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Surveillance, a key strategy in the elimination of diseases. The case of polio and measles surveillance in Belgium

by

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Abstract

The European Region of WHO has been certified polio-free in June 2002 and a global eradication goal for polio has been set. Surveillance of acute flaccid paralysis (AFP) in children less than 15 years old plays a crucial role in monitoring possible cases of paralytic poliomyelitis and provides evidence of the elimination of indigenous wild poliovirus transmission in a region or country.

Elimination of measles in the European Region is targeted by 2010. Recommended strategies for reaching this goal focus on achieving very high coverage (≥ 95%) with 2 doses of measles vaccine and strengthening surveillance systems with laboratory confirmation of all suspected measles cases.

In Belgium, a joint surveillance system for AFP and measles was initiated in October 2002. Surveillance occurs through a monthly voluntary reporting system by paediatricians and general practitioners. On average 25% of physicians participate each month in the surveillance.

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Substantial progress has been made in 2004 towards better surveillance of AFP in Belgium, but further efforts are needed to improve completeness of reporting and improve the quality of virological investigation of AFP cases.
Moving further towards elimination of measles in Belgium, measles surveillance will need to be expanded to all physicians. Meanwhile, additional information on the number of measles cases is collected through a network of sentinel laboratories and through school health services in order to improve the quality of the surveillance.

Keywords: *elimination, eradication, measles, poliomyelitis, surveillance*

Introduction

The eradication of smallpox in 1980 stands as one of the greatest achievements of international cooperation ever and other candidates for eradication have been proposed. Eradication is the state in which transmission of a disease has stopped worldwide. When the incidence of the disease is reduced to zero in a large geographic area, the disease is called to be eliminated in that area.
Eradication of a disease can only be considered feasible when certain criteria are met (1). Humans must be the only natural reservoir of the agent, sensitive and specific diagnostics tests must be available and an effective intervention such as vaccination must exist.

The World Health Organization (WHO) identified a number of targets for vaccine preventable disease control. A goal of global eradication of poliomyelitis has been set for 2005 and a strategic plan for eliminating measles and rubella infection exists for some of the WHO Regions. A worldwide goal of measles eradication can only be established when feasibility of stopping circulation of measles virus in countries with densely populated cities has been demonstrated (1). The European Region of WHO has been certified polio-free in June 2002 and elimination of measles and rubella in the Region is targeted by 2010.

Prior to stopping polio immunization, it will be necessary to certify the absence of wild poliovirus circulation from every country in the world. For a region to be certified polio-free, each country needs to demonstrate the absence of wild poliovirus transmission for at least three consecutive years in the presence of excellent surveillance. In order to ensure that wild polioviruses do not circulate and any newly imported virus is rapidly detected, children with limb weakness of sudden onset are tested to rule out poliovirus in acute flaccid paralysis (AFP)

surveillance. Poliomyelitis is a mandatory reportable disease in Belgium, but up to 2002, there was no surveillance system for AFP.

Since measles are so contagious, zero incidence for measles in a region or country is very difficult to achieve and cases will continue to be imported as long as the disease is endemic in some parts of the world. Elimination of measles is therefore defined as "a situation in which endemic transmission cannot occur and secondary spread from importations will end naturally, without intervention" (2).
For meeting the goal of elimination of measles by 2010, the WHO Regional office for Europe elaborated a strategic plan (3). Recommended strategies focus on achieving very high coverage with 2 doses of measles vaccine (levels of immunity must be at least 95% to ensure transmission of measles cannot be sustained) and strengthening surveillance systems with laboratory confirmation.
The most recent data available on measles vaccine coverage in Belgium are those from the 1999, 2000 and 2003 random cluster sampling surveys conducted in the three regions: 83.4% in Flanders (1999) (4), 82.5% in Wallonia (2003) (5) and 74.5% in the Brussels Capital Region (2000) (6). Routine first-dose coverage rates in the three regions are below the 95% coverage goal for measles elimination.
In 1979-1980 and from 1982 up to 2000, measles surveillance occurred through a sentinel network of about 150 General Practitioners (GPs) representative of the total group of Belgian GPs and covering 1.5% of the Belgian population (7).
With the incidence of measles decreasing to low levels (only 8 cases were reported by the sentinel system in 1999), the sentinel network of GPs was considered inappropriate to assure further surveillance and surveillance of measles stopped in 2000 (8).

