of work (Surveillance, SIAs and EI) as related to HR&MP to be strengthened in HR&MP priority UC.

Keywords: Investigation, Polio Cases, Routine EPI, Dera Ghazi Khan

1. Introduction

Polio is a viral disease that affects the children and causes the permanent disability. Three environmental sites were established in district DG Khan in 2016 for isolation of polio virus from sewerage samples of these environmental sites. Two Human Wild Polio Viruses (WPV1) cases are confirmed by the NIH Laboratory. Need of the hour is to dig out the reason/s behind. The question relevant in this situation is that whether the recently emerged situation is due to the WPV circulation in various regions of Pakistan especially against the backdrop that some areas among them are now heavily flooded with virus or there are some programmatic and/or performance gaps responsible for it [2, 6-8].

Therefore, the answer is to be sought for the question, if the recent infection is due to direct importation, via an intermediate carrier or as a result of any internal circulation.

Moreover, it is important to gauge the extent of spread of infection and the risk of its spread to other areas and to rule out the possibility of establishment of internal circulation.

Finally, the investigation team is to come up with recommendations based on the drawn conclusion to halt this virus circulation followed by subsequent follow ups of status of implementation of recommendations along with measuring their impact [9-11].

Keeping in view the epidemiological risk factors faced by district DG khan, performance gaps in RI, some operational issues in SIA and challenges like massive HR&MP influx of suboptimal immunized population from already infected areas with a back ground of sensitive surveillance system, an educated guess can be made that the recently identified WPV infection is a result of

an established circulation in the city following importation of virus due to inundation of infected public/HR&MP arriving the city from core reservoirs and endemic areas. The compromised quality of RI services is possibly a nidus for development of the recent outbreak [4, 14-15].

2. Materials and Methods

Thursday 9th of January 2020, the National Laboratory shared the communication about the Positive isolation of WPV1 from two AFP Cases with EPID No. PAK/PB/81/19/431 and PAK/PB/81/19/433.

In consultation initiated by the OIC WHO and EOC Core team, EOC coordinator approved to constitute the Investigation Team for deployment immediately.

The assessment was carried out through EPI desk review supplemented with quick 30 HH cluster surveys in selected UCs of Tehsil DG Khan, verification of HRMP registration, Zero Reporting and AFP case validation, retrospective active case search in selected health facility settings and assessment of the extend of HCP capacity and attitude to detect and timely report AFP cases using traditional RRU assessment Tools, plus focus group discussion and social profiling of the Polio Case.

The field investigation was conducted from 10-13 January 2020. Debriefing Meeting was held in DC office on 18th January 2020 as CR was started from 14th January. TAG recommendation implementation status was checked. Microplans desk review and field validation was done. DPEC minutes were reviewed. APF cases desk review and field validation was done. ODK visits and zero reports were reviewed. Active and zero sites visits were done.

District Surveillance Review Committee minutes and cluster investigation reports were also reviewed. HR&MP field validation and analysis was done. Health Care Providers orientation assessment and compilation was done. 30 HH clusters were taken, Granular analysis and HR analysis was done. Social Profiling and Focused Group Discussion was done.

Dera Ghazi Khan Division is in southern Punjab having boundaries with Sindh, KPK and Baluchistan. It has total population of 2.8million. DG khan city serve as junction for population movement from Sindh, Baluchistan & Khyber Pakhtoon Khawa, because of its geographic location. The bordering districts are DI Khan including FR DI Khan from KPK, Kashmore in Sindh and Barkhan, Dera Bugti and Musa Khel from Baluchistan [5].

3. Results

Table 1: Shows the demographic and clinical features of both cases EPID Number PB/81/19/431 and PB/81/19/433. [1]

Demographic and clinical features	PB/81/19/431 (Case Number)	PB/81/19/433 (Case Number)
Age	6 months	12 months
Gender	Female	Female
Date of onset of paralysis	18-12-2019	25-12-2019
Site of paralysis	Left lower limb	Both lower limbs
SIA Doses	2	5
RI Doses	2	0
IPV	0	0
ITD Result	NSL1	NSL1
Genetic Sequencing	R4B5C5B2B	R4B5C5B2B

Field validation of 112 children in 9 Union Councils were done against the District HR&MP Registration. 89 out 112 (79%) children were matching with the registration. 76 Children were found fully vaccinated which comprises of 67% of the total. 7 Zero dose children were recorded as well which is quit a big number among the validated children. Travel history was found among the children to and from following districts: Rajanpur, Muzaffargarh, Pakpattan, Sahiwal, Multan, Sehwan Sharif, Kashmor, Loralai and Kolhu, which shows a movement of three provinces: Punjab, Bolochistan and Sindh. Seasonal migration during winter and crops harvesting seasons is observed. 75% HR&MP children found matching during field validation with registration done by the district team. Only 68% among eligible children found aged matched vaccination (fully immunized). 6% eligible children found as zero dose. HR&MP validation shows that 58% of population is on the move. HR&MP population having trend of mobility in all infected areas (Karachi, Quetta Block, South KPK) [3].

