SURVEILLANCE OF POLIOMYELITIS: LESSONS LEARNT FROM THE 1992/1993 OUTBREAK IN THE NETHERLANDS

WORLD HEALTH ORGANIZATION
Regional Office for Europe
COPENHAGEN

TARGET 5

REDUCING COMMUNICABLE DISEASE

By the year 2000, there should be no indigenous cases of poliomyelitis, diphtheria, neonatal tetanus, measles, mumps and congenital rubella in the Region and there should be a sustained and continuing reduction in the incidence and adverse consequences of other communicable diseases, notably HIV infection.

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SURVEILLANCE OF POLIOMYELITIS: LESSONS LEARNT FROM THE 1992/1993 OUTBREAK IN THE NETHERLANDS

Report on a WHO Meeting

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ABSTRACT

The aim of the meeting was to share experiences in outbreak control, laboratory methods and virus circulation studies in view of the 1992/1993 outbreak of poliomyelitis in the Netherlands. Special attention was paid to existing policies on clinical, laboratory and environmental surveillance. Information was given on the epidemiological situation in the Netherlands in the pre-outbreak period, the 1992/1993 outbreak and the control measures applied. As in the 1978 outbreak, cases were restricted to religious groups who reject vaccination. There was general agreement on the containment activities undertaken in the Netherlands. Some other outbreaks were presented (Israel 1988, Oman 1991, Bulgaria 1991) and policies on surveillance and control in relation to the specific epidemiological situations were discussed. It was concluded that especially pockets of non-vaccinated people should be identified and approached to perform immunization activities. There is a continuing risk of importation of poliovirus as long as the poliovirus is around. European countries should put more effort in the control of poliomyelitis in endemic areas and ask for more political support.

Keywords

COMMUNICABLE DISEASE CONTROL
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INTRODUCTION

In 1989 the eradication of poliomyelitis from the WHO European Region was officially launched with a plan of action and by 1991 the average European immunization coverage for poliomyelitis was 84%. In 1990 and 1991 there was still an increasing number of reported cases of poliomyelitis. However, since 1992 the morbidity rate has dropped to 52%. In 1992 cases of poliomyelitis were reported in the Netherlands (64), Azerbaijan (22), Turkey (20) and Ukraine (12).

In addition to providing routine services, most countries with endemic transmission have adopted active eradication strategies. However, there is a need for continuous, effective surveillance. Countries should report to WHO monthly, but often the reporting is delayed or the information incomplete. The key element of polio surveillance – acute flaccid paralysis (AFP) surveillance – is in place in only six countries. By 1995, all countries should have AFP surveillance or other means to ensure that any case of poliomyelitis in any age group will be detected. Another important component of the WHO poliomyelitis eradication initiative is environmental surveillance. A regional laboratory network is partially in place but needs strengthening, particularly in the newly independent states of the former Soviet Union.

The Meeting on Surveillance of Poliomyelitis: Lessons Learnt from the 1992/1993 Outbreak in the Netherlands, was held in Bilthoven, Netherlands, from 22 to 23 June 1993. The aims of the Meeting were to:

- inform participants about the results of the virus circulation studies, the outbreak control measures and laboratory investigations carried out in the Netherlands;
- review the existing European policy on the eradication of poliomyelitis;
- review the existing European policy on preventing the importation of wild poliovirus.

Sir Joseph Smith chaired the Meeting, Dr Marina Conyn-van Spaendonck served as Rapporteur and Dr George Oblapenko as Secretary. The participants are listed in Annex 1.

RECENT OUTBREAKS

Netherlands, 1992–1993

In 1957, inactivated poliomyelitis vaccine (IPV) was introduced in the Netherlands and offered to everyone born after 1945. Since 1962, IPV has been incorporated into a quadruple and triple vaccine (DTP-IPV and DT-IPV). Vaccinations are given at 3, 4, 5 and 11 months and 4 and 9 years of age. At present, vaccination is carried out through a decentralized computerized network on a non-compulsory basis. The parents of all registered newborn infants are invited to bring their children to immunization sessions at well-baby clinics. The national vaccination coverage for three doses of IPV at the age of one year is more than 95% for the target population. The non-vaccinated segment of the population can be divided into three groups.

