



## Research Article

### Acute Flaccid Paralysis Surveillance in Central of Iran, 2003 to 2007: A Multicenter Study

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#### Keywords:

*Acute flaccid paralysis (AFP),  
Surveillance system,  
Poliomyelitis,  
Communicable diseases, Iran*

Received: 2015-10-01

Accepted: 2016-02-02

DOI: [10.13183/jcrg.v5i1.130](https://doi.org/10.13183/jcrg.v5i1.130)

#### Abstract

**Purpose:** To examine the national program indicators for Acute flaccid paralysis (AFP) surveillance system in Isfahan and Markazi provinces of Iran.

**Methods:** This is an evaluation study assessing indicators of acute flaccid paralysis surveillance system in Isfahan and Markazi provinces. All data registered for suspected AFP cases in departments of communicable diseases in health deputy of the mentioned provinces were reviewed. These documents included linear lists, patient records, national polio lab results, and classification committee reports. Demographic information and specific AFP surveillance indicators such as AFP number and non-polio AFP rate were obtained and calculated exactly, finally being compared with the available standards. Data analysis was performed by SPSS statistical software package.

**Results:** Five-year mean values for all indicators (AFP number, non-polio AFP rate, AFP reported and tested within 48 hours of onset, AFP detected after 7 days, AFP with two stool specimens in 14 days, Stool specimens sent to lab in 3 days, AFP cases followed up in 60 days) in both provinces were above the standard rate.

**Conclusion:** Our study showed AFP surveillance system in central parts of Iran worked effectively and appropriately, however, it is necessary to regularly monitor ongoing process of this sensitive surveillance system.

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#### Introduction

Poliomyelitis, or infantile paralysis, as an acute infectious disease was described firstly in 1789. In 1988, the world health assembly decided to eradicate poliomyelitis globally by the year 2000 [1]. Polio cases had been decreased over 99% since 1988, from an estimated 350 000 to 406 reported cases in 2013. The reduction is the result of global effort to eradicate the disease. In 2014, only 3 countries (Afghanistan, Nigeria and Pakistan) remain polio-endemic, down from more than 125 in 1988. In 1994, the WHO Region of the Americas was certified polio-free, followed by the WHO Western Pacific Region in 2000 and the WHO European Region in June 2002. On 27 March 2014, the WHO South-East

Asia Region was certified polio-free, meaning that transmission of wild poliovirus has been interrupted in this block of 11 countries stretching from Indonesia to India. This achievement marks a significant leap forward in global eradication, with 80% of the world's population now living in certified polio-free regions. Of wild poliovirus 3 strains (type 1, type 2, and type 3), type 2 was eradicated in 1999 and cases of wild poliovirus type 3 are down to the lowest-ever levels with no cases reported since November 2012 from Nigeria [2]. Global eradication will require several key actions such as providing rigorous, ongoing oversight [3]. AFP is defined as any case of new onset of hypotonic weakness in a child aged less than 15 years of age. This includes possible illnesses due

to Guillain-Barre syndrome (GBS), transverse myelitis, traumatic neuritis, viral infections caused by other enteroviruses, toxins and tumors [4].

Acute flaccid paralysis (AFP) surveillance system remains the gold standard of poliovirus surveillance and all efforts should be made to maintain it at a high level of performance and improve it when necessary. Maintaining certification-standard surveillance in all countries is one of the main challenges. WHO will continue to support national efforts in this regard. As well, WHO will support AFP surveillance reviews and will follow up implementation of their recommendations [5]. The WHO recommends that all polio non-endemic countries conduct AFP surveillance in children less than 15 years of age to monitor and verify polio-free status [6]. Effective AFP surveillance is important because a WHO region is only certified polio-free after a period of 3 years without isolation of wild poliovirus from AFP cases [7]. To maintain WHO certification as polio-free, it is expected of each country to: 1) Detect at least one case of non-polio AFP for every 100,000 children less than 15 years of age annually; 2) Collect two fecal specimens more than 24 hours apart and within 14 days of the onset of paralysis, from at least 80% of AFP cases; and 3) Submit all specimens for processing to a WHO accredited laboratory [8]. The epidemiology and actions required to address the major causes of AFP in childhood are, however, unknown in spite of active surveillance to detect poliomyelitis in more than 150 countries. In 2012, there were 223 reported wild type cases of poliomyelitis. More than 47000 cases of AFP were reported globally to detect these cases [9]. To end poliomyelitis forever, the Global Polio Eradication Initiative (GPEI) has developed a comprehensive strategic plan to interrupt all transmission of wild-type poliovirus by the end of 2014 and to certify the world as poliomyelitis free by 2018 [10]. The last laboratory-confirmed indigenous polio case in Iran was reported in 1997. From 1998–2000, cases were imported from Pakistan/Afghanistan of wild virus circulation. No polio cases have been confirmed in the Islamic Republic of Iran since 2001 (reference). The AFP rate (cases per 100,000 children less than 15 year) for Iran was increased to two cases per 100,000 because Iran is near polio-endemic countries such as Afghanistan, Pakistan and Iraq. Routine immunization against polio has been mandatory since 1984. Surveillance reporting started on a regular basis in 1991. Virologic classification was introduced in 1995. The Islamic Republic of Iran has maintained certification standards since 2001 [11]. High-quality surveillance is of paramount importance, because less than 1% of polio infections ever result in clinically detectable disease such as paralysis. Also absence of polio cases might in fact indicate poor surveillance, not absence of circulating polio virus. To avoid complacency, the reliability of the surveillance system for detecting and investigating all AFP cases should be examined and tested regularly [12]. To review AFP surveillance system for best functioning in Iran because of its vicinity to polio-endemic countries such as Afghanistan, Pakistan and Iraq, we examined the performance of AFP surveillance system during five years from 2003 to 2007 in Isfahan and Markazi provinces (Central part of Iran).