As part of the investigation for isolation of WPV in 02 cases in DG Khan, the surveillance system in DG Khan was assessed for the sensitivity.

The district has NPAFP rate of 32 for the year 2019. Tehsil DG Khan has NPAFP rate 32.6, Taunsa has 32.5 and tehsil Tribal has NPAFP rate of 21.3. A total 454 cases have so far been reported for the year 2019. Notification within 07 days and stool adequacy is >80% for all the tehsils. The NPEV for the district is 19% and all the tehsils have >10% EV Isolation [1].

AFP cases with 03 doses through RI among children between 6-59 months are 78% [2].

Case files are well maintained except the files for the month of December as the cases are still under process [2]. The line list is maintained for the year 2019.

Zero reports are maintained with the support of the district support staff, monitored regularly by the WHO staff [3].

The surveillance sites visited included DHQ Hospital, Private Hospital Dr. Suleman Malik, RHC Sarwar Wali, RHC Sakhi Sarwar, BHU Samina, and Civil Hospital Fort Monroe. The visits were regular but the visits are required to be more effective. In DHQ hospital a case “Aleena” was labelled as AFP on 04.01.2020 and not in the line list. The District Surveillance Officer informed that the child is not traceable due to insufficient address; however, the child was found on the same day by the reviewer without any significant effort. Another child “Yousaf” mentioned as traumatic Neuritis in the register of 09th January was not notified and could not be traced as yet. In RHC Sarwar Wali, the PEO Dr. Sehrish had a documented visit on 10th January 2019 but a child “Irshad” was mentioned on 09th January as suspected GBS but was not notified by the MO and also could not be picked up by the surveillance team.

The DSRC meetings are held regularly and the minutes are available in the district office. The cluster investigation reports till week 51 are prepared and shared with the Divisional surveillance officer. The DSO has shared the reports till week 48 with the provincial office.

04 AFP cases were visited for review. One each from the UCs of the 02 cases and one each from the adjoining UCs. The data was concordant, however, the issue of monitoring of the samples was found in EPID 390 where the ice packs were not changed with one sample collected on 30.11.2019 and the other on 03.12.2019. 20 Formal and 22 Informal

health care providers were visited for the assessment of their orientation status. As per the assessment based upon the said criteria, AFP Orientation Sensitivity of Formal HCP was found to be 63% and that of in formal HCP was 65%.

Non Polio-AFP Rate for district was 32 in 2019 (AFP-Clustering in every month). 78% AFP-cases reported with Essential Immunization-03 OPV-doses but field revealed this DATA as fake. Missed case during active surveillance visit to DHQ hospital DG-Khan (GBS). Zero-reporting books for 2019 not found at health facilities (reportedly collected by DHMT and ZD for 2020 yet to be issued). Reverse cold chain not maintained 01/04 AFP-cases validated. AFP-case of UC-Aali Wala provided stool carrier 07-months back but not collected by the team (Samples were then collected at NMC Multan). WPV-I Case of Aali Wala found zero dose for EI-OPV and SIA OPV (Fake entries noticed in EI-record).

Overall assessment of the SIAs indicators clearly show that district has significant difference in target versus reported coverage i.e., in 04/05 SIAs in year 2019, the coverage exceeded 105% and June, 2019 SIA is an exception in which it was 102%. This variance may be explained by notable population influx or poor micro planning or both at the same time. Most importantly, the target population of district is 650,950 and on an average 31543 children are vaccinated in excess to the expected (target population) in each SIA during the last 05 rounds. This led to the utilization of 32547 additional doses (1806-Vials) in each SIA which was most probably taken from EI-stock. Additionally, based on the statements of LHW, Vaccinators and LHVs, the EI-antigens were administered without OPV doses which may be consequent upon extra utilization during the SIAs [3].