1. People who refuse vaccination on traditional religious grounds. Such groups have close social ties. They represent about 20% of the total number of unvaccinated persons.

2. Immigrants, whose numbers are still increasing, especially in the large cities.

3. A scattered, mixed group of people who do not belong to either of the above groups.

The beliefs of the first group can be traced back to the nineteenth century Reveille movement which denounced smallpox vaccination; vaccination was seen as proof of the arrogance of modern medicine. Both the local and the nation-wide outbreaks occurred among members of this group. The remaining vaccinated and non-

vaccinated population seemed well protected, even when the virus was circulating during the outbreaks.

The only possible approach the health authorities can take in this situation is to keep contact with members of these religious groups to exchange points of view and give objective information. Vaccination cannot forcibly be given in the Netherlands.

Since the nationwide outbreak in 1978, poliovirus has been imported repeatedly in the Netherlands as shown by isolation of wild poliovirus from stools of adopted children and from incidental isolation of wild poliovirus from surface water. Data from virological laboratories and from incidental surface water monitoring support this.

AFP surveillance of children began on 1 October 1992. The system is based on monthly reporting by paediatricians. At present, more than 90% of all paediatricians in the Netherlands participate.

The most recent outbreak lasted from 17 September 1992 to February 1993. It ultimately resulted in 68 reported cases of poliomyelitis (43 males, 25 females). The median age was 20 years (ranging from 3 weeks to 61 years). Four cases were younger than one month, six younger than four months. Sixty-seven belonged to the group who object on principle to vaccination. The clinical picture for the 1992 outbreak is as follows:

paresis/paralysis (including 11 cases of meningitis without paralysis)	57
paralysis with supported ventilation	7
bulbar paralysis	3

Four days after notification of the first case, vaccination was offered to everyone up to 62 years of age in a wide area around the city where the first patient went to school (Rotterdam). There was an

overwhelming public response, which caused major logistical problems, especially at the municipal health services. After one week vaccination was restricted to: people who had come into contact with cases of poliomyelitis (oral poliomyelitis vaccine (OPV)); people younger than 41 years who had previously refused vaccination (OPV); and children up to 13 years of age who were not or incompletely immunized (OPV or IPV). This rapidly restored general public confidence.

In addition, outbreak, school and environmental investigations were conducted as were population surveys. All clinicians were alerted to possible cases by adjusting the case definition: cases of AFP, acute bulbar paralysis, aseptic meningitis and encephalitis with or without bulbar involvement were included.

Apart from the individual case and case contact investigations, the main objective of outbreak investigations was to determine the extent of poliovirus circulation throughout the country: initially the virus spread within the high-risk group and in risk areas; later poliovirus was detected outside the risk areas.

In the early days of the outbreak, primary and secondary schools for specific religious groups and the general population were investigated. Poliovirus was soon detected among both vaccine-protected and unprotected people. One week after the onset of the first case the spread of virus outside the initial risk area was confirmed. Infections clustered among household members attending the same school.

Initially, environmental sampling was focused on the high-risk areas. There were positive findings in week 2 inside the initial risk area and from week 4 onwards throughout the risk area. Retrospectively, a wild poliovirus type 3 was detected in a surface water sample taken three weeks before the first clinical case. From week 13 of the outbreak, sewage samples were taken nationwide at two-week intervals. PV3-NSL was detected only in the risk area. The main isolated vaccine strain was PV2-SL.

To assess the circulation of poliovirus in persons not belonging to the risk group, a population survey was carried out in December 1992 of two age groups at four locations: 2400 children aged 5–14 years and 3000 adults aged 40–64 years. PV3-NSL was isolated from 8 of the 3182 people who responded. All positive findings were detected in the younger group; all but one were not vaccinated and belonged to the group rejecting vaccination. Poliovirus was not detected outside the risk area. Vaccine-like isolates were found inside the risk area.

With regard to laboratory methods, classical virus isolation was done on faecal and pharyngeal specimens. All isolates were sero-typed. Poliovirus isolates were further characterized as vaccine-virus or wild-type virus by an ELISA using cross-absorbed antisera. Molecular typing was carried out by sequencing of early epidemic isolates. Results were compared with recent poliovirus type 3 strains that had been isolated elsewhere.

