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Report on the

FIFTH INTERCOUNTRY MEETING OF DIRECTORS OF POLIOVIRUS LABORATORIES IN THE WHO EASTERN MEDITERRANEAN REGION

Cairo, Egypt, 21–23 May 2001

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1. INTRODUCTION

The fifth intercountry meeting of directors of poliovirus laboratories in the WHO Eastern Mediterranean Region was held in Cairo, Egypt, from 21–23 May 2001. The meeting was attended by directors of laboratories in: Egypt, Jordan, Kuwait, Oman, Pakistan, Saudi Arabia, Syrian Arab Republic and Tunisia. Participants also included scientists from: the Centers for Disease Prevention and Control (CDC) in Atlanta, USA; National Institute of Public Health and the Environment (RIVM), Netherlands; National Public Health Institute, Finland; and World Health Organization (WHO) headquarters and Regional Office for the Eastern Mediterranean.

Dr. M.H. Wahdan, Special Advisor to the Regional Director on Poliomyelitis Eradication, welcomed the participants and addressed them on behalf of the Regional Director, Dr Hussein Gezairy. In his message to the meeting Dr Gezairy welcomed the participants and thanked them for their significant input in the efforts made by the laboratory network to ensure effective surveillance capable of properly directing the programme at this critical stage of polio eradication in the Region. He referred to efforts made by the laboratories to maintain the high levels of performance achieved and to respond to programme needs. Dr Gezairy specifically requested responsible officers to ensure that no delay occurred in confirming wild virus circulation.

A different chairman was elected on each day of the meeting; elected persons were Dr Siham Al Mufti of Kuwait, Dr Humayun Asghar of Pakistan and Mrs Iman El Maamoun Naser of Egypt. The programme of the meeting and list of participants are included as Annexes 1 and 2 of this report.

2. IMPLEMENTATION OF THE RECOMMENDATIONS OF THE FOURTH INTERCOUNTRY MEETING OF DIRECTORS OF POLIOVIRUS LABORATORIES IN THE EASTERN MEDITERRANEAN REGION

Recommendations of the previous meeting were reviewed and the main achievements in implementation were as follows.

- The WHO Regional Office has emphasized to ministries of health and other partners involved in poliomyelitis eradication that laboratory support will be necessary beyond the interruption of wild poliovirus transmission and at least until global cessation of OPV immunization.

- The speed of obtaining intratypic differentiation results for polioviruses has generally improved. Simultaneous referral of original stools with virus isolates to reference laboratories has become standard practice for all national poliovirus laboratories. Additionally, several national laboratories have identified and used more efficient mechanisms to refer viruses to reference laboratories and most have met the performance target of referral within 14 days of detection. Only the Syrian laboratory continued to experience problems with sample referral.

- A module on laboratory quality assurance has been included in the updated polio laboratory manual produced by WHO/HQ in 2001. To improve cell line quality all

reference laboratories in the WHO Eastern Mediterranean Region have accessed or introduced mycoplasma testing of cell lines that are being distributed.

- Regional network laboratories are playing a leading role in containment of polioviruses. Eleven of the 12 laboratories have completed an inventory of their stored materials, and directors of 8 laboratories have been designated as national containment coordinators.

- The scope of work of 8 poliovirus network laboratories has been expanded as they have also been designated as national measles laboratories. This proves that the laboratory infrastructure established for the poliomyelitis eradication programme is of benefit to another public health programme. A regional network of measles virus laboratories is being established, and its activities and resource needs have been outlined in a regional 5 year plan of action.

3. OVERVIEW

3.1 Progress towards global poliomyelitis eradication

Mr D. Featherstone, WHO/HQ

In 1988 WHO resolved to eradicate poliomyelitis by the year 2000. Although that goal was not attained, there can be little doubt that significant progress has been made towards eradication. The number of reported poliomyelitis cases in the world has declined by 99%, from 350 000 in 1988 to 3500 in 2000. The WHO Region of the Americas and Western Pacific Region have already been certified as polio-free and no indigenous wild polioviruses have been detected in the European Region since November 1998. In the other regions of the world efforts were intensified in 2000 to accelerate the interruption of wild poliovirus transmission in 20 remaining endemic countries.

