ACUTE FLACCID PARALYSIS SURVEILLANCE
A Laboratory Perspective

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Introduction

• Acute Flaccid Paralysis (AFP) is a clinical syndrome characterized by a sudden onset of weakness of a limb, described as flaccid in a child below 15 years of age.

• AFP mimics the clinical presentation of poliomyelitis, hence AFP surveillance was adopted globally as a key strategy for monitoring the progress of the polio eradication initiative.

• A good AFP surveillance system serves as a sensitive tool for detecting potential poliomyelitis cases and thus alerting health managers and clinicians to timely institute appropriate interventions to interrupt any poliovirus transmission.

• Effective AFP surveillance is also crucial for verifying, with confidence, the absence of wild poliovirus circulation in countries that are no longer reporting cases of poliomyelitis.

• In RSA the last case of poliomyelitis due to the wild poliovirus was reported in 1989.

• However the country remains at risk of wild polio virus re-importation from the remaining polio-endemic countries.
Poliomyelitis- Epidemiology

1. Infectious Agent

• The polioviruses are three related enteroviruses: types 1, 2 and 3 (serotypes).

• All three types cause paralysis, but the most frequent cause of epidemic polio is poliovirus type 1.

• Type 1 is most neurovirulent with a case to infection ratio about 1:200.

• Most vaccine-associated cases are due to type 2&3.

• Circulating wild type 2 poliovirus has not been isolated since October 1999.
Epidemiology

2. Infectivity & Immunity

Infectivity

• Highly infectious with an infected individual infecting all other non-immune persons in a household, especially where sanitation is poor.

Immunity

• Protective immunity against poliovirus infection develops by immunization or natural infection.
• Immunity to one type does not protect against the other types.
• Immunity following natural infection or administration of live oral polio vaccine (OPV) is believed to be life-long.
Epidemiology

Transmission

• Person-to-person via the faecal-oral route, i.e. the poliovirus multiplies in the intestines and is spread through faeco oral route;

• The incubation period is 7-21 days and virus spreads rapidly to the non-immune and transmission is usually widespread by the time of paralysis onset.

• The virus is intermittently excreted for 1 month or more after infection;
Epidemiology

Reservoir

• Poliovirus infects only human beings and there is no animal reservoir.
• The virus does not survive long (less than a month) in the environment outside the human body.
• There is no long-term carrier state.
• Good candidate for eradication
Global Polio Eradication Initiative

- Polio earmarked for eradication and strategy adopted at the 41st WHA in 1988 (initial plan was to eradicate polio by 2000)
- Revised target to interrupt wild poliovirus transmission by 2012

**Strategy pillars of the GPEI**
- High routine infant immunisation coverage
- Supplementary immunisation via NID & SNIDS
- Surveillance programmes
  - AFP
  - Laboratory virological studies
- Targeted mop-ups operations in areas of focal transmission

**Afterwards—Polio Endgame**
- Polio-free certification.
- Laboratory containment of poliovirus.
- Stopping polio immunization.
Surveillance

**AFP Surveillance-role**
- To identify high risk areas or groups
- To monitor progress
- To certify a country polio-free
- Utilize data to choose supplementary strategies

**Laboratory surveillance-role**
- Includes clinical and environmental samples
- WHO global polio laboratory network-145 accredited labs worldwide
- Use standardised diagnostic methods for viral isolation and intratypic differentiation
  - To trace the origin of a case
  - To certify that polio has been eradicated
  - To identify wild type vs vaccine derived polioviruses
AFP surveillance standard case definitions

Any patient under 15 years of age with acute, flaccid paralysis, not caused by trauma

OR

A patient of any age in whom a clinician suspects poliomyelitis

For Surveillance purposes we are looking at AFP not Poliomyelitis

Any condition which presents with rapid onset of paralysis or weakness
AFP DIFFERENTIAL DIAGNOSIS
(CONDITIONS WHICH MAY GIVE AFP SYMPTOMS)

- Guillain-Barré Syndrome
- Traumatic neuritis
- Transverse myelitis
- Other enteroviruses
- Poliovirus
- TB-spine
- Organophosphate poisoning

Acute flaccid paralysis
AFP investigation

- Collection of TWO stool specimens, 24 to 48 hours apart in the first 14 days following the onset of paralysis-packed on ICE
- Fill in AFP Case Investigation Form, include Epid #(NOT usual NHLS request form)
- AFP CIF is packed with sample, serves as request for the test
- Send specimen to NICD
- 60 day follow up, where indicated (incompletely investigated cases)
- Classification of cases by NPEC
Why 2 stools within 14 days of AFP onset?

- Poliovirus has a diurnal excretion pattern
- 2 specimens are taken because the viral content varies on a daily basis;
- Most of the excretion occurs in first 14 days

Days following paralysis onset
Procedure for collection of stool

• Collect at least 1 adult thumb-sized amount of stool
• Place in wide-mouthed plastic container, with screw on cap tightly closed
• Label container with name, case Epid number & number of stool specimen (1 or 2)
• Specimen placed in a sealed plastic bag
• CIF placed in a separate & sealed plastic bag
• Transport specimen in a cool box below 8°C
• Ensure arrival to NICD within 3 days of collection
Stool Sample

Stool Processing
Purification / virus extraction

National Lab e.g. NICD

Isolation: 14/7

RRL: Sequencing Lab: 7/7

Sequencing: Wild poliovirus/ VDPV/ Vaccine

Intratypic Differentiation Lab: 7/7
ITD (NSL/Discordant/ vaccine)
Timeline of AFP investigation

