Surveillance of Acute Flaccid Paralysis: Epidemiological Aspects and Surveillance Indicators in Kankan Health Regional

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Research Article

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Abstract

Since September 2015, Guinea has experienced the vaccine-derived poliovirus type 2 epidemic. Objectives: To describe the epidemiology and factors associated with AFP cases and analyse surveillance performance indicators. Methods: This is a descriptive historical study covering the period from January 1th to December 31th, 2016 among children under the age of 15 of Kankan regional health directorate, Guinea. The data collection is done based on the existing documents review. Results: 200 cases of AFP were notified during the study period. 59.5% of the children are male with an average of 3.5 years. 60.5% of patients had received 3 or more doses compared to 15.5% who had never received polio vaccine. Malaria was the most probable cause about 39% of AFP cases. The clinical picture is classic, fever is associated with 65.5% of cases and it evolved in 3 days in 75% of cases. The hospitalization rate is 53%. 72% of the samples came out negative. Three indicators did not achieve the expected objectives. Conclusion: The performance of the surveillance system needs to be improved for better sensitivity by both government staff and supporting partners, in order to avoid a new epidemic.

Introduction

Before the establishment of the Expanded Program on Immunization (EPI) in 1974, there were 500,000 new cases of poliomyelitis per year in the world [1].

Acute flaccid paralysis (AFP) surveillance has been adopted by the World Health Organization (WHO) to monitor the progress of the Global Polio Eradication Initiative [2].

Since the establishment of the "GPEI" in 1988, the incidence of polio has been reduced by 99%, from an estimated 350,000 cases/year to 1,633 cases in 2008[3].

National acute flaccid paralysis (AFP) surveillance is the gold standard for detecting polio cases. It has four steps [4]:

- • Detect and notify children with acute flaccid paralysis (AFP);
- • Transport stool samples for analysis;
- • Isolate and identify poliovirus in the laboratory;
- • Map the virus to determine the origin of the strain.

According to the WHO, in 1988 there were 350,000 cases of poliomyelitis reported by 125 countries. Most of them were from African countries. But in the year 2000, the deadline for poliomyelitis eradication, it was realized that there were still 2,800 cases of poliomyelitis recorded in 20 countries, particularly those affected by armed conflict [5].

Following the 1988 World Health Assembly resolution to eradicate poliomyelitis, the number of countries in which the disease is considered endemic fell from over 125 in 1988 to just six by the end of the year 2003. As part of the eradication strategies, a sensitive global surveillance network has been established,

which detects a high proportion of cases of acute flaccid paralysis (AFP) in children < 15 years of age, by submitting specimens coprological to virological examinations aimed at detecting cases of paralytic poliomyelitis [6].

A good AFP surveillance system serves as a sensitive instrument for detecting potential cases of poliomyelitis and thus alerting health policy makers and clinicians to undertake timely and appropriate interventions to interrupt any transmission of wild poliovirus [2].

However, it must remain an anti-polio fortress until the confirmation of the "world polio free" status by maintaining a level of performance capable of identifying and investigating all cases of AFP [7].

It must, however, be recognized that indisputable successes have been achieved. In 1994, the Americas region was declared polio-free, and in 2000 the Western Pacific region, including mainland China, was declared free of wild polioviruses. The number of reported cases worldwide has decreased drastically [8].

In 2002, WHO and partners developed the Reach Every District (RED) approach to raise and maintain routine immunization coverage at a high level [9].

The eradication of the disease by vaccine is the main challenge of the current century and the end of the tunnel has never been so close. The 4 strategies recommended by the WHO are [10] [11]:

- -Achieving high routine coverage of at least 95% with 4 doses of the oral vaccine in the first year of life;
- -Organize mass vaccination activities against poliomyelitis to reach all children from 0 to 5 years old;
- -Organize door-to-door vaccination campaigns to sweep areas at high risk of transmission;
- - Surveillance through early detection and laboratory analysis of samples of all cases of AFP in children under 15 years of age.

The WHO, as part of the strategy of vertical programs, initiated in 1974 the expanded immunization program to protect children against poliomyelitis, measles, whooping cough, diphtheria and tuberculosis [11].