Between 1999 and 2000 several hundred WHO-funded immunization staff were deployed, mostly at country level, to assist with AFP surveillance and implementation of extra NIDs in remaining polio endemic countries. There has also been synchronization of NIDs across large geographical areas, and strong emphasis is being placed on effective supervision to achieve high quality immunization campaigns, with delivery of OPV by vaccinators who move from house to house to locate children. A challenge with this approach has been ensuring the availability of approximately 1.25 billion doses of OPV per annum to meet global demands, and this has required careful stock management by UNICEF to ensure that each country's needs are met on time.

The impact of acceleration efforts is already being seen. The total number of cases of acute flaccid paralysis (AFP) detected worldwide increased by approximately 25% from 22 669 in 1999 to 27 599 in 2000. At the same time the number of confirmed poliomyelitis cases reported globally declined from 6914 in 1999 to 2837 in 2000, although 1000 AFP cases were still awaiting final classification up to 14 March 2001. One of the 3 poliovirus serotypes may already have been eliminated. The last time type 2 was detected was in October 1999 in India. Indeed there has been particularly impressive performance by the eradication programme in India demonstrated by the dramatic decline in reported wild virus

confirmed cases from 1934 in 1998, to 1126 in 1999, to 265 in 2000. Up to 14 May 2001 only 9 wild virus cases had been confirmed in India.

In 2001, priorities for the polio eradication programme are the 20 countries with reported poliomyelitis cases in 2000. There is need to interrupt poliovirus transmission in the highly populated 'reservoir' countries of Angola, Democratic Republic of the Congo, Nigeria and Pakistan. Special challenges to programme implementation exist in areas affected by conflict e.g. Afghanistan, Ethiopia, Somalia and southern parts of Sudan. There is a need for assuring highly sensitive surveillance throughout the world to ensure detection of AFP cases, collection and testing of adequate stool specimens so that wild virus transmission will not go undetected. A programme of accreditation of laboratories by WHO is aimed at assuring availability of high quality virology investigations to support surveillance efforts. In 2000 a network of 167 laboratories was involved in the eradication programme. Of these laboratories, 147 were fully accredited, 11 were provisionally accredited and 9 were not accredited. While the latter laboratories address weaknesses in performance, they are being required to split all samples and refer aliquots to accredited laboratories for testing and provision of accurate results for programme use.

Several challenges are to be met in the final stages of the poliomyelitis eradication programme. Countries are currently implementing plans to contain laboratory stocks of polioviruses so that such materials do not serve as a source of reintroduction of polioviruses into communities. Importation of wild virus into polio-free countries will remain a risk until global poliomyelitis eradication goal is achieved. For example, wild polioviruses were isolated from 2 AFP cases in Bulgaria in 2001, even though no wild viruses had previously been detected in this country for several years. Initial investigations suggest that the wild viruses detected in Bulgaria represented importation from India. Similarly, a poliomyelitis outbreak due to an imported virus from Angola occurred in Cape Verde in 2000, in which 44 persons were paralysed and 17 people died. Cape Verde had previously been polio-free and transmission of the imported virus was probably facilitated by low immunity among the population, because of low OPV3 coverage. Similar conditions of low OPV3 coverage existed on the island of Hispaniola where an outbreak of poliomyelitis occurred between July 2000 and April 2001. The Hispaniola outbreak was caused by a vaccine derived poliovirus. The outbreak has direct implications for strategies to be used to stop vaccination in the post-eradication era as the region of the Americas, to which Hispaniola belongs, was declared polio-free in 1994.

3.2 Regional progress towards poliomyelitis eradication

Dr F. Kamel, WHO/EMRO

In the year 2000 the following were the regional achievements in implementing WHO recommended strategies for poliomyelitis eradication.

- Routine immunization coverage with OPV3 showed improvement particularly in countries with previously low rates.

