Acta Biomed 2020; Vol. 91, Supplement 3: 85-91 DOI: 10.23750/abm.v91i3-S.9436

Original article

Reorganization of Active Surveillance of Acute Flaccid Paralysis (AFP) in Emilia-Romagna, Italy: a two-step Public Health intervention

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Summary. *Background and aim of the work:* The International Health Regulations Emergency Committee declared in 2014 that poliovirus circulation is a public health emergency of international concern. In 2017 and 2018 Italy was classified at intermediate risk of poliovirus reintroduction based on suboptimal poliovirus surveillance. Acute flaccid paralysis active surveillance is the gold standard in the polio eradication process. The aims of this study were to investigate the causes of reduced acute flaccid paralysis case reporting in Emilia-Romagna in the last few years (step 1) and to study a public health intervention to restore an adequate level of acute flaccid paralysis surveillance in that region (step 2). *Methods:* In the first step a context analysis was performed by analysing the 2015-2017 Hospital Discharge Registers in Emilia-Romagna with the ICD-9-CM differential diagnosis codes for acute flaccid paralysis. Data from context analysis was then used to plan a new regional collaborative network of acute flaccid paralysis active surveillance. *Results:* The active surveillance network was, at the end of the study, composed by 49 doctors from both hospital administrations and clinical wards from 4 University Hospitals and 7 Local Health Authorities throughout the Region. In 15 months, 7 acute flaccid paralysis cases have been reported; 85,7% received a full clinical and virological investigation and 83,3% completed the 60 day's follow-up. The mean response to each e-mail was 48,5% (SD 7,5%). *Conclusions:* In 2019, the Emilia-Romagna's active surveillance system reached the sensitivity, completeness of case investigation and follow-up required to achieve the minimum levels for certification standard surveillance.

Key words: poliomyelitis, poliovirus, public health practice, disease notification, active surveillance, disease eradication, acute flaccid paralysis

Introduction

As the year 2019 ends, the total number of polio cases worldwide has reached a significant number. Acute flaccid paralysis (AFP) due to wild polio virus type 1 (WPV1) counted 173 cases, the highest peak since 2014, 140 cases more than 2018 (1).

Poliovirus eradication, as stated by the 41st World Health Assembly in 1988, has been considered possible under three simultaneous circumstances: 1) Overall child vaccination till the complete interruption of poliovirus transmission, 2) Verification of cessation of transmission certified by appropriate surveillance systems, 3) Poliovirus containment in international authorized laboratories.

In 2018 the European Centre for Disease Prevention and Control (ECDC), Communicable disease Threats Report, stated that "*importation of the infection as well as of polio cases into the European Union (EU) remains* possible" (4). Furthermore, given the persistence

of endemic outbreaks and the difficulty to obtain optimal vaccination in high risk groups, the International Health Regulations Emergency Committee confirmed the statement that poliovirus circulation is a public health emergency of international concern, already declared in May 2014 (5).

In 2017 and 2018, during the 31st and 32nd meeting of the European Regional Commission for Certification of Poliomyelitis Eradication (RCC), Italy was classified as a nation with intermediate risk of poliovirus reintroduction based on suboptimal poliovirus surveillance. While AFP surveillance is recommended by WHO to maintain a clear clinical picture of poliovirus infection and circulation, in the last few years, in Emilia-Romagna Region, as well as in other Italian Regions, there has been a decrease in AFP notifications. To maintain polio-free certification, the National Surveillance System (NSS) should be able to annually detect at least one case of non-polio associated AFP per 100,000 children under 15 years of age and no cases of wild-polio occurring for three consecutive years.

AFP is defined as the detection of new onset of hypotonic weakness in a child younger than 15 years. Numerous conditions can cause AFP: paralytic poliomyelitis, West Nile virus and other enteroviruses, as well as Guillain-Barré syndrome (GBS), transverse myelitis and traumatic paralysis (6-9).