Although PFA is the most visible sign of infection, it appears only in rare cases at a rate of 1/200 for wild virus type 1, 1/1200 for wild virus type 3 and 1 /2000 for wild virus type 2 [4]

Since September 2015[12], Guinea has been hit by the type 2 vaccine -derived poliovirus epidemic. To date, 7 cases of type 2 cVDPV have been notified, including 6 in the Siguiri health district and 1 in Kankan. Indeed, on September 3, 2015, the Republic of Mali detected a case of poliovirus derived from vaccine type 2 (cVDPV2) [5]. The child came from the District of Siguiri in the Kankan Region in Guinea. In August 2014, a first case of cVDPV type 2 was detected in the same health district of Siguiri, but did not benefit from a vaccination response. Genetic sequencing had shown that these two viruses are 98.13% compatible, suggesting circulation undetected by the surveillance system for at least a year. In

response to this epidemic, 7 polio vaccination campaigns were organised, including four (04) at the national level and three (03) located in regions at risk (Kankan and Faranah).

Research Questions:

- -What are the factors that would favour the appearance of acute flaccid paralysis?
- -What is the epidemiological and vaccination profile of acute flaccid paralysis?

The search for an explanation to these questions and the lack of study on the monitoring indicators of acute flaccid paralysis motivated the choice of the topic entitled:

“Acute Flaccid Paralysis Surveillance: Epidemiological Aspects and Surveillance Indicators in the Kankan Regional Health Directorate”.

Objectives of the study 1- General objective:

Describe the epidemiology and factors associated with AFP cases and analyse surveillance performance indicators.

2- Specific Objectives:

- - Describe the epidemiological characteristics of AFP cases.
- - Analyse the factors causing acute flaccid paralysis.
- - Describe the monitoring performance indicators.
- - Analyse the administrative vaccination coverage in OPV.

Materials And Methods

1. Scope:

The Kankan region is an administrative subdivision of Guinea. The city of Kankan is the capital. It is made up of five districts: Kankan, Siguiri, Kérouané, Mandiana and Kouroussa. It covers an area of 72,145 km2 and has a total population estimated in 2016 at 2,074,689 inhabitants, including 933,610 under the age of 15. To the east, the region has a common border with Côte d'Ivoire and Mali. It is a vast plateau (average altitude: 250 m) cut by the Tinkisso, Niger and Milo valleys, which forms the major part of the savanna zone in the north of the country: Upper Guinea [15].

2. Methodology:

This is a descriptive and analytical historical study taking into account the period from January 1 to December 31, 2016. This period corresponds to the implementation of enhanced surveillance of AFPs by the WHO. The study covered all reported cases of AFP in children under 15 years of age during the study

period and all children from 0 to 59 months who received OPV vaccination. Data collection was based on the literature review on vaccine-preventable diseases. The data was collected from existing folders:

- - For AFP cases and monitoring indicators: The annual AFP register and notification forms were used.
- - For vaccination coverage: The vaccination coverage data were used. They were collected from the monthly vaccination reports and encoded in the DVD-MT (District Vaccine Data Management Tools).

Data were analysed using R software, STATA. This analysis made it possible to describe the epidemiological profile of AFP cases and to assess the performance indicators of the surveillance system.

AFP cases have been adjusted:

- - On the time of year.
- - On the other causes of the appearance of AFP (Severe malnutrition, severe malaria, post-injection trauma) in accordance with the new (sensitive) case definition of AFP in Guinea.
- - On the vaccination status.

Operational definition of variables:

AFP Surveillance Performance Indicators

AFP surveillance performance is analysed using standard indicators whose objectives have been set by the WHO. The indicators below have been analysed.

Indicator 1: Rate of AFP in children under 15 years old year. This is the number of AFP cases recorded per 100,000 children under 15 years of age. (WHO target > 2); Indicator 2: The percentage of AFP cases for which 2 samples are collected within 14 days (WHO target > 80%);

Indicator 3: The percentage of AFP cases for which a 60-day follow-up is carried out to check if the patient has residual paralysis (WHO target > 80%); Indicator 4: Percentage of samples arriving at the laboratory less than 3 days after dispatch (WHO target > 80%);

Indicator 5: Percentage of stool samples arriving at the laboratory in good conditions (temperature < 8°C, stool volume, absence of desiccation) (WHO target > 80%);

Indicator 6: Percentage of samples for which the results are sent within 28 days of their receipt at the laboratory (WHO target > 80%);

Indicator 7: Percentage of samples for which a non-poliovirus enterovirus is isolated (WHO target > 10%);

Indicator 8: Percentage of cases investigated within 48 hours of notification (WHO target > 80%).