- Supplementary immunization campaigns were implemented in all Member States, except Cyprus, Oman and United Arab Emirates. These supplemental immunizations were in the form of subnational immunization campaigns covering border communities,

high-risk areas and/or high-risk population groups in Bahrain, Islamic Republic of Iran, Kuwait, Palestine, Libyan Arab Jamahiriya and Tunisia. Full scale national immunization days with two rounds of delivery of oral poliovaccine (OPV) were held in Jordan, Lebanon, Morocco, Qatar, Saudi Arabia and Republic of Yemen. Most significantly, several countries of the Region (Afghanistan, Djibouti, Egypt, Iraq, Pakistan, Somalia and Sudan) conducted 3 or more rounds of NIDs, using mostly a house-to-house approach in an attempt to hasten interruption of virus transmission.

- During 2000 there were improvements in AFP surveillance. The regional AFP detection rate was 1.4 per 100 000 children under 15 years of age, which was an improvement compared to rates of 0.85 in 1997, 0.88 in 1998 and 1.1 in 1999. AFP rates of more than 1 per 100 000 children under 15 years were reported from 16 countries, although lower rates were reported by Cyprus, Djibouti, Libyan Arab Jamahiriya, Morocco, Palestine, Qatar and United Arab Emirates. A challenge in several countries is the collection of adequate stool samples (i.e. 2 stools collected at least 24 hours apart and within 14 days of paralysis onset) from at least 80% of all AFP cases for virology investigations. Only 11 of 23 countries achieved this performance in 2000, and the regional average was 69% for collection of adequate stools. It is likely that the performance target of at least 80% for collection of adequate stools will be met in the Region in 2001 based on projections from reported surveillance data for the first 4 months of the year.

Significant progress has been made towards interruption of wild poliovirus transmission in the WHO Eastern Mediterranean Region. By December 2000, 16 of the 23 countries of the Region were polio-free, and poliomyelitis cases were detected in 7 countries, namely Afghanistan, Egypt, Islamic Republic of Iran, Iraq, Pakistan, Somalia and Sudan. The total number of reported poliomyelitis cases in the region has declined from 914 in 1999 to 499 in 2000 representing approximately a 40% decline. This decline was even more encouraging because it occurred in a setting of significantly improved AFP surveillance in the remaining poliomyelitis endemic countries. Further, approximately 80% of all poliomyelitis cases from the Region were reported by a single country, Pakistan. Intensive efforts are under way to accelerate the interruption of wild poliovirus transmission in Pakistan and in the other remaining polio endemic countries.

As part of acceleration of efforts, there has been an increase in the number of rounds of NIDs conducted in the remaining polio endemic countries with greater emphasis on supervision and quality of campaigns. Efforts are also being made to strengthen AFP surveillance, and, there has been deployment of close to 600 health care professionals, who have been recruited through WHO, to assist with programme implementation. It is recognized that several challenges are facing the programme in the remaining polio endemic countries, including the following.

- Civil unrest in Afghanistan, Somalia and in southern areas of Sudan

- The need to secure sufficient stocks of OPV to respond to the planned increase in the number of immunization campaigns

- Assurance of political commitment by countries through continuation of advocacy efforts

- Ensuring availability of sufficient human and financial resources

- Ensuring appropriate response targeted at stopping virus transmission should there be poliovirus importation into polio-free countries

The regional activities for certification of poliomyelitis eradication are keeping pace with the implementation of program activities. By December 2001 the Regional Certification Commission (RCC) had reviewed documents submitted by 11 countries (Bahrain, Cyprus, Islamic Republic of Iran, Kuwait, Jordan, Morocco, Oman, Qatar, Syrian Arab Republic, Tunisia and United Arab Emirates). The quality of documentation in all but one report was found to be satisfactory. All countries are however to continue with the implementation of program activities until the entire Region is certified as polio free. It is anticipated that polio-free status will be achieved before the end of 2002 and that the Region will be certified as polio-free by 2005.