In order to fulfil the criteria of certification of polio-free status, and to implement WHO recommendations regarding measles elimination, a surveillance system of AFP and measles in Belgium needed to be set up in 2002.

Methods

Surveillance systems

Following the success of the British Paediatric Surveillance Unit (BPSU) for surveillance of rare paediatric diseases (9), the same methodology has been adopted to set up a surveillance system in Belgium in October 2002, using a monthly reporting system of several rare paediatric conditions: AFP, measles, mumps and rubella. The

surveillance is carried out by paediatricians covering the whole country. Since vaccine coverage for the first dose of measles vaccine in Brussels is the lowest in Belgium (6), general practitioners (GPs) for the Brussels Capital Region have also been invited to participate in the surveillance. A total of 2190 medical doctors (1200 paediatricians and 990 GPs) are registered in the two categories and have been contacted to participate in the surveillance network. Medical doctors report on a voluntary base, through an Internet website or by returning a form by mail in the first week of each month. Zero reporting is requested to assess cases that are not reported by omission. Doctors reporting a case receive a questionnaire to collect epidemiological data.

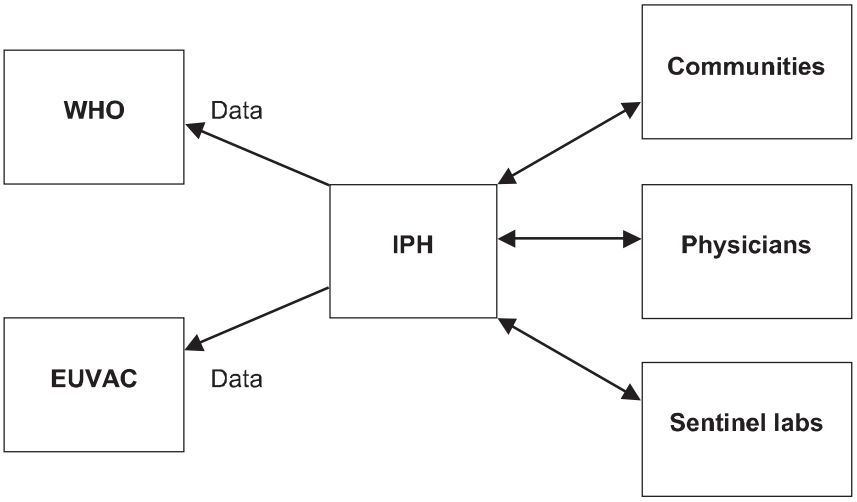
Since June 2004, Belgian paediatric neurologists have been invited to participate in AFP surveillance more specifically, reporting cases by telephone or by mail.
Surveillance of measles is completed by information on laboratory confirmed cases reported by a nationwide network of sentinel laboratories and cases in schools reported by the health inspectors of the communities.

Case definitions

A case of AFP has been defined as a case of acute onset of focal weakness or paralysis characterised as flaccid (reduced tone) without other obvious cause. All AFP cases among children aged less than 15 years and all cases of suspected poliomyelitis of any age need a full clinical, epidemiological and virological investigation. This investigation includes the collection of 2 stool samples collected within two weeks of onset of paralysis and examined for poliovirus, and a clinical follow-up examination at 60 days after the onset of paralysis.
The quality of AFP surveillance is measured using a standard definition for sensitivity and completeness: a rate of one or more non-polio AFP cases per 100,000 people aged <15 years with timely collection of specimens indicates that surveillance is sensitive enough to detect polio (10). With a total population of about 10 million of which 1,804,785 persons are under 15 years old, we should expect about 18 cases/year of AFP in Belgium.