Vaccination coverage:

The children were divided into three categories according to the number of doses of OPV administered:

- - Less than one dose: All cases of AFP who did not receive any dose of OPV.
- - One to two doses: All AFP cases who took one to two doses of OPV.
- - Three or more doses: All AFP cases receiving more than three or more doses of OPV, thus considered to have acquired definitive immunity against poliomyelitis.

Other Factors favouring AFP:

These are the factors on the occasion of which a case of AFP is discovered:

- - No Objective Cause: AFP occurring in a child less than 15 years of age in whom no other probable cause is found.
- - Severe malnutrition: A child under the age of fifteen in whom AFP is discovered during severe acute malnutrition.
- - Malaria: Any child under the age of fifteen in whom malaria is the apparent cause of the onset of AFP.
- - Post-injection: When following an intramuscular injection, AFP occurs.
- - Other causes: When it is a cause other than those cited that is at the origin.

Results

Table 1
Distribution of AFP cases by age group and sex in 2016 in the district of Kankan.

Sex	< 1 yr	1–5 yrs	6–10 yrs	11–15 yrs	Total	Percentage
Female	9	52	8	8	77	38,5
Male	15	85	18	5	23	61,5
Total	24	137	26	13	200	100
Percentage	12	68,5	13	6,5	0	

Table 2
Distribution of AFP cases by time of year

Year	Nombre AFP Case	Percentage
January	3	1,5
February	3	1,5
March	23	11,5
April	24	12
May	24	12
June	50	25
Jully	26	13
August	20	10
Septembre	11	5,5
October	9	4,5
November	3	1,5
December	4	2
Total	200	100

Table 3
Distribution of AFP cases according to the dose of OPV received and by gender

	Female	Male	Total	Percentage
0	11	20	31	15,5
01-february	22	25	47	23,5
3+	44	78	122	61
Total	77	123	200	100
Percentage	38,5	61,5	100	

Table 3
Distribution of AFP cases according to medical diagnosis

	Female	Male	Total	Percentage
Anemia	16	24	40	20
Malaria	29	49	78	39
Malnutrition	14	17	31	15,5
Injection	4	10	14	7
None	14	23	37	18,5
Total	77	123	200	100
Percentage	38,5	61,5	100	

Table 4
Clinical presentations of AFP cases

Clinical presentation	yes	no	unspecified
Fever at the onset	131(65,5%)	69(34,5%)	
Progress in 3 days	150(75%)	50(25%)	
Asymmetric Paralysis	54(27%)	146(73%)	
Hospitalization	106(53%)	94(47%)	
Location of Paralysis			
The 2 lower limbs	114(57%)		
Left lower limb	10(5%)		
Right lower limb	8(4%)		
Left upper limb and right lower limb	3(1,5%)		
Right upper limb and Left lower limb	6(3%)		
All 4 members	13(6,5%)		
Left upper limb	14(7%)		
Right upper limb	8(4%)		
The 2 lower limbs and the left upper limb	0(0%)		
The 2 upper limbs	19(9,5%)		
The 2 limbs on the left side	4(2%)		
The 2 lower limbs and the right upper limb	0(0%)		
The 2 limbs on the right side	1(0,5%)		
The 2 upper limbs and the right lower limb	0(0%)		
Location not specified	0(0%)		

Table 5
Distribution of AFP cases by culture results

	Female	Male	Total	Percentage
Negative	60	84	144	72
Suspected poliovirus	13	20	33	16,5
Non-polio enterovirus	4	19	23	11,5
Total	77	123	200	100
Percentage	38,5	61,5	100	

Table 6
AFP case surveillance indicators by health district

Indicators	WHO Objectives	Kankan	Kérouané	Kouroussa	Mandiana	Siguiri	Région
Estimated target population (< 15 ans)		221 901	99 182	126 070	159 584	326873	933 610
Number of AFP cases notified		52	13	51	25	59	200
Nombre of confirmed case		0	0	0	0	0	0
Rate of non-polio AFP in children under 15	≥ 2/100.000	23,4	13,1	40,45	15,67	18,05	21,42
Percentage of AFP cases for which 2 stool specimens are collected within 14 days	≥ 80%	94	84,6	100	100	88	93,32
Percentage of AFP cases for which a 60-day follow-up is performed to check if the patient has residual paralysis.	≥ 80%	1,8	2,4	3,6	4,1	5,6	3,5
Percentage of samples arriving at the laboratory less than 3 days after dispatch	≥ 80%	25	18	34	32	41	30
Percentage of stool samples arriving at the laboratory in good conditions (temperature < 8°C, 7-10g volume, absence of desiccation.	≥ 80%	79	81	76	80	84	80