Active Surveillance System allows early AFP detection and proper sample collection for virological testing. At the same time, it is necessary to be sure AFPs are not underestimated through the zero-reporting system. The absence of reported cases is not equivalent to absence of cases. The combination of these 2 surveillance systems are crucial to be certain AFP cases are reported and tested.

The aim of this study was, in a preliminary context analysis, to study whether the lack of AFP reporting was due to a lack of AFP cases in Emilia-Romagna or due to a lack of notification and eventually to analyse any critical issue preventing doctors from notifying AFP cases. Secondly, to study a public health intervention to restore an adequate level of AFP surveillance in Emilia-Romagna region.

Methods

Step 1: Preliminary Context Analysis

In the present section we discuss the preliminary context analysis methods and results. Analyzed data refers to the years were no notification occurred and its presence in "Methods" section is functional to define the methodology used to develop Step 2: proposed Public Health Intervention.

Between January and May 2018, we analyzed the cases of pediatric AFP that were not notified in the previous three years. The Public Health and Community Prevention Service of the Emilia-Romagna Region, extracted the Hospital Discharge Register (HDR) data of patients under 15 years old in Emilia-Romagna during the period 2015-2017, which reported in the first three diagnoses "International Classification of Diseases, 9th Revision, Clinical Modification" (ICD-9-CM) codes identified in literature that frequently go into differential diagnosis with AFP (Table 1) (9-10).

The 295 selected records were then divided per year and stratified by city of the discharging hospital, by diagnosis and by ICD-9-CM codes. Data was further analyzed highlighting records with codes 357 and 323 that are the diagnosis that more frequently are reported as AFP in literature (11). The cumulative annual incidence of these two codes resulted to be 5.9 cases per 100 000 people, while incidence calculated using GBS codes resulted to be 1.1 cases per 100 000 people, the same AFP annual rate expected by WHO. Clinical areas mainly interested Pediatrics (72%), Child and Adolescent Neuropsychiatry (13%),

Table 1. ICD-9-CM codes used for extraction of the Hospital Discharge Registers

ICD-9-CM code	Description
047	Meningitis due to enterovirus
320-322	Bacterial meningitis, Meningitis due to other organisms or of unspecified cause
323	Encephalitis, myelitis, and encephalomyelitis
341	Other demyelinating diseases of central nervous system
356	Hereditary and idiopathic peripheral neuropathy
357	Inflammatory and toxic neuropathy
950-957	Injury to nerves and spinal cord

Intensive Care Unit (4%), Pediatric Oncohematology (2%), Day Surgery (2%) and Pediatric Intensive Care Unit (2%).

Based on these evaluations it appeared imperative to restore an adequate level of Active Surveillance in Emilia-Romagna through a prompt reporting of AFP. Data was discussed with Emilia-Romagna Region and the next step was planned.

Step 2: Public health Intervention

Participants and proposed intervention

The "Emilia-Romagna's Reference Centre for polio surveillance", located in the Department of Medicine and Surgery (Hygiene Institute) of the University of Parma, in collaboration with the Public Health and Community Prevention Service of the Emilia-Romagna Region, studied the reorganization of the system through 4 phases:

1. Establishment of a regional collaborative network for AFP Surveillance.
2. Review of the Surveillance protocol in use and development of an algorithm to share with the regional network.
3. Creation of a computerized system of Active Surveillance – Zero Reporting.
4. Formation meetings for the whole regional collaborative network.

Phase 1. To establish the regional collaborative network for AFP Surveillance, we recruited doctors from every clinical ward involved in Emilia-Romagna hospitals with higher AFP incidence, previously identified in the context analysis. For each selected hospital we recruited also a contact person in the hospital administration.

Phase 2. Surveillance protocol was revised to better support clinicians in case of AFP detection. A visual flowchart was created to aid clinicians through the notification process. This material was explained and distributed during the formation meetings (Stage 4) and was sent via email to the physicians belonging to the regional collaborative network.