According to the case definitions for communicable diseases listed in Decision No 2119/98/EC from the European Commission, the following case definition is applied to measles: clinical picture compatible with measles, i.e. a generalised rash lasting >3 days and a temperature >38.0 C and one or more of the following: cough, coryza, Koplik's spots, conjunctivitis.
Diagnosis of measles cases is mainly clinical.

FIGURE 1
Flow chart of information collected by the surveillance system



Data on measles cases reported by the different sources of information (physicians, communities and sentinel laboratories) is collected by the IPH (Figure 1).
Participating doctors receive quarterly reports with results of the surveillance. Health inspectors of the communities and sentinel laboratories receive an annual report.

Results of AFP surveillance are reported to WHO on a weekly base, and measles cases are notified each month to WHO and to EUVAC.NET, a European surveillance network of vaccine-preventable diseases (11).

Results

Participation

The percentage of physicians who accept to participate increased from 35% in 2003 to 40% in 2004. However, monthly participation is lower and varies around 25% (average of 565 participants each month). Globally, the monthly number of participants remained stable during the first two years of the surveillance. There is no difference in participation rate between paediatricians and GPs. The participation rate is higher among participants returning a form by mail than among internet users. In 2004, 52.7% of the first group participated at least 10 months of the year, compared to 28.1% of the second group.

Surveillance of AFP

Only 1 case of AFP has been declared in 2003, stool specimens were not collected. In 2004, 10 cases of AFP have been reported. Two cases were reported by paediatric neurologists and 8 cases by general paediatricians. The non-polio AFP rate (number of declared non-polio AFP cases / number of expected non-polio AFP cases) is presented in table 1.

TABLE 1
AFP surveillance quality indicators, Belgium, 2003-2004

Indicators	**2003**	**2004**
Number of AFP cases reported	1	10
Non-polio AFP rate in children under 15 years of age*	0.06	0.56
Percentage of total AFP with 2 faecal specimens within 14d	0 %	0%
Percentage of total AFP with 1 faecal specimen within 14d	0%	30%
Percentage of AFP cases investigated < 48h after report	100 %	90%
Percentage of AFP cases with follow-up	100 %	100%

* number of non-polio AFP cases declared / number of non-polio AFP cases expected per 100,000 children under 15 years old (18 in Belgium). A rate of 1 indicates that the surveillance system is sensitive enough to detect circulation of polio in the country.

At least one stool specimen was collected for 3 cases. No polioviruses were isolated. All were cases of the Guillain-Barré Syndrome.

Surveillance of measles

As illustrated in table 2, the number of reported measles cases increased in 2004.
One case has been reported both by the network of physicians and a laboratory, and 3 cases were declared by physicians as well as by health inspectors.
Some of the reported cases were part of a cluster of cases. Both in 2003 and in 2004, a cluster of measles cases occurred in schools in Brussels, with respectively 16 and 28 reported cases. Cases of the outbreaks were partly reported by physicians and partly by school medical services to the health inspectors. Investigation of the outbreaks identified additional cases. A second small cluster of 3 measles cases occurred in a hospital in Brussels in 2004.

The 52 participating paediatricians in the Brussels Capital Region (11.5% of participating physicians in the region) contributed to 30% of the reported measles cases by physicians in the region.

TABLE 2
Number of reported cases of measles in Belgium, 2003-2004

Surveillance system	**2003**	**2004**
Physicians	24	38
Investigation of outbreaks	3	3
Sentinel laboratories	4	8 (+1)*
Community Health Inspectors	14	17 (+3)**
Total	45	66

* One case reported both by a physician and a laboratory
** Three cases reported both by physicians and health inspectors

Cases reported by physicians and health inspectors are clinically suspected cases or laboratory confirmed cases. Cases identified through outbreak investigation and having an epidemiological link with a confirmed outbreak of measles were classified as confirmed cases. Sentinel laboratories only report laboratory confirmed cases.
One case in 2003 and 5 cases in 2004 fulfilled the clinical case definition of measles, but results of laboratory testing were negative (Table 3) and therefore these cases have been discarded off the final list of cases.