- AFP onset → Stool sample
- Lab result: Wild polio virus?
  - Adequate
  - Inadequate
- 60 Day Follow-up
  - Residual paralysis?
  - Lost to follow up?
  - Died?
- Classification
Application of Lab results

- Suspected poliovirus: Inform program & refer for ITD (no program action yet)
- NSL at ITD: report, refer for sequencing for confirmation, respond as if WPV (outbreak investigation),
- WPV: Respond by outbreak investigation/vaccination - Mop up activities
- VDPV: Surveillance for more and if circulating; respond exactly as for WPV
Classification of AFP cases

Clinical criteria (early stages of polio eradication)

- Wild poliovirus → Confirm
- Residual weakness, died or lost to follow-up → Confirm
- Inadequate specimens → Inadequate specimens
- No wild poliovirus → No wild poliovirus
- No residual weakness → Discard
- Two adequate specimens → Discard

Virological criteria (advanced stages)

- Compatible → National Expert Committee Review → Discard
- Discard
- Discard
- Discard
NPEC-National Polio Expert Committee members

• Paediatrician
• Paediatric Neurologists
• Epidemiologist
• Public Health Specialist
• Virologist
AFP Surveillance targets

• Good vaccine coverage >90% routine and >95% during mass campaigns

• Target of AFP cases = 4/100 000 (previously 2/100 000)

• AFP STOOL ADEQUACY= 80% (2 stool specimens, 24hrs apart, within 14 days of onset of paralysis)

• COMPLETENESS & TIMELINESS OF REPORTS (incl. weekly zero reports)
## AFP surveillance Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Target</th>
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<tr>
<td>Non-Polio AFP rate per 100,000 of the ≤15 yr old target population</td>
<td>4.0/100 000</td>
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<tr>
<td>Stool adequacy: cases with 2 adequate stools collected 24 to 48 hours apart within 14 days of onset of paralysis</td>
<td>80%</td>
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<td>Specimens arriving at lab &lt;3 days of being collected</td>
<td>80%</td>
</tr>
<tr>
<td>Specimens arriving at lab in good condition (± 5g, on ice, not leaking)</td>
<td>90%</td>
</tr>
<tr>
<td>Non-polio Enterovirus isolation rate</td>
<td>10%</td>
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<tr>
<td>Lab results available within 14 days of receipt</td>
<td>80%</td>
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<tr>
<td>Indicators</td>
<td>Min target</td>
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<td>---------------------------------------------------------------------------</td>
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<tr>
<td>Number of isolation samples annually</td>
<td>At least 150</td>
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<tr>
<td>ITD test results reported within 7 days:</td>
<td>&gt;80%</td>
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<tr>
<td>Wild poliovirus and suspected VDPV isolates from AFP cases and contacts referred for sequencing within 7 days of detection</td>
<td>&gt;80%</td>
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<tr>
<td>Score on most recent Isolation/ intratypic differentiation PTs is at least 90%:</td>
<td>&gt;90%</td>
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<tr>
<td>Score on annual on-site review is at least 90%:</td>
<td>&gt;90%</td>
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<tr>
<td>Reporting isolation results of AFP clinical specimens within 14 days of receipt</td>
<td>&gt;80%</td>
</tr>
<tr>
<td>Annual NPEV isolation rate</td>
<td>10%</td>
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Vaccine Derived Polioviruses (VDPVs)

- Oral polio vaccine related viruses that have re-acquired the transmission characteristics of wild polioviruses
- Genetically different to Sabin vaccine viruses by >1% in the major surface protein-VP1
- The genetic change occurs when Sabin vaccine viruses recombine with other enteroviruses in the gut.
- 3 types of VDVPs
  - cVDPV-circulating VDPVs emerge when poor vaccine coverage allowing their circulation in susceptible communities
  - iVDPV-occurs in small number of patients with primary immunodeficiencies
  - aVDPV-little known, occur in situations with insufficient clinical, epidemiological and virological data.
- VAPP-vaccine associated paralytic polio
  - Rare paralytic disease in a vaccine recipient or close contact (1: 3-5 million OPV cases)
Status update-Wild and Vaccine derived polio

Wild Poliovirus & cVDPV Cases¹, 2015
01 January – 31 December

Data in WHO HQ as of 16 February 2016
POLIOVIRUS CONTAINMENT TIMELINE

**Phase I: Global Readiness Coordination**
- 2014: Inventory, Destruction, Preparation for containment
- 2015: Essential facilities holding WPV
- 2016: WPV2 containment (Biorisk management; Population immunity)

**Phase II: Global Poliovirus type 2 Containment Period**
- 2016: Global readiness of withdrawal
- 2017: OPV2 withdrawal
- 2018: 6x Regional eradication certification
- 2019: OPV2/Sabin2 poliovirus containment (Biorisk management; Population immunity)

**Phase III: Longterm Poliovirus Containment**
- 2019: Final containment* of all WPV (Biorisk management; Population immunity; Environmental siting)
- 2020: Containment of all Sabin polioviruses (Maintain OPV2/Sabin2 requirements)
- 2021: Safe handling of new samples potentially containing PV material in non-essential laboratories

Legend:
- Green: No containment
- Yellow: Adoption of safe handling measures
- Pink: Containment of WPV2, OPV2/Sabin2; Final containment of all OPV/Sabin polioviruses
- Red: Final containment of all WPV

*proposed major facility enhancements:
1. exhaust air filtration
2. effluent treatment