A recently developed antibody-capture ELISA for poliovirus type-specific IgM antibodies greatly facilitated rapid diagnosis of poliomyelitis. Faecal samples yielded positive results for virus isolation in 95% of cases; throat swab isolation was successful in 34% of cases. IgM in serum was positive in 61 of 67 patients (= 91%); 30 cerebral spinal fluid (CSF) samples from 45 cases were IgM positive (67%). The poliovirus-specific IgM persisted for about 10 weeks.

The same methods were used for the epidemiological investigations. The yield of the pharyngeal cultures was low.

For environmental investigations chloroform-treated sewage was concentrated 100–200 fold by ultrafiltration and inoculated on HEp-2 cells. Virus isolates were typed and characterized by the above methods.

On the basis of all the above investigations, it was concluded that:

- closed, non-vaccinated groups remain at risk of poliomyelitis, independent of the vaccination coverage of the surrounding population;
- a plan for outbreak response should be ready at all times, including how to deal with the mass media;
- IPV gives good individual protection in the vaccinated population;
- IPV gives good herd immunity to a highly vaccinated population;
- AFP-surveillance should be extended to adults;
- the serological IgM test may be of use for rapid diagnostic and epidemiological application;
- methods for environmental surveillance as used in the Netherlands outbreak are still rather laborious and need improvement.

Israel

A poliovirus type 1 outbreak of 15 cases occurred in 1988 in Israel, mostly among vaccinated people. The majority had a history of OPV vaccination. One child received three doses of IPV. Possible explanations for the outbreak were:

- the level of neutralization of the Hadera population against the outbreak of wild poliovirus was considerably lower than against Sabin-1 or Mahoney;
- virus exposure was mainly among those aged 0–6 years who had been given enhanced IPV, with only one case of poliomyelitis;
- the presence of an antigenic and genetically different strain from vaccine-related strains;
- the immunization coverage of a selected Hadera population could not provide protection against the massive infectious doses of wild poliovirus.

The mucosal immunity of the children given enhanced IPV, considered to be lower than after OPV, did not play a role in the spread of wild virus in the community. The extent of excretion was similar in both groups.

Oman

Following the 1988–1989 outbreak, the immunization schedule in Oman is OPV at birth, 40 days, 3, 5 and 7 months of age, with boosters at 18 months and 6 years. Since mid-1989 coverage has been 95%. AFP surveillance has since been implemented. Each notified case of AFP is investigated within 24 hours and if there is a probable case, control measures are instituted by offering two doses of OPV two months apart in a house-to-house delivery to children up to 6 years. The AFP surveillance system traced the 1991 outbreak. An increasing rate of AFP has been detected: in 1990 it was 1.3 per 100 000 children less than 15 years and in 1991 it was 2.8 per 100 000 children less than 15 years.

Of 20 notified cases, 4 were confirmed based on faecal isolates due to wild poliovirus type 3. The outbreak of poliomyelitis in Oman demonstrated the usefulness of AFP surveillance. The rate of AFP cases per 100 000 population seems to vary. In the United Kingdom, 0.65 cases of AFP have been detected recently, whereas in Oman more than two cases have been detected. Further analysis of causes of AFP other than poliomyelitis is indicated. The recommendations to stop ear, nose and throat surgery and to stop intramuscular injections and immunizations (IPV) are considered to be highly appropriate.

Bulgaria

An outbreak in Bulgaria occurred which emphasizes the importance of sustaining health programmes in times of rapid political change. The outbreak occurred predominantly in gypsy children and groups with low immunization coverage. The outbreak was controlled with a national mass immunization campaign. Since cases were found

both among Bulgarians and Turks, political and ethical considerations were also involved.

IMMUNOLOGICAL CONSIDERATIONS

Appropriate mucosal immunity is of great importance for the reduction of virus excretion and circulation and therefore for the control of poliomyelitis. IPV and OPV were developed in the 1950s and in extensive field studies the influence of vaccination on virus excretion was examined. Both vaccines appeared to induce mucosal immunity. Mucosal immunity induced by OPV is as mucosal immunity after infection. It is more effective than mucosal immunity induced by IPV or enhanced IPV. The amount of excreted virus and duration of virus excretion was reduced in people vaccinated with IPV compared with those who were not. Differences in mucosal immunity between both vaccines are most marked in the gut and less so in the pharynx. The difference in immunity after OPV and IPV can be explained by the local reaction to virus replication of the vaccine virus.