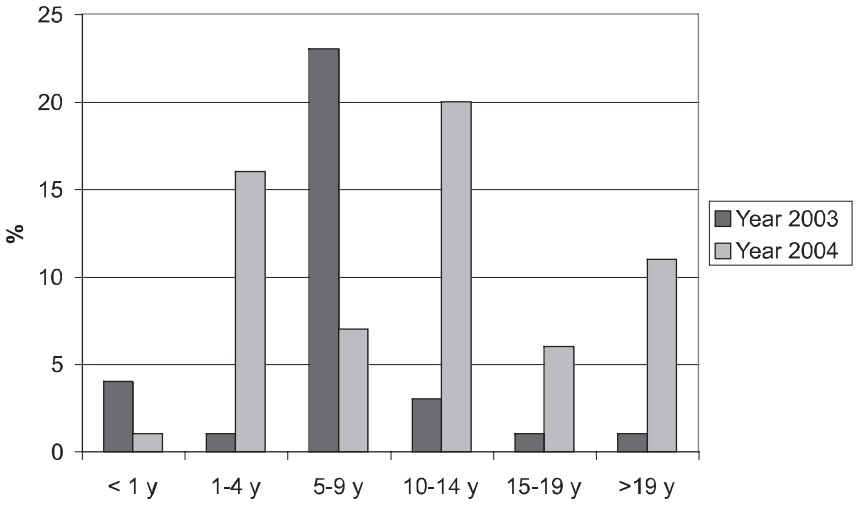
TABLE 3
Laboratory tests on reported measles cases in Belgium, 2003-2004

	N reported cases	Laboratory testing	Negative result	Laboratory confirmation
2003	45	8 (17.8%)	1	7 (15.6%)
2004	66	24 (36.4%)	5	19 (28.8%)

Of reported measles cases with known vaccination status, 38.5% in 2003 and 22.8% in 2004 were vaccinated with at least one dose of measles containing vaccine (MCV).

The age distribution of measles cases (Figure 2) is different for the 2 years of surveillance. The majority of cases in age group 5-9 years in 2003 is attributed to the cluster of cases in some primary schools in Brussels, whereas the majority of cases of the cluster/age in 2004 were 12 to 18 years old (12). In general, most cases were 5 years or older.

FIGURE 2:
Age distribution of measles cases in Belgium, 2003-2004



Discussion

The experience of AFP surveillance in the eradication of poliomyelitis has been useful and served as a model for measles surveillance. At present, two thirds of countries with AFP surveillance systems have adapted their systems for surveillance of measles and other vaccine-preventable diseases (10). In Belgium, a joint surveillance system of AFP and measles was set up in 2003.

Although Belgium has been certified polio-free in June 2002, the risk of importing the disease from countries where polio is still endemic remains, and further surveillance of AFP is essential. After having repeatedly informed the pediaetricians and after involvement of paediatric neurologists, progress has been made toward better surveillance of AFP in Belgium in 2004. The concept of AFP as a surveillance tool for poliomyelitis seems difficult to understand for physicians, the main cause of AFP being Guillain-Barré Syndrome, clinically not suspected for polio at all. Further improvement is expected for 2005 through regular reminders sent to participants. Especially adequate virological investigation of AFP cases, to rule out infection with wild polioviruses, needs to be improved.
According to the WHO European Region strategic plan for measles elimination (3), countries are classified into 4 groups. Coverage for one dose of measles containing vaccine (MCV1) and measles incidence is used