Phase 3. A computerized system of Active Surveillance-Zero Reporting was created as follows: every 15 days, one doctor from each piece of the network would receive an e-mail with a link connecting him to a webpage with two yes/no questions asking whether they had an AFP case in the past two weeks and whether the surveillance protocol was activated. Time to fill in the form was estimated less than 30 seconds, to help compliance and not burden colleagues. Attached to the e-mail an up-to-date epidemiological report in Italian on Poliovirus or Polio-related news was sent. The report was created using mainly data from GPEI (Global Polio Eradication Initiative) website (12).

Phase 4. Two meetings where organised before starting with the Active Surveillance-Zero Reporting. The first meeting was directed to the contact person in the hospital administration, the second one to the doctors from the clinical wards. The meetings were delivered in one day and were held at the regional government headquarters in Bologna. Formation was delivered by experts in the field coming from the AFP Regional Reference Centre and the Public Health and Community Prevention Service of the Emilia-Romagna Region. Information regarding national and international AFP epidemiology, the importance of AFP Surveillance, regional context analysis was delivered. Changes and innovation in Regional AFP Surveillance System was explained (phases 1-3). Educational material was handed out to the participants (the same material was also sent via e-mail to the whole collaborative network).

The two-step public health intervention was realized with no additional expenses by identifying personnel that was already present on the territory and using free online platforms. Context analysis and the planning and realization of the public health intervention was realized by researchers, expert in the field and residents of the Public Health Residency School of the University of Parma in collaboration with the Public Health and Community Prevention Service of the Emilia-Romagna Region. Doctors selected to participate to the regional collaborative network were all employees of the public Italian Sanitary System.

Hypothesis and expected Outcomes

The main hypothesis was that by reorganizing the Regional Surveillance System alongside with the implementation of a Computerized Active Surveillance-Zero Reporting system we could restore the AFP notification system to meet WHO requirements without increasing the work-load on colleagues.

Expected Primary Outcome: achievement of WHO standards for sensitivity of AFP Surveillance, one case of non-polio AFP to be detected annually per 100,000 population aged less than 15 years, meaning 6 for Emilia-Romagna Region.

Expected Secondary Outcome: (a) achievement of the WHO standards of completeness of case investigation (all AFP cases should have a full clinical and virological investigation with at least 80% of AFP cases having 'adequate' stool specimens collected) and (b) completeness of follow-up (at least 80% of AFP cases should have a follow-up examination for residual paralysis at 60 days after the onset of paralysis). Finally, (c) a complete monitoring of active surveillance program adherence.

The present paper was reported following the TREND statement for public health intervention and its extension TIDieR-PHP for population health and policy interventions. (13-14).

Results

Participant flow

The renovated active AFP surveillance began in October 2018. At the start, 23 doctors were included in the regional collaborative network for AFP Surveillance: 11 doctors from the hospital administration and 12 doctors from the clinical wards (pediatrics, pediatric surgery, child and adolescent neuropsychiatry, neurology, infectious diseases, intensive care unit, microbiology). Of the latter, 3 never actively participated to the new surveillance system and 2 dropped the network due to retirement, naming a substitute. By the end of 2019, the regional collaborative network for AFP Surveillance was composed of 49 doctors: 14 from the hospital administration and 35 from the clinical wards.

The network included 11 facilities throughout the region: 4 University Hospitals (UH) and 7 Local Health Authorities (LHA), that directly manage Territorial Healthcare Facilities, including smaller hospitals.

No variation from protocol was detected.

Outcome

Primary outcome: In 15 months of active surveillance, 7 cases of AFP have been reported through bimonthly e-mail (6 of them in 2019) (Figure 1). Of these, only 6 correctly activated the surveillance protocol. The cases were reported by doctors of the hospital administrations, child and adolescent neuropsychiatry wards and pediatric wards. We can say that the primary outcome of 6 AFP notifications per year was achieved.