Widespread use of IPV is apparently able to stop endemic virus circulation in countries such as Finland, the Netherlands and Sweden. There are no data on the exact contribution of IPV-induced mucosal immunity. Data on the persistence of both IPV- and OPV-induced mucosal immunity are scarce. Very little is known about the effect of combination (IPV–OPV) schemes on mucosal immunity.

The studies undertaken so far have suffered from a few imperfections: (*a*) they have only been done for poliovirus type 1; (*b*) they took place shortly after immunization; (*c*) they were not conducted in the field; and (*d*) differently formulated vaccines (both OPV and IPV) were used with varying immunization schedules. Data are lacking on the degree of mucosal immunity and the importance for virus transmission after six doses of IPV. Such information may contribute to further improvement of both routine immunization strategies and outbreak containment measures.

FURTHER LESSONS

Laboratory investigations during outbreaks

Virus isolation remains an essential aspect of both case diagnosis and epidemiological investigation. Poliovirus typing and the differentiation of vaccine-like viruses from wild viruses are needed for outbreak characterization. Poliovirus isolation is essential for present molecular techniques.

Standardized laboratory tests for immunity are needed, referring where possible to international standards and reference preparations. Comparability between different studies would otherwise remain difficult.

Detection of IgM antibodies in serum or CSF is a valuable additional rapid diagnostic test. It also may provide quick evidence of the spread of infection in a population.

Molecular typing of poliovirus isolates is useful when investigating an outbreak and global routes of the spread of polioviruses, and may assist in specific detection of viruses from environmental samples.

Sewage sampling is useful for monitoring the geographical spread of the virus. It may anticipate cases, particularly if the methods are improved and become less time-consuming and laborious. It can also provide good evidence of whether an outbreak has come to an end.

Immunology

OPV is preferred for outbreak control. The number of OPV doses and their timing needs further study: in a type 3 outbreak a single dose could be sufficient. Combined and sequential IPV/OPV schedules have recently been shown to be capable of highly effective immunization. However, IPV may boost immunity more reliably than OPV in developing countries, particularly in respect of type 3 poliovirus.

The immunogenicity of routine immunization schedules differs in developing versus industrial countries. The Netherlands immunization programme has proved effective in protecting the general population.

It is unlikely that (additional) OPV would protect unvaccinated people through indirect routes of vaccine-virus transmission. The only way to protect the unprotected is to prevent importation. This is achievable only through the global eradication of poliovirus.

The waning of immunity and the response to booster vaccinations requires further study. It is necessary to consider booster vaccinations for adults. The lack of antibodies in women of childbearing age has consequences as their babies will be born without maternal immunity. The significance of this for control strategies needs further study.

Many excellent studies on the development and effectiveness of mucosal immunity have already been conducted. However, to gather further information, the opportunities offered by natural outbreaks of poliomyelitis should wherever possible be followed up. During the outbreak in the Netherlands it was shown how this could be done.

Detailed immunological analysis, including the antigenic variation of polioviruses, could contribute to understanding immunity to poliomyelitis.

Surveillance

Serological surveillance is valuable in assessing population immunity. Surveys should focus on groups that might be at greater risk of not being naturally or artificially immunized. It is especially important to look at declining levels of immunity in adults, immunized many years before.

AFP surveillance should be introduced in more countries since it is an excellent control measure, especially when used in the early

stages of an outbreak. Virological surveillance should be done in samples of stools taken for clinical purposes and in samples of AFP cases and people who have come into contact with them.

In addition to AFP surveillance and virological surveillance, environmental surveillance can also serve as an early warning system and is of increasing importance to the poliomyelitis eradication initiative. A system of sewage sampling should be developed for environmental surveillance. However, it is first necessary to evaluate the meaning of a wild poliovirus isolation in such a context. This would allow for better planned investigations after the detection of wild poliovirus in sewage and thus lead to effective preventive action. The methodology of detecting wild polioviruses in sewage and other samples is an area of promising research.