as a management tool for assessment of a country's measles control programme. With a vaccine coverage for at least one dose of measles vaccine consistently less than 90% and a reported incidence of measles ≥1 case per million inhabitants, Belgium belongs to the first group of countries. Following accumulation of susceptible cohorts in the population over time, measles epidemics will continue to occur. Three clusters of measles cases have been identified through the surveillance, both by the system of physicians and by reporting infectious diseases in schools to the community's health inspectors. The detection of small clusters suggests that larger outbreaks that are the marker for endemic transmission, would certainly be detected as well.
Since participation of physicians in the surveillance is voluntary and only GPs of the Brussels Capital Region are included, data do not allow to calculate incidences of measles. Nevertheless, the stable monthly participation rate allows to make comparisons over the years and data are useful for follow-up of trends over time.
The increase in number of suspected measles cases can be explained by an increase in awareness of the importance of surveillance. The latter is also reflected in the number of cases reported through 2 different sources and the increase in laboratory confirmation. In one year time, both the number of tests for confirmation of suspected measles cases and the number of confirmed cases doubled. Moving further towards elimination, all suspected cases will have to be laboratory tested but the percentage of confirmed cases should decrease to zero. Laboratory confirmation of measles cases plays a key role in measles surveillance. The National Laboratory for Measles and Rubella is currently validating a salivary test for detection of measles antibodies. The collection of a saliva sample is easy and painless, and therefore well accepted by both parents and physicians.

Although paediatricians in the Brussels Capital Region reported relatively more measles cases than the GPs, GPs play a crucial role in measles surveillance. Surveillance will need to be expanded to all GPs and all paediatricians, for example through mandatory notification.
The large majority of European countries use mandatory notification systems for measles. In addition, some countries such as Germany and Switzerland also provide data from sentinel surveillance systems. Within the framework of the measles and rubella elimination plan in France, mandatory notification for measles has been reintroduced in June 2005, after a period of 20 years of sentinel surveillance. Besides differences in surveillance systems, some countries report suspected clinical cases (Germany, Italy, Sweden), whereas others only report laboratory confirmed cases (Denmark, Netherlands, United Kingdom). Information on

measles incidences in the different countries, as presented by WHO on the website "Centralized Information System for Infectious Diseases" (CISID) (13), should therefore be interpreted with caution.

In general, studies on sensitivity and completeness of measles surveillance demonstrate that passively reported measles cases are the tip of the iceberg of measles incidence (14). Even though the surveillance system in Belgium is not exhaustive, the system presents the advantage that the surveillance is active, since cases are actively searched through the monthly form or email reminder sent to participants. However, even passive surveillance systems or non-exhaustive systems can fulfil some major purposes of measles surveillance: detect transmission of measles virus, determine age group at risk, identify causes of transmission (outbreak investigations) and monitor trends in transmission (14). Furthermore, surveillance of measles in Belgium is important to convince Belgian physicians that measles is still circulating in the country and therefore, measles vaccination remains necessary.
As long as mandatory notification of measles in Belgium is not introduced, the surveillance of measles through the actual surveillance system will continue. Implication of the Belgian associations of paediatricians, and the integration in the surveillance system of other diseases that are of more interest to paediatricians (such as invasive pneumococcal diseases), should increase the participation rate in the future. All GPs of the country will be informed of the target of measles elimination in Europe and polio eradication worldwide. Mandatory notification of cases in school to health inspectors will be reinforced.

In response to WHO recommendations, a Committee for the Elimination of Measles in Belgium was set up in January 2003. The role of the committee is to elaborate a national action plan and follow up implementation of activities. Activities specifically aim to improve the epidemiological surveillance of measles and reinforce the role of the laboratory in measles surveillance.

Conclusions

In a process of eradication or elimination of a disease, a sensitive surveillance is essential to monitor progress, to demonstrate the absence of endemic transmission and to allow rapid detection of newly imported cases. Quality of the information collected must be assured to make sure reporting reflects the real situation in a country. Therefore it is essential that several complementary surveillance systems are in place.