## Methods

Information sources for AFP case reports include physician offices, rural and urban health centers, health houses, hospitals,

ambulatory teams, physiotherapy centers and birth centers. An examination team from district health centers were formed and attended for surveillance and diagnostic confirmation as soon as identification of any AFP case reports. After initial AFP confirmation, identification information and stool specimens were gathered. Then stool specimens were sent to national health polio lab in Tehran University of Medical Sciences within 24 to 48 hours. Immediately after diagnostic confirmation, results of examined case were reported to national center of disease control (CDC). At least 60 days after occurrence of paralysis, AFP survey team reexamined AFP case to diagnose residual paralysis. At provincial level there was an expert committee who reviewed clinical AFP cases information in accordance with national polio lab results to conclude if the case is really poliomyelitis or non-polio AFP. Finally based on these documentations, decision making about diagnosis was possible.

In order to examine the performance of AFP surveillance system in Isfahan and Markazi provinces, firstly we explained research plan and coordinate with provincial health center authorities. After permitting to access data, we review the whole information and documents about AFP cases during 5 years from 2003 to 2007 to calculate related indicators. Information sources about AFP cases consisted of linear lists, patients' records, national polio lab results, and classification committee reports. Demographic information and AFP surveillance specific indicators were gathered and data analysis was performed by SPSS software (version 15).

## Results

During study period, 153 reported AFP cases were examined. Total number of AFP cases from 2003 to 2007 years were 115 and 38 people in Isfahan and Markazi provinces respectively. Of them 41% was female and 59% male. The mean and standard deviation of age of all cases were  $5.7 \pm 3.8$  years. Approximately 70% of AFP cases complete their paralysis evolution in about one to two days. Notification source of AFP cases were 93% reported from governmental centers and 7% from private sector. Performance indicators of AFP surveillance system during 5 years (2003 - 2007) have been shown in **Tables 1 and 2** in Isfahan and Markazi provinces respectively. According to these tables non-polio AFP rate was 2 to 4 cases annually. Also some important follow up indices of AFP cases were measured in which the examination rate of cases after 48 hours was 98.3% and 100% in Isfahan and Markazi provinces respectively. Also confirmation of diagnosis one week after admission had rates more than 80% in both provinces. Collection of two stool specimens within 2 weeks of the onset of paralysis was more than 90% in both provinces too. Likewise follow up of patients 60 days after onset of paralysis indicator was 80% and 98% in Isfahan and Markazi provinces respectively. However some indicators showing downward trend especially after 2005 year onward, may be due to weaknesses on program implementation. Moreover, the frequency distribution of AFP final diagnosis after provincial classification committee notification was demonstrated in **Table 3**. It is necessary to note that before reaching 60 day of follow up, four AFP cases were dead owing to underlying disease and follow up had not been possible.