Indicators	WHO Objectives	Kankan	Kérouané	Kouroussa	Mandiana	Siguiri	Région
Percentage of specimens for which results are sent to the district within 28 days of receipt at the laboratory	≥ 80%	20	18	21	17	62	27,6
Percentage of samples for which a non-polio enterovirus (NPENT) was isolated.	≥ 10%	23	0	7,8	8	10	9,76
Percentage of health districts having notified at least one case	≥ 80%	66,66	87	75	83,33	86,66	79,73
Percentage of cases investigated within 48 hours of notification	≥ 80%	100	100	100	96	98	98,8
percentage of non-polio AFPs who have never received an OPV vaccine	0%	9,6	17,6	0	0	29	11,24

Table 7
Administrative OPV vaccination coverage by health district

		OPV 1		OPV 3	
District	**Target Pop (0–11 month)**	**Vaccinated Children**	**VC**	**Vaccinated Children**	**VC**
Kankan	17752	16509	93%	15267	86%
Kouroussa	10086	9481	94%	9279	92%
Siguiri	26150	26935	103%	24058	92%
Kérouané	7935	7380	93%	6586	83%
Mandiana	12767	13022	102%	12639	99%

Table 8
Regression data, influence of time of year, OPV doses and causal factors on occurrence of flaccid paralysis.

Coefficients				
	Estimate	**Std. Error**	**z value**	**Pr(>|z|)**
Intercept	4,565495	1,0355666	4,41	0,000
Year	-0,3741232	0,108053	-3,46	0,001
OPV Doses	0,0784533	0,1054444	0,74	0 ,457
Origin Factor	0,0221357	0,1567514	-0,14	0,888

Comments

During the study period, 200 cases of AFP were notified in the Kankan region, including 59 cases for the district of Siguiri (29.5%), 52 cases in Kankan (26%), 51 cases in Kouroussa (25. 5%), 25 cases in Mandiana (12.5%) and 13 cases in Kérouané (6.5%). The districts of Siguiri and Kankan are the epicentre of the epidemic that has hit Guinea, which justifies the high number of notifications there.

Most of our patients (61.5%) are male and 68.5% are in the age group of 1-5 years; the average age is 3.5 years with extremes of 1 month and 15 years (Table 1). These results are consistent with most studies, it was noted in Mauritania that 77.5% of patients were under 5 years old [7] and 82.5% in Akwa Ibom (in Nigeria) [13].

The months of June and July recorded the greatest number of notifications, i.e. 26% and 13%, this period constitutes the lean period and the winter period (period of high transmission), which makes it possible to envisage a link with the diet, this same hypothesis was put forward in Mauritania [7].

The cases of AFP were classified according to the number of doses of OPV received, 61% had received 3 doses or more against 15.5% having received no dose. This same result was observed in Mauritania (85.9%) [7] and in the DRC (67%) [5], on the other hand, D. Sounkalo et al reported 25% of children who received a maximum of three doses. .

Severe malaria was associated with AFP cases in 39% of cases followed by anemia in 20%, malnutrition and injections were respectively responsible for 15.5

% and 7%, AFP was isolated in 18.5% of cases.

After investigation of all AFP cases, fever was associated in 65.5

% of cases, this fever evolved in 3 days in 75% of cases. Our results are consistent with the literature, Doumtsop obtained the association of fever in 90.3% of cases and the evolution in 3 days in 82.7%.

Paralysis was asymmetrical in 27% of cases and the hospitalization rate was 53

%. The latter denotes the weakness of community-based surveillance, these cases of AFP should be detected in the community before arrival at the hospital.

The predilection site of paralysis was the two lower limbs at 57%, the two upper limbs were involved in 9.5% of cases followed by the left upper limb at 7% and the four limbs at 6.5%; Asymmetrically, the two limbs on the left side represented 2% of cases against 0.1% for the two limbs on the right side.