Surveillance of cases of acute flaccid paralysis provides a means for detecting circulating wild poliovirus in a population and is therefore

crucial to the global polio eradication effort. AFP surveillance will be necessary as long as global eradication is not achieved. Quality of AFP surveillance in Belgium increased in 2004, but further efforts are needed. To improve the quality of the information, AFP surveillance is supplemented by laboratory surveillance of circulation of enteroviruses.

In a first stage of measles elimination, surveillance should be adequate to detect ongoing transmission, but might be missing isolated cases. Moving further towards elimination, laboratory confirmation of all suspected measles cases and virus isolation or nucleic acid detection from all chains of measles transmission will be required to determine interruption of indigenous transmission of measles and evaluate the impact of elimination activities. Surveillance of measles in Belgium will need to be expanded to all physicians. Notification of measles cases through schools and laboratory surveillance are useful supplementary sources of information.

Acknowledgements

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Samenvatting

De Europese Regio van de Wereldgezondheidsorganisatie (WGO) werd poliovrij verklaard in juni 2002 en er bestaat een plan voor de eradicatie van poliomyelitis wereldwijd. Surveillance van acute slappe verlamming (AFP) bij kinderen onder de 15 jaar speelt een belangrijke rol bij de opvolging van mogelijke nieuwe gevallen van paralytische polio en laat toe om de eliminatie van endogene transmissie van wilde poliovirussen in een regio of land te bewijzen.

Eliminatie van mazelen in de Europese Regio is gepland tegen het jaar 2010. Aanbevolen strategieën om dit doel te bereiken zijn een verhoging van de vaccinatiegraad (≥ 95%) voor twee dosissen van het mazelenvaccin en het versterken van de surveillance van mazelen, met bevestiging van alle verdachte gevallen door een laboratorium.

Een surveillancesysteem voor de surveillance van zowel AFP als mazelen, werd in België gelanceerd in oktober 2002. De surveillance bestaat uit een maandelijkse vrijwillige melding door kinderartsen en huisartsen. Gemiddeld 25% van de artsen neemt elke maand deel aan de surveillance.

De surveillance van AFP in België nam in 2004 sterk toe, maar blijvende inspanningen zijn nodig om de kwaliteit van de surveillance verder te verhogen. Wanneer de eliminatie van mazelen in België dichterbij komt, zal de surveillance zich moeten uitbreiden naar alle artsen. Om de kwaliteit van de huidige surveillance te verbeteren, wordt bijkomende informatie over het aantal gevallen van mazelen verzameld via een netwerk van laboratoria en via schoolgezondheidsdiensten.

Résumé

La Région européenne de l'Organisation mondiale de la Santé (OMS) a été déclarée indemne de la poliomyélite en juin 2002 et un objectif d'éradication mondial de la polio existe. La surveillance de la paralysie flasque aiguë (PFA) chez les enfants de moins de 15 ans joue un rôle important dans le monitoring des nouveaux cas possibles de paralysie par poliomyélite et fournit des preuves de l'arrêt de la transmission endogène de virus sauvages de la polio dans une région ou un pays.

L'élimination de la rougeole dans la Région européenne est ciblée pour l'année 2010. Les stratégies recommandées pour atteindre cet objectif préconisent une augmentation de la couverture vaccinale (≥ 95%) pour 2 doses du vaccin antirougeoleux et un renforcement de la surveillance de la rougeole avec confirmation des cas suspects par un test de laboratoire.

En Belgique, un système de surveillance incluant la PFA et la rougeole a été lancé en octobre 2002. La surveillance consiste en un rapportage mensuel volontaire par des pédiatres et médecins généralistes. Chaque mois, en moyenne 25% des médecins sollicités participent.

Un progrès considérable a été réalisé dans la surveillance de la PFA, mais des efforts continus sont nécessaires pour améliorer la qualité de la surveillance. En progressant vers l'élimination de la rougeole en Belgique, la surveillance de la rougeole devra être étendue à tous les médecins. Pour améliorer la qualité de la surveillance, des informations supplémentaires sur le nombre de cas de rougeole sont collectées par un réseau de laboratoires et les services de médecine scolaire.

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