3.3 Overview of wild poliovirus surveillance in the Region

Dr E. de Gourville, WHO/EMRO

Virology results are increasingly being used for final classification of AFP cases in the WHO Eastern Mediterranean Region. Twenty-three countries referred samples to WHO network laboratories in 2000, and 19 countries are using virology results for final classification of AFP cases. Established standards for laboratory performance, as well as technical and managerial procedures are evaluated through an accreditation programme that requires an annual review of performance, with on-site observation of work practices, as appropriate.

In 2000, the Region reported a total of 3255 AFP cases and virology investigations were done on 95.4 % of these cases. Overall 7392 samples were tested, comprising 6303 stools from AFP cases and 1089 samples collected from contacts, the environment or other sources. Adequate stool samples (i.e. 2 samples collected at least 24 hours apart and within 14 days of paralysis onset) were collected from only 69.7% of reported AFP cases, and this fell short of the performance target of 80%. Only 48% of samples were received in laboratories within 3 days of collection from patients, and, failure to meet the performance target of 80% generally resulted from unavoidable delays as samples are shipped via commercial couriers to distant laboratories. Despite transport delays, 96% of all samples were received in laboratories in good condition. Virology results were reported within 28 days of sample receipt for 80% of AFP cases, and, non-polio enteroviruses (NPEV) were isolated from 12% of all samples tested. It was very encouraging to see that improvement was made in several aspects of surveillance and laboratory performance. High priority will be given in 2001 to shortening the time between disease onset and final intratypic differentiation results (ITD) for poliovirus positive cases, as reported data from network laboratories showed that an average of 68 days elapsed between onset and final results for cases with poliovirus isolates.

Wild polioviruses were isolated from 286 of the 501 confirmed polio cases in the Region in 2000, with the remaining cases confirmed on the basis of clinical findings.

Confirmed wild virus cases were from 7 countries. Poliovirus serotypes 1 and 3 were detected in Afghanistan, Egypt, Pakistan and Somalia. Only serotype 1 was detected in the Islamic Republic of Iran, Iraq, and Sudan. Serotype 2 was not detected in the Region in 2000 and was last reported in Pakistan and Afghanistan in 1997. It was noted that indigenous wild viruses continued to occur in Afghanistan, Egypt and Pakistan in 2000. In the Islamic Republic of Iran there were 3 polio type 1 cases, all from the Char Bihar district of Sistan va Baluchistan province. This province borders Pakistan, and epidemiological investigations revealed that the population in Char Bihar has frequent contact with the Pakistan community across the border and this could provide opportunities for virus transmission. Wild virus cases detected in Iraq in 2000 represented the last 4 cases of an outbreak that started in May 1999 and extended until January 2001. Viruses from Somalia in 2000 were isolated as part of an outbreak in which 46 wild virus cases were confirmed (41 of serotype 1; 4 of serotype 3; and 1 co-infected with types 1 and 3), with the majority of cases being detected in Mogadishu. Although only 4 wild virus confirmed cases were reported from Sudan in 2000, there was an additional 72 cases were confirmed on clinical grounds, and confirmed poliomyelitis cases had a wide geographical distribution throughout the country.

Between January and 14 May 2001, confirmed wild poliovirus cases were reported from Afghanistan (type 1), Egypt (type 1), Pakistan (types 1 and 3) and Republic of Yemen (type 1). Initial investigation of the single wild virus cases from the Republic of Yemen suggests transmission of a virus that is genetically linked to contemporary Egyptian viruses.

3.4 Update on genetic characteristics of polioviruses from countries of the Eastern Mediterranean Region

Dr M. Pallansch, CDC, Atlanta, USA

All poliovirus isolates from the Region are being genetically characterized through collaboration between WHO network laboratories and specialized laboratories at CDC, Atlanta and RIVM, The Netherlands.

Serotype 1 viruses from 2000 fell into distinct genotypes, all indigenous to the Region, and each with a separate geographical location corresponding to the countries of Egypt, Iraq, Sudan and Somalia, and genotype that spans the countries of Afghanistan and Pakistan. The Iraq type 1 genotype has not been detected since January 2000. There was very close genetic similarity among all 2000 type 1 viruses isolated during the outbreak in Somalia. Similar close genetic homology has been seen among viruses isolated in 1999 and 2000 from Sudan. In the year 2000, type 1 viruses isolated from 2 AFP cases and from a few environmental samples from Egypt had a high degree of genetic homology. The Egypt viruses represented continued circulation of a lineage of an indigenous genotype, even though transmission appears to be restricted to a few foci in southern areas of the country.