Table 2: This table shows the still missed children (NAs and Refusals) reported during campaigns in 2019. [3]

Name of Campaign	Still Missed NAs (n)	Refusals (n)
NID-January-2019	97	0
SNID-March-2019	818	1
NID-April-2019	2460	4
SNID-June-2019	547	5
NID-December-2019	480	0

Still missed children analysis in below table clearly shows an increase in still NA which is most likely due to an impact of April-Peshawar incidence but was well managed by the district PEI-team as depicted by the Data.

HR&MP coverage is in line with their seasonal migration pattern (arrival in winter and return during summer) to a great extent, however the dramatic increase in recording of zero dose among them (2505 in SNID-June and 6175 in NID-December) and reporting of 08 AFP cases during campaign seemed to be an alarming bell for an Outbreak. Unfortunately, these facts remained unnoticed by the district technical support team.

Table 3: This table shows the recording of zero dose children, AFP cases and HR& MP coverage during the campaigns of 2019 [3]

Name of Campaign	HR&MP Coverage (n)	Zero Dose Recording (n)	AFP Recording (n)
NID-January-2019	9544	2714	4
SNID-March-2019	9191	2792	1
NID-April-2019	7800	2089	1
SNID-June-2019	4843	2505	1
NID-December-2019	9266	6175	8

Table 4: This table shows the LQAS passing percentage tehsil wise during the campaigns of 2019

Name of Tehsil	LQAS Passing %
DG Khan	100%
Taunsa	83%
Tribal	50%

Annual summary of LQAS conducted in 2019 shown cumulative poor quality of Campaigns in Tehsil Taunsa and very much poor quality of Campaign in tribal tehsil (50%) [5].

Having a bird's eye view at the data, the SIA workload at Tehsil and district level seems rationalized. However, some of the MTs have been found to be suffering from extra workload during field investigation (e.g., Sakhi sarwar, Aaliwala, Kot Chutta) especially against the backdrop of the fact that nearly 32000 children are being vaccinated in excess to the planned target in every SIA for which rationalization is yet to be done, off course after hiring new Mobile Teams.

Further analysis of EI Service availability done in reference to 5 components; as related to the presence or not of GOVT Health facility, EPI Centre, Vaccinators, LHVs and LHWs revealed that every UC (100%) of DG Khan District has at least one vaccinator. There are no Government Health facilities in only 7 UCs (12%): All in DG City, Ramin, Urban-1, Urban-2, Urban-3, Urban-5, Urban-6, and Urban-7. No EPI Centre nor LHVs in 8 UCs (14%): All in DG Khan City, Ramin, Urban-1, Urban-2, Urban-3, Urban-5, Urban-6, Urban-7, and Churhatta. No LWHs in 5 UCs (8%): Bahadar Garh, Paigan, Ramin, the 3 in City, Kot Qaisrani (in Taunsa), and Mubarki (in Tribal Tehsil). There are less than 10 LHWs in 8 UCs (14%): Chabbri, Churhatta, Haji Ghazi, Wadoor, Yaroo (the 5 UCs in City), Basti Malana, Darkhast Jamal Khan (the 2 UCs in Kot Chutta), and Makwal Kalan (in Taunsa). 15 UCs (25%) having 10 to 19 LHWs: 9 in City, 4 in Kot Chutta, 1 in Taunsa and 1 Tribal Tehsil. 31 UCs (53%) having 20 or more LHWs: 9 in City, 9 in Kot Chutta, 10 in Taunsa and 3 Tribal Tehsil. By these numbers Tehsil wise aligning with the 5 parameters, the Assessment team depicted positive observation about UC level EPI service availability in the District; requiring to be efficiently operated.

However, observations from 3 years comparative analysis of OPV-3 administrative coverage through UC wise categorization according to RI coverage data from 2017 till December 2019 revealed contrasting performances in the last 2 years. UC wise Administrative coverage in 2017 were far better, with no UC classified under 80% OPV3 coverage, 11 UCs (19%) with OPV3 coverage between 80 to 90%, 16 UCs (27%) with coverage between 90 to 95% and 32 UCs (54%) with OPV3 coverage above 95% [3].

The remedial efforts in 2019 raising the trends but still not better than 2017; this with increase of the number of UCs with OPV3 coverage >=95% from 4 in 2018, to 29 by December 2019; the number of UCs with OPV3 coverage between 90 to 95% from 8 in 2028 to 14 in 2019 (24%); and

the decrease of the number UCs with OPV3 coverage between 80 to 90% from 31 in 2018 to 14 (24%) in 2019; and last the decrease of the number of UCs with OPV3 coverage below 80% from 16 in 2018, to 2 in 2019.