Secondary outcome: Completeness of case investigation: of the 7 AFP reported cases, 6 (85,7%) had a full clinical and virological investigation with adequate stool specimens collected.

Completeness of follow-up: of the 6 AFP cases that activated the protocol, 5 (83,3%) had a follow-up examination for residual paralysis at 60 days after the onset of paralysis.

The final diagnosis of the cases was: 3 Guillain-Barre, 1 transient polyneuritis after HAV vaccination, 1 neuromyopathy from chronic disease, 1 acute myelitis in patient with DADA2. In 2 cases the paralysis persisted after 60 days.

Active surveillance program adherence: the response rate to each surveillance e-mail varied from 63,0% (November 2018) to 35,4% (June 2019) with a mean response of 48,5% (SD 7,5%). Instead, the individual response rate varied from 0 to 100%: 7 doctors have never answered to any e-mail; 3 doctors answered to all the e-mail received; the median response rate was 53,6% (IQR 74,4%). In Figure 1 we represented the AFP surveillance adherence by each doctor of the network, specifying whether it was zero reporting or the report of a case.

Conclusions

AFP surveillance remains the gold standard in the Polio eradication process. Alongside with environmental and serological control, it represents a territorial safety system in a national surveillance network, as well as other surveillance networks (15-18), whose aim is to prevent the possibility of poliovirus circulation (19-24). With the implementation of this public health intervention, we achieved the sensitivity of the surveillance, the completeness of case investigation and the completeness of the follow-up. Completeness of reporting still appears critical: the adherence to each e-mail varied from 35% to 63% and not 80% as sug-