Out of the 200 samples taken, 72% came out negative, 11.5% contained non-polio enteroviruses and 16.5% of the samples were qualified as "Suspected Poliovirus", the latter all arriving negative in their final classification. The percentage of non-polio enterovirus remained above the WHO standard [7]. During the study period, the percentage of health areas reporting AFP cases remained slightly below the thresholds, which may pose a threat to the health system's ability to detect poliovirus. However, the districts of Mandiana, Siguiri and Kérouané remained above the targets.

The quality of the stool samples that arrive at the laboratory is decisive for the success of AFP surveillance because from this quality derives the ability to detect a virus if it exists. Although this indicator reached 80% as recommended by WHO, not only were delivery times to the laboratory unsatisfactory (30%) but also this did not translate into results of investigations in Kouroussa, Kérouané and Mandiana with regard to the percentage of non-polio enteroviruses in the stools, which must be greater than 10%. This could be justified either by limits in the assessment of the quality of the stool samples or in the reporting of the results of the investigations of the samples in the database .

The 60th day follow-up examination only concerned cases whose sample was deemed inadequate in the laboratory, it is 3.5% for the region.

In our study, all districts exceeded the vaccination coverage target set for OPV1 (92%). For all, OPV1 coverage is higher than for OPV3, and for the latter, only three districts have met or exceeded this target.

This is a real problem of specific use of health services in the region [16].

The adjustment on the appearance of flaccid paralysis, in logistic regression, the number of doses of OPV received, the time of year and the medical diagnosis was carried out. Only the time of year has a statistically significant impact on the occurrence of flaccid paralysis.

Conclusion

The clinical picture of AFP cases notified in the health region of Kankan during the year 2016 is classic.

The greatest number was notified during the lean season, June-July, which launches the hypothesis of an ecological link with the change in climate and diet.

The performance of the surveillance system needs to be improved for better sensitivity, in order to avoid a new epidemic both at the level of the health system and at the level of the partners.

Declarations

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Figures

Figure 1

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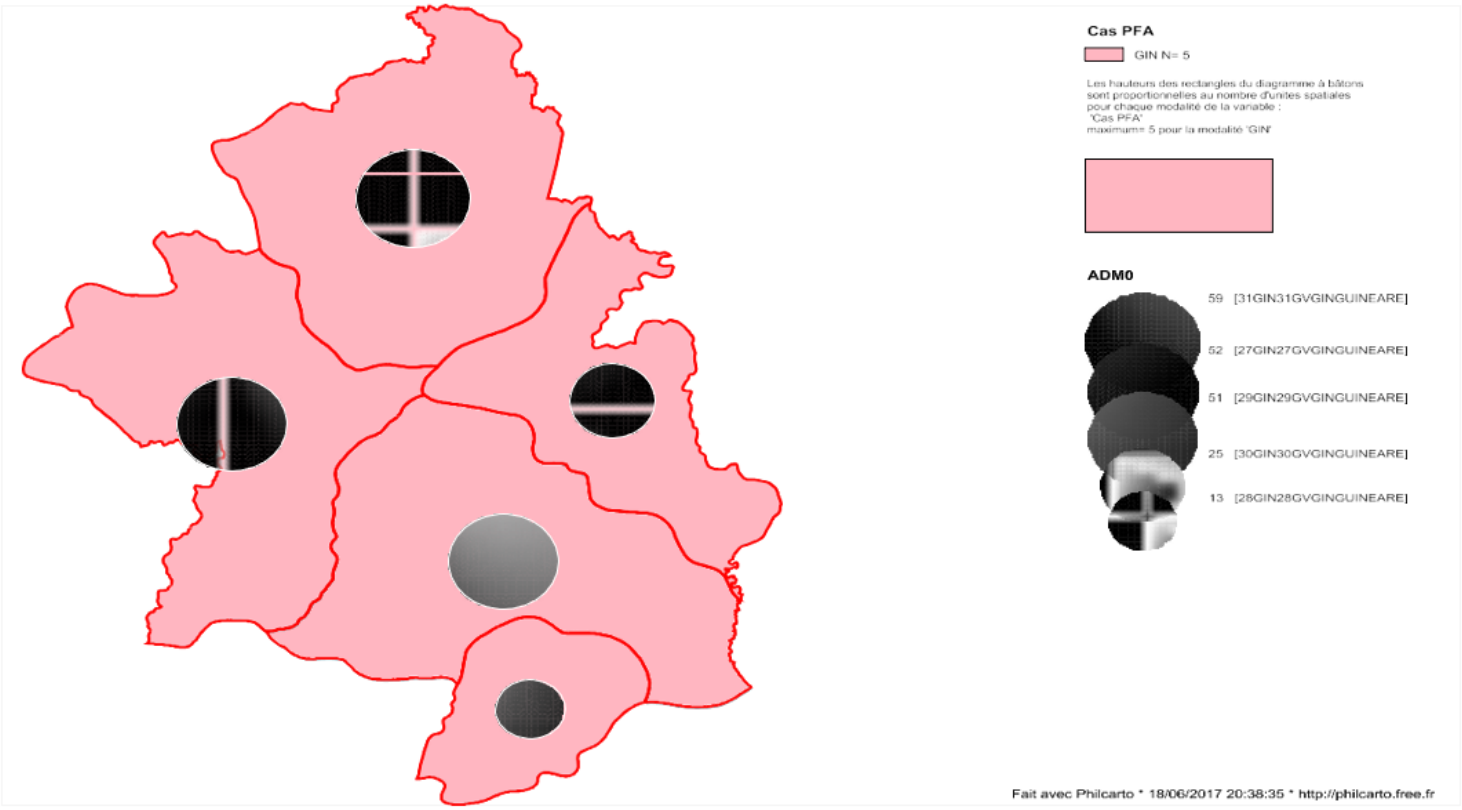