Essential Immunization handed over to LHWs at UC-level. LHWs not providing OPV with BCG/P-I/P-II/P-III (due to lesser target 8-10 antigens/month and OPV is 20-doses vial hence were not provided with). LHWs also involved in BCG/Measles vaccination (6/21-FGD in UC-Aali Wala). LHWs keeping vaccine at home (all antigens) for vaccination. Issuance of Fake EPI-Cards with full antigens entry but non-vaccination simultaneously (LHVs, LHWs). Willfully leaving blank rows in daily EPI-register to cover any un-expected scenarios (Like Polio/Measles cases outbreak). Lack of supervision of essential immunization activities due to shortage of supervisory cadre (Vacant positions). Lack of understanding of newly introduced EI-HR structure confusing district health authorities for filling of positions and budgeting.

A total of 608 HHs were visited during the survey, in 20 UCs of DG Khan, including 7 from the rural Tehsil (Kot Chutta) & 13 UCs of DG Khan City. With exception from Tribal UC of Tuman Laghari, bordering UCs of Ali Wala, the UC of Case EPID # PB/81/19/431 and Sakhi Sarwar, the UC of Case EPID # PB/81/19/433 were included in the Survey. 50 (8%) of the 608 visited households were identified as non-local. During the Survey, 1,141 under 5 year's children were evaluated for immunity, health and nutritional status:

On Routine Immunization, the main findings during 30 HH Cluster were as follows;

Analysis of RI as revealed during the survey clearly relayed alarming figures of administrative coverage. On Recall, OPV-3 coverage for children of 6-23 months of age were found at 80% (312 out of 389 found vaccinated). UC level large shortfall in OPV3 coverage (on recall) highly worse. 6 out 13 UCs surveyed in DG Khan City found with OPV3 coverage below 80%: Khakhi (76%), Urban-1 (75%), Wadoor (74%), Urban-3 (71%), Urban-6 (68%), and Urban-2 (62%). Ghaus Abad with 83% and Ali Wala with 68%, Kot Chutta Tehsil. Looking at the Vaccination status for Children of 0-23 months of age, with Routine OPV doses (on Recall), the distribution (number &%) by Age Group showed;

36 children of 6-11 months (30%) un-fully vaccinated out of 119; this reflecting the large immunity gap as related to worse service delivery in 2018.41 children of 12-23 months (15%) un-fully vaccinated out of 268; this reflecting the situation in 2017.

In overall, the card retention was found poor at only 63% for children of 6-23 months of age; with the highest retention in UC Gadai of 71% and poorest in Urban-2 (15%), Urban-1 (38%), Urban-5 (26%) of DG Khan City and Choti Bala (24%) and Ghaus Abad (39%) in Kot Chutta.

Further issues of concerns as revealed during the 30 HH cluster survey were as follows; Essential Immunization uptake for due dose and/or antigen per age cohort were found the poorest; because only 18% of children tallying with specific age cohort for due dose was found vaccinated accordingly (98 out of 542 children). The uptake at younger age (<1.5 month), meaning for BCG and OPV-0 was 64%, then decreasing gradually as the children grow, up to only 18% at 15 months for MVC2. This meaning that most children are not vaccinated on due schedule. The overall defaulter rate was 29%, early defaulters' rates were found at 27% and 64% respectively for OPV-0 and OPV-1, while late and/or chronic defaulters' rates at 48%, 18%, and 12% respectively for OPV-3, MCV1 and MCV2.

5 children under 24 months of age were found with doses and/o antigen beyond current age; this would be either data compilation issue, or a really problem of incorrect records on vaccination cards by vaccinators (suggestive of suspicious of fake card requiring to be investigated).

From Households with history of travel out of the District, 32 individuals (including some adults) went out of the District; 6 (19%) of them went to Multan, 4 (13%) to Karachi, 4 (13%) to Lahore, 1 (3%) to DI Khan, 1 to Quetta (3%), and the remaining to destinations of minor importance in this assessment.

Regarding communication, the ssurvey suggested that parents or caretaker of 505 Households (83%) out of 608 feel polio as a risk. Parents or caretakers of 438 Households (72%) out of 608 are fully aware of immunization values for their children.