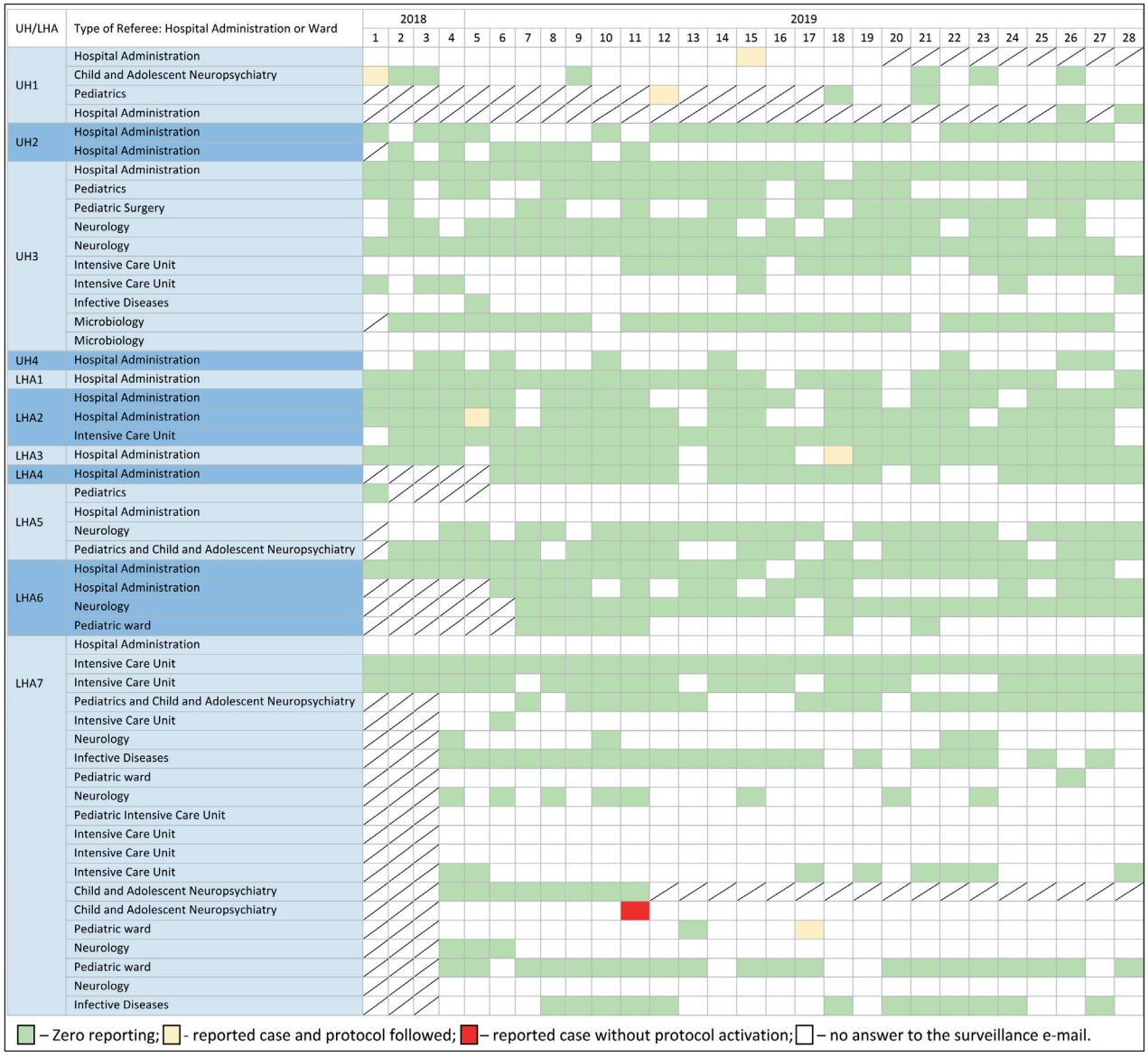

Figure 1. AFP surveillance adherence divided by type of referee of the University Hospital (UH)/Local Health Authority (LHA); - not yet part of the network;

gested by the WHO (12). However, taking into account the history of no reporting we may consider the achievement satisfactory, aiming to improve it during the years to come.

These results were influenced by the fact that the regional network met personally during the formation sessions and by the short period between the e-mails of the surveillance. Due to a direct bimonthly email contact, doctors were encouraged to express their doubts regarding AFP notification by contacting directly the Regional Surveillance Centre. The fact that the questionnaire was made of only 2 yes/no questions may have played a role in increasing the compliance. However, the fact that no polio AFP occurred for so long contributes to the lack of a proper perception of the risk by clinicians and contributes to the difficulty of implementing the zero-reporting system.

This practice is generalizable to other realities, there were no extra economic resources needed, use of human resources was limited and no extra-time load

to the clinicians was required. The collaboration of the public health residents was decisive for the success of the project, as well as representing a useful training moment on the field of real public health issues.

Acknowledgments

The authors would like to thank for their collaboration: Bizzarro A.; Conca M.; Referents from the Public Health and Community Prevention Service of the Emilia-Romagna Region: Giannini A., Pascucci M.G., Cagarelli R., Gualanduzzi C., Mattei G., Cintori C.; Referents of the Regional Collaborative Network for AFP Surveillance: Manoni N., Gentile V., Gennari M., Trapani F.F., Antonioli P., Vecchi E., Bergonzini P., Caponcelli E., Fini N., Ariatti A., Scotti M., Lunghi P., Orlando G., Gennari W., Sarti M., Vitali P., Zuenelli B., Rini F., Silvestrini D., Bacchilega I., Santangelo M., Bacchini P., Spezia E., Federici F., Terlizzi E., Trevisan C., Frattini D., Cavazzuti L., Codeluppi L., Caldarelli V., Farolfi E., Baccarini F.D., Guerra D., Vestrucci M., Amanti E., Guidi C., Di Cesare S., Castiglioni L., Terlizzi R.., De Magistris A., Martino C., Gamberini E., Rasi A., Gulli M., Sarajlija J., Ciofini S., Lotti E.M., Ricciardelli P., Callegarini C., Della Vittoria A.

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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Received: 15 February 2020
Accepted: 15 March 2020
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