**Table 1. Indicators of acute flaccid paralysis (AFP) surveillance system performance in Isfahan province during 2003-2007 years.**

Year	AFP number	No polio- AFP rate*	AFP reported and tested within 48 hours of onset (%)	AFP detected after 7 day (%)	AFP two stool specimen in 14 day (%)	Stool specimens send to lab in 3 day (%)	AFP cases followed up in 60 day (%)
2003	30	2.8	96.7	90	96.7	66.7	96.7
2004	26	2.5	97	92.3	97	88.5	80.8
2005	18	1.8	100	100	100	94.4	72.2
2006	25	2.7	100	84	88	91.7	78.2
2007	16	1.7	100	85	100	87.5	70
Total (2003-2007)	115	2.36	98.3	89.6	95.7	84.2	80

\*Per 100000 population aged &lt;15 years

**Table 2. Indicators of acute flaccid paralysis (AFP) surveillance system performance in Markazi province during 2003-2007 years.**

Year	AFP number	No polio- AFP rate*	AFP examined after 48 h (%)	AFP detected after 7 day (%)	AFP two stool specimen in 14 day (%)	Stool specimens send to lab in 3 day (%)	AFP cases followed up in 60 day (%)
2003	9	3.8	100	77.8	88.9	88.9	88.9
2004	6	2.6	100	100	83	83	100
2005	3	1.3	100	75	100	100	100
2006	12	5.4	100	67	92	100	100
2007	8	3.7	100	87.5	100	87.5	100
Total (2003-2007)	38	3.9	100	81.4	92.7	91.8	97.7

\*Per 100000 population aged &lt;15 years

**Table 3. Frequency distribution of AFP final diagnosis after expert classification committee certification in Isfahan and Markazi province during 2003-2007 years.**

Diagnosis*	Isfahan (%)	Markazi (%)
Guillain- Barre Syndrome (GBS)	81 (70.4)	16 (42)
CNS Tumors	17 (4.8)	1 (2.6)
Myelopathy/Neuropathy	3 (2.6)	7 (18.6)
CNS Infection	2 (1.7)	1 (2.6)
Viral Arthropathy	3 (2.6)	12 (31.6)
Vaccine Derived Paralytic Polio (VDPV)	1 (0.9)	0 (0)
Unclassified	8 (7)	1 (2.6)
Total	115 (100)	38 (100)

\*Provided in neurologic, non-neurologic order

## Discussion

This evaluation study is a comprehensive province-based survey of five-year AFP surveillance system performance in two central provinces of Iran (Isfahan and Markazi) from 2003 to 2007. In our study the average detection rate of non-polio AFP was approximately 2 and 4 cases per one hundred thousand under 15 years old children in Isfahan and Markazi provinces respectively. This amount is obviously higher than WHO standard rate (detection of at least 1 case of AFP in 100,000 children less than 15 years old) for measurement of sensitivity of AFP surveillance system. The stool sampling in 24 hours apart during two weeks of paralysis onset index, was more than 95% and 92% for Isfahan and Markazi provinces respectively. Also as this index is higher than 80%, the second AFP surveillance criteria defined by WHO has been obtained. In addition to indices mentioned above, three other timeliness indicators of

AFP surveillance i.e. AFP cases investigated within 48 hours of notification, AFP cases with stool specimens arriving at laboratory within 3 days after paralysis onset, all achieved more than WHO targets (more than 80%) in both provinces. The AFP surveillance indicators mentioned above in association with well conducted immunization, reflect appropriate progress toward interruption of polio-virus transmission in both provinces. In 2007, AFP cases were 562, 939, 77395 and non-polio AFP rate was 3.17, 4.19, and 4.19 on Iran, East Mediterranean Region Office (EMRO) and world respectively. In 2014 these figures were 595, 9460 and 81631 for cases and 3.36, 5.1 and 5.1 for non-polio AFP rate. In this study average non-polio AFP rate in five years (2003-2007) was 2.36 and 3.9 for Isfahan and Markazi respectively [13].

Similar study that was performed on 165 non-polio AFP cases in Australia showed that the target rate of 1.0 per 100,000 children less than 15 years old was still not achieved in Australia [14]. Results of our study was against this findings in Australia. Another study which was performed on 273 AFP cases in Ghana during 11 years period from 1999 to 2009, showed that the non-polio AFP rate ranged from 0.12 to 3.94 per 100000 and stool adequacy from 60% to 80% [15]. Similar study was performed in South Africa showed that during 2005 to 2009, 161 AFP cases were notified with the case detection rate of 2 cases per 100,000 children less than 15 years. This study showed only four of ten WHO targets but five of seven timeliness indicators for effective surveillance were met [16]. These findings shows contrary to our results, in Africa the AFP surveillance system was not adequately work. In another study performed in seven provinces of the southern region of Turkey, AFP case detection rate ranged from 0.6 per 100,000 in 2008 to 1.6 per 100,000 in 1999 and even