Only 344 households (57) out of 608 surveyed know about the last SIA round prior to the house visits, which is very small and reflecting poor social mobilization activities before the SIA. Major communication channels relaying information about campaigns prior to house to house visits were; Health workers (LHWs), 58%, TV 19%, Mosques 8%, Radio 6%, SMS 2%, Posters/Banners 1% and Other 5%.

4. Conclusion and Discussion

WPV1 introduction to DG Khan might have been through high presence of semi to permanently settled HRMP but traveling and returning frequently to or from their areas of origin; substantiated by identification of about great number of HRMP Settlements scattered all across DG Khan, harboring families originally from Districts with ongoing/intermittent WPV1 circulation. These links as described, are basis for classification as high priority as travel history reveled by 30 HH clusters show intense links of district DG Khan with Multan, Karachi, Lahore, DI Khan and Quetta.

Possible means of importation of WPV in DG Khan were frequent to and fro movement from districts Karachi, Loralai, Lahore and Multan which are already infected. There is usual HR&MP influx at the start of winter from Baluchistan. Majority of these are seasonal migrants from Loralai. People from Baluchistan (Kohlu, BarKhan, Dera Bugti, Rukni, Moosa khel) pop in for seeking health from DG Khan Teaching Hospital and other health care facilities. Pushtoons from Bannu and DI khan arrive here for tobacco purchase after its harvesting in July and August. Notable number of people hailing from DG Khan, work in Quetta and Loralai in Education department as teachers, Baluchistan Levi, Baluchistan police and manage their personnel business there. These people reappeared from time to time in DG khan during gazette and other holidays [12].

Possibility of internal circulation also cannot be ruled out especially in the background of scarce campaigns (No campaign after June till December).

Vanished herd immunity due to long time with no Campaign and worsened by deteriorating of RI service delivery; and specially missed opportunities to provide high number of due OPV doses in 2019 played incremental role to widen the

gap.

Imbalances between the extent of availability of RI services as related to the presence or not of EPI Centre, the presence or not of Vaccinators, the presence or not LHVs and the presence or not of LHWs and the level of deteriorating RI performances is obvious; such that there is need to strengthen the quality of operations using efficiently current resources under the leadership of DG Khan DHMT.

Awareness level regarding vaccines and vaccine-preventable diseases in the community is very low. Health staff working on the curative side has limited knowledge about the preventive aspect of medical interventions. Families frequently pay visit to curative practitioners and on asking a question about vaccine they do not get suitable answers.

Polio workers IPC skills, general behavior and knowledge base is a concern. Suboptimal training of FLWs needs urgent attention.

Three high quality case responses campaigns are required. Ensure implementation of high-quality subsequent Polio SIAs. Carry out Emergency Immunization activities in terms of quality Crash Programs with regular frequencies of 1 every 2.5 months from January 2020 onward till minimum of 1-year period in all priority UCs (Red and yellow UCs). Ensuring gradual Strengthening of Routine Immunization Service delivery by Banning RI provision by LHWs, Conduct refresher Training for Vaccinators on Immunization in Practice, Regular supervised updates of UC micro plans according to monthly defaulter lists, Regular and quality supportive supervisions of vaccination sessions at health facilities and during outreaches. Multi-pronged approaches required to enhance the community awareness and demands. Vigilant monitoring and supervision of EPI record by tehsil and district health authorities. Practice of willfully left-over blank rows on EPI registers to be condemned [13].

Stern accountability measures for those involved in data tempering and found to be irresponsible. All NEAP areas of work (Surveillance, SIAs and EI) as related to HR&MP to be strengthened in HR&MP priority UCs. On surveillance, adequate measures required to enhance the AFP case detection on 1st contact; Town wise early detection within 7days. Enhanced Monitoring of surveillance activities is need of the hour. Community mobilization and influencer engagement should be ensured to explain the effectiveness of vaccines, rationale of frequent campaigns and missed children follow ups.

Pediatricians in Private and Public hospitals and health staff working in civil dispensaries need to be taken on board regarding vaccines and vaccine preventable diseases. This can help in avoiding Peshawar like unfortunate incidents. IPC training should not be limited to operational questions. Front line workers need to be properly trained/knowledge full so that behaviors that are social and culturally accepted may be promoted.

5. Data Availability

There will be open access to the data to all the readers who will see the data supporting the conclusion.

6. Conflict of Interest

The authors declare that they have no competing interests.

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