Figure 2

Distribution of AFP cases by health district in 2016 in the Kankan district.

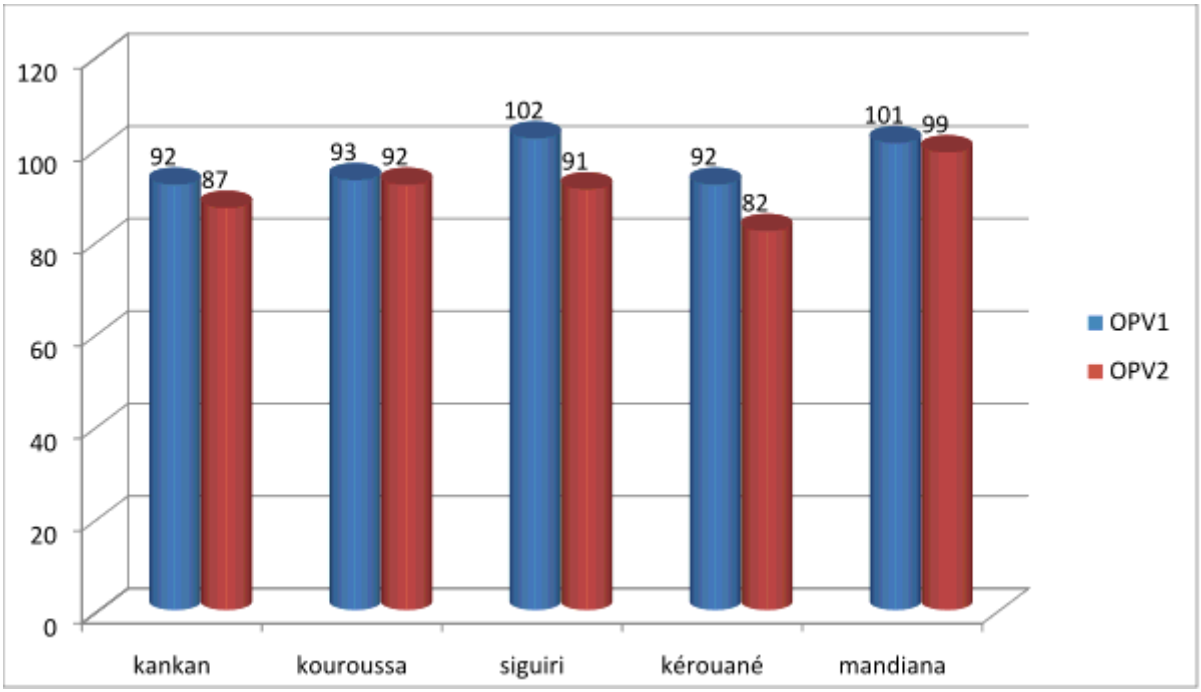

Figure 3

Evolution of OPV vaccination coverage by district