one quarter of cases was not followed-up appropriately [17]. In comparison with present study findings, Iran have a better AFP surveillance system performance than Turkey. Another similar survey that was performed in Hamadan, in the west of Iran, from 2002 to 2009 showed that AFP surveillance system in this province follow the active and comprehensive AFP surveillance in Iran, with case detection rate exceeded 1 per 100,000 children aged less than 15 years old [18]. In a cross-sectional study which was performed from 1995 to 2006, all patients less than 15 years of age with flaccid paralysis in Fars province at the south of Iran were enrolled. In that study, the non-polio AFP cases were 227 and both first and second AFP surveillance criteria were met [19]. Both two recent studies that performed in other parts of Iran and approximately coincident with our study showing similar results with us, indicate that over ally AFP surveillance system in our country worked effectively in first decade of 21th century. The most common causes of AFP in this study was Guillain- Barre Syndrome (GBS) with more than 70% and 42% of case detection in Isfahan and Markazi provinces respectively. Similar studies in Australia [13], Pakistan [11], Republic of Korea [20], Iraq [21] and Egypt affirmed that GBS was the most common diagnosis attributed to non-polio AFP cases [22]. It is worthy to note that in both above Iranian studies [17, 18], GBS was the most common cause of paralysis like this study. Also according to the last AFP case reviewing and classification done by the national expert committee in Iran, GBS was the most common causes of non-polio AFP in Iran in 2010 [23]. One of the interesting findings of this study was detection of one case of vaccine -derived paralytic polio (VAPP) in Isfahan province during five years of study. Since 2000, more than 10 billion doses of OPV have been administered to nearly 3 billion children worldwide. As a result, more than 10 million cases of polio have been prevented, and the disease has been reduced by more than 99%. During that time, 20 cVDPV (circulating VDPV) outbreaks occurred in 20 countries, resulting in 758 VDPV cases [24]. In 2007 the cVDPV cases were 0, 58, 1387 in Iran, EMRO, world and in 2014 were 0, 20, 49 respectively [13]. In a vaccine-derived poliovirus (VDPV) is a strain of poliovirus that was initially contained in OPV and that has changed over time and behaves more like the wild or naturally-occurring virus [25]. Although oral polio vaccine (OPV) has several advantages such as low cost, ease of use, and high efficacy rate with herd immunity, OPV has a drawback of causing a rare but serious complication of vaccine associated paralysis or paralysis by means of circulating vaccine-derived poliovirus that have acquired some properties of wild viruses [26, 27]. Recently, some countries including the U.S.A. and Germany have changed their national policies to recommend vaccination with IPV alone instead of OPV [28]. According to OPV position in Iran vaccination schedule, it is important to focus on VAPP in AFP surveillance and calculate the rate of VAPP among vaccinated children. Recently a case series study has been published that reviewed characteristics of 6 cases of VAPP among immune-deficient infants in Iran from 1995 to 2008 [29]. Owing to the last report of polio eradication in Iran which was published in February 2012 [22] the final documentation for eradication in Iran was approved by the Regional Certification Committee of EMRO in April 2006. Also

according to this report, routine immunization coverage is close to 100% and AFP performance indicators are maintained. The completeness of routine AFP surveillance was 98% in 2009 and 98.5% in 2010. The number of detected cases was 622. Non-polio AFP has been maintained at over 1.7 per 100, 000 (< 15 years age group) and it was 3.3 per 100 000 in 2010. Evaluations show that 90.2% of the adequate specimens were sent to the laboratory. It is now over ten years that no wild polio virus (WPV) cases has been found in Iran; however, certain issues such as supplementary immunization in high risk provinces must be taken into consideration. Polio outbreak in China in 2011, 11 years after certification as a poliomyelitis- free region showed that polio-free countries remain at risk for outbreaks while the poliovirus circulate anywhere in the world [3]. This fact means a sensitive and timeliness AFP surveillance system is required in any country and its performance must be monitored and evaluated strictly and regularly. One of strength of this study was its comprehensive investigation of AFP surveillance system aspects in 2 provinces of Iran. This study and similar ones can be better performed if the final diagnosis of AFP cases would be stated clearly with more detailed as new data gathered and analyzed.

## Conclusion

According to our study and two different ones that were performed in other parts of Iran, AFP surveillance system in our country reinforced and empowered at provincial and national level so that could be suggested that it worked effectively and appropriately in first decade of 21th century.

## Acknowledgement

We wish to thank the Deputy of Health Services, Isfahan and Arak University of Medical Sciences and all health care workers for their valuable efforts and contributions to this study.

**Conflict of interests:** The authors declare no conflict of interest.

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