Pockets of non-vaccinated people and importation of wild poliovirus

The Netherlands has been able to uncover its pockets of unvaccinated people, whereas such pockets in other countries remain undetected. This places great importance on surveillance. Pockets of low coverage or immunity can be identified through vaccination returns from districts, surveillance of cases, liaison with social and religious workers, local knowledge of public health workers and serological surveys. Protection of people who are unvaccinated for religious reasons poses great difficulties; the involvement of religious leaders is essential. Other groups of non-immunized people such as gypsies, travellers and immigrants could be reached by committed health workers.

Compulsory immunization and indirect immunization by means of the spread of live polio vaccine virus is not recommended owing to the political, ethical and practical issues involved.

The danger of importation of wild viruses is growing, despite the progress made under the WHO eradication programme, owing to increasing international travel and illegal immigration. The Indian

subcontinent seems the main source of concern. While immunization of travellers should be encouraged, it is unrealistic to implement measures such as vaccination certification requirements at borders.

Industrialized countries should put more effort into the control of poliomyelitis in endemic areas, and ask for more political support for such efforts.

CONCLUSIONS AND RECOMMENDATIONS

1. Sustaining immunization coverage with at least all six antigens recommended under the Expanded Programme on Immunization (EPI) remains first priority for WHO's poliomyelitis eradication initiative and must remain so during times of political change.

2. All areas or groups with reduced coverage should be identified and contacted, with a view to improving immunization coverage.

3. A strategy for outbreak response should be based on a good understanding of the epidemiological situation in a country; take account of social constraints and expectations; be flexible and adaptable to changes; set priorities for laboratory work and the use of probably scarce reagents; and include ways in which to handle the press and public communication.

4. Careful investigation and scientific analysis of outbreaks are of great value, as shown by the excellent work of the investigators in the Netherlands, both in the 1978 and in the 1992/1993 outbreaks.

5. The risk of an outbreak among pockets of unprotected people who refuse or avoid immunization is a persisting danger, especially as the virus can spread throughout a community. Increased awareness of the progress of the WHO poliomyelitis eradication initiative could contribute to discussions within

these communities. The people from such pockets remain at risk of contracting poliomyelitis until global eradication has been achieved.

6. Effective and continuous active surveillance will be of increasing importance to all countries in Europe. AFP surveillance remains to be established in most countries.

7. All countries need to plan flexible strategies for the control of outbreaks, and to be aware of the need to update these in the light of advancing knowledge.

8. Outbreak investigations and laboratory research on poliomyelitis must continue to be given high priority.

Annex 1

PARTICIPANTS

Temporary Advisers

Dr H. van der Avoort
Virology Laboratory, National Institute of Public Health and Environmental Protection (RIVM), Bilthoven, Netherlands

Dr H. Bijkerk
Waddinxveen, Netherlands

Dr D. van den Bosch
Tilburg, Netherlands

Dr I.G. van 't Bosch
Ministry of Welfare, Health and Cultural Affairs, Rijswijk, Netherlands

Dr Blenda Böttiger
Department of Virology, Statens Seruminstitut, Copenhagen, Denmark

Professor Margareta Böttiger
National Epidemiological Officer, Department of Epidemiology, National Bacteriological Laboratory, Stockholm, Sweden

Dr M. Conyn-van Spaendonck
Department of Infectious Diseases Epidemiology, National Institute of Public Health and Environmental Protection (RIVM), Bilthoven, Netherlands (*Rapporteur*)

Dr R. Coutinho
Municipal Health Service, Department of Public Health, Amsterdam, Netherlands

Dr R. Crainic
Institut Pasteur, Paris France

Dr A.M. Dingemans-Dumas
Virology Laboratory, Municipal Health Service, Rotterdam, Netherlands

Dr F. Dondeyne
Médecin en Chef-Directeur, Ministère de la Communauté flamande, Administration de la Santé publique, Brussels, Belgium

Dr Sergey G. Drozdov
Director, Institute of Poliomyelitis and Viral Encephalitides of the Academy of Medical Sciences of the Russian Federation, Russian Federation