There was much genetic variability among polio type 1 viruses from the Afghanistan/Pakistan reservoir, with evidence of the existence of many separate transmission chains in 2000. It was noted that serotype 1 viruses detected in the Islamic Republic of Iran in 2000 had a high genetic homology in the VP1 gene to contemporary viruses of Sindh, Pakistan, even though the cases had disease onset in the Islamic Republic of Iran. There has been sequencing of the VP1 gene of all polio 1 viruses isolated in the Islamic Republic of Iran

since 1998 and available genetic data suggest repeated importation into the Islamic Republic of Iran of viruses from the Afghanistan/Pakistan reservoir.

Type 3 polioviruses isolated in the Region in 2000 were from AFP cases detected in Egypt (2 cases), Afghanistan, Pakistan and Somalia. As with type 1 viruses, a single type 3 genotype spans the countries of Afghanistan and Pakistan with detection of many separate genetic lineages. Type 3 viruses from Egypt were indigenous to that country and represented a continuation of transmission 2 genetic lineages that were also detected in 1999. Polio type 3 viruses from Somalia were distinguishable from those of Afghanistan, Egypt and Pakistan.

4. REPORTS FROM LABORATORIES SERVING COUNTRIES WITH WILD POLIOVIRUS CIRCULATION

4.1 Egypt

Mrs I. El Maamoun Naser, VACSERA, Egypt

Evidence suggests there is continued, although considerably reduced, circulation of polioviruses of serotypes 1 and 3 in Egypt, and that wild type 2 virus was last detected in 1994. The total number of reported AFP cases in Egypt in 2000 were giving rate of 1.2 per 100 000 children under 15 years of age. Adequate stool samples were collected from 89.5% of AFP cases and the non-polio enteroviruses (NPEV) isolation rate was 9.5%. Cases with wild poliovirus isolates were all from southern governorates and included 2 cases with serotype 1 viruses from Assiut and Qena and 2 cases with serotype 3 viruses from Assiut and Fayoum. On the basis of genetic characteristics, wild polioviruses of 2000 were indigenous to Egypt and represented continuation of transmission of genetic lineages that had been detected in previous years. All cases were less than 24 months of age and all had received more than 3 doses of OPV. Between January and 30 April 2001 the laboratory investigated samples from 194 AFP cases and wild serotype 1 polioviruses were isolated from samples from 3 AFP cases, all from the southern governorate of Al Minya.

VACSERA is a designated WHO poliovirus reference laboratory and 59% of its workload in 2000 was due to testing of samples from countries other than Egypt. In this regard, VACSERA tested samples referred from Eritrea, Iraq, Jordan, Lebanon, Qatar, Sudan, Syrian Arab Republic and Republic of Yemen. Altogether 793 samples were received from foreign countries, of which 561 were from AFP cases and 45 from contacts of cases. Wild polioviruses were detected in 2000 in samples from Iraq and Sudan, and Sabin-like polioviruses were isolated from samples from Eritrea, Iraq, Jordan, Lebanon, Sudan, Syrian Arab Republic and Republic of Yemen. Between January and 30 April 2001, VACSERA received 141 specimens for testing from foreign countries, and wild polioviruses were detected from two samples from an AFP case from the Republic of Yemen.

The VACSERA poliovirus laboratory was fully accredited by WHO in 2000. It provided virology results for 80% of AFP cases from Egypt within 28 days of receipt of samples, and intratypic differentiation results for 100% of poliovirus isolates within 28 days of their isolation. In 2000, the laboratory scored 100 % in proficiency tests that evaluated performance for virus isolation, serotyping, and, intratypic differentiation of polioviruses. The laboratory's performance was adversely affected by its relocation to different rooms within the same institution in 2000, and temporary problems were experienced with cell line

contamination. These problems resulted in delayed analysis and reporting of results that affected a few countries. Cell line problems were resolved in early 2001.