Professor G. Elzinga
Board of Directors, National Institute of Public Health and Environmental Protection (RIVM), Bilthoven, Netherlands

Dr C.F. Engelhard
Public Health Organization, Rotterdam, Netherlands

Dr L.B. Flugsrud
Deputy Head, Department of Virology, National Institute of Public Health, Norway

Dr J. Greaves
Public Health Organization, Dordrecht, Netherlands

Dr Nicole Guérin
International Children's Centre, Paris, France

Dr Tapani Hovi
Head, Enterovirus Laboratory, National Public Health Institute, Helsinki, Finland

Professor J. Huisman
Rotterdam, Netherlands

Dr H. van den Kerkhof
Public Health Organization, Dordrecht, Netherlands

Dr A.M. van Loon
Head, Virology Laboratory National Institute of Public Health and Environmental Protection (RIVM), Bilthoven, Netherlands

Mr M. Mulders
Division of Viral and Rickettsial Diseases, Centers for Disease Control and Prevention, Atlanta, GA, USA

Dr P. Oostvogel
Virology Laboratory, National Institute of Public Health and Environmental Protection (RIVM), Bilthoven, Netherlands

Dr H.C. Rümke
Medical Centre Immunizations, National Institute of Public Health and Environmental Protection (RIVM), Bilthoven, Netherlands

Dr D.M. Salisbury
Principal Medical Officer, Department of Health, London, United Kingdom

Professor B. Sangster
Director-General, Volksgezondheid, Rijswijk, Netherlands

Mr J.H.F. Schaeffer
Kampen, Netherlands

Dr J. Sekhuis
Health Council, 's-Gravenhage, Netherlands

Dr G. Siemons
Ministry of Welfare, Health and Cultural Affairs, Rijswijk, Netherlands

Sir Joseph Smith
London, United Kingdom (*Chairperson*)

Dr G. van Steenis
Laboratory for Control of Biological Products, National Institute of Public Health and Environmental Protection (RIVM), Bilthoven, Netherlands

Professor T.A. Swartz
Adviser for Epidemiology Problems to the Director General of the Ministry of Health, Israel, Ramat Aviv, Tel Aviv, Israel

Dr Béatrice Swennen
PROVAC - Ecole de santé publique, Bruxelles, Belgium

Dr T. Tromp
Kampen, Netherlands

Dr Loredana Vellucci
Medical Officer, Infectious Diseases Unit, Ministry of Health, Rome, Italy

Dr Hans P. Verbrugge
Medical Officer for Maternal and Child Health, Department of the Chief Medical Officer of Health, Rijswijk, Netherlands

Mr J.K. van Wijngaarden
Principal Medical Inspectorate of Public Health, Rijswijk, Netherlands

Dr David Wood
Division of Virology, National Institute for Biological Standards and Control, Parrs Wood, United Kingdom

Observers

Dr Frederik P.L. van Loon
Medical Epidemiologist, Surveillance, Investigation and Research Branch, National Immunization Programme, Centers for Disease Control and Prevention, Atlanta, GA, USA

Dr Mark Pallansch
Chief, Enterovirus Section, Respiratory and Enteric Virus Branch, Division of Viral and Rickettsial Diseases, Centers for Disease Control and Prevention, Atlanta, GA, USA

Dr Roland Sutter
Acting Chief, Infant Immunization Branch, National Immunization Programme, Centers for Disease Control and Prevention, Atlanta, GA, USA

World Health Organization

Regional Office for Europe

Ms Johanna Kehler
Secretary, Polio Eradication

Dr George Oblapenko
Medical Officer, Polio Eradication (*Secretary*)

Headquarters

Dr Yuri Ghendon
Medical Officer, Division of Communicable Diseases

Dr Barbara Hull
Medical Officer, Expanded Programme on Immunization

Dr Harry Hull
Medical Officer, Expanded Programme on Immunization

Dr Rob McNair Scott
Medical Officer, Expanded Programme on Immunization

Dr Susan Robertson
Medical Officer, Expanded Programme on Immunization

Dr Henrik Zoffmann
Deputy Director, Expanded Programme on Immunization