4.2 Pakistan

Dr H. Asghar, National Insitute of Health, Pakistan

In 2000 the laboratory tested 2167 stool samples from 1098 AFP cases from Pakistan. Overall 70% of AFP cases had samples collected within 14 days of paralysis onset, 66% of cases had samples that met criteria for adequacy, 95% of samples were received in the laboratory in good condition although only 47% of samples were received within 3 days of collection from patients. Reports were available within 28 days of sample receipt for 80% of AFP cases and the NPEV isolation rate was 13%. There has been improvement in AFP surveillance in Pakistan with a concomitant decline in detection of wild poliovirus confirmed cases during the period 1997 to 2000. The reported non-polio AFP detection rate among children less than 15 years of age has reached more than 1.0 since 1999. There has been a declining trend in the total number of wild poliovirus confirmed cases from 1147 in 1997 to 202 for 2000. The 202 wild virus positive cases of 2000 comprised 101 cases of type 1, 95 cases of type 3; and 6 cases that were co-infected with type 1 and type 3 viruses. Statistics for the period January to April 2001 show that 917 samples were tested from 460 AFP cases and wild polioviruses were detected from a total of 16 cases: 11 had type 1 viruses and 5 had type 3 viruses.

The laboratory in Pakistan provides support for the polio eradication programme in Afghanistan. In 2000 the laboratory tested 471 stool samples from 241 AFP cases from Afghanistan. Overall 55% of AFP cases had samples collected within 14 days of paralysis onset, 54% of cases had samples that met criteria for adequacy, 97% of samples were received in the laboratory in good condition although only 24% of samples were received within 3 days of collection from patients. Reports were available within 28 days of sample receipt for 78% of AFP cases and the NPEV isolation rate was 19%. During 2000, wild poliovirus type 1 was detected in 16 AFP cases, type 3 viruses were isolated from 11 cases and 1 case was co-infected with type 1 and type 3 polioviruses. Between January and April 2001, a total of 172 samples were tested from 88 AFP cases and wild poliovirus type 1 was detected in only 4 cases from Afghanistan.

A few problems were experienced by the Pakistan laboratory in 2000. One incident of bacterial contamination of cell lines delayed sample processing over a few weeks. There were delays in obtaining some needed laboratory supplies. There were also a few technical problems with the ELISA for intratypic differentiation of type 3 polioviruses, although these were resolved through consultation with scientists from RIVM, the Netherlands, who provide the reagents for the test.

4.3 Report from Kenya Medical Research Institute, KEMRI

Dr P. Tukei, WHO Temporary Adviser

KEMRI is situated in Nairobi, Kenya, and has been part of the WHO global polio laboratory network since 1995.

KEMRI performs virology investigations on AFP cases detected in Kenya, St. Hellena, Seychelles and Eritrea for the WHO African Region and Djibouti, southern parts of the Sudan and Somalia for the Eastern Mediterranean Region. KEMRI also performs vaccine potency tests for the Kenya EPI programme. During 2000, KEMRI tested 609 samples from Kenya, 313 from Somalia, 116 from south Sudan and 4 from Djibouti. Of total samples from the Region referred to KEMRI, the percentage received within 3 days of collection from patients was 2% for Somalia, 20% for south Sudan and 0% for Djibouti. The overall NPEV isolation rate at KEMRI in 2000 was 10% and was 26%, 7% and 0% for samples from Somalia, south Sudan and Djibouti, respectively. Sample handling practices appear to be good in Somalia and south Sudan based on the high rate of NPEV isolation. KEMRI reported results within 28 days of sample receipt for 94% of all samples from AFP cases in 2000, and from 82%, 98% and 50% of samples referred by Somali, south Sudan and Djibouti, respectively. KEMRI isolated only Sabin-like viruses from samples referred from Kenya and south Sudan in 2000, but 73 wild polio type 1 and 6 wild type 3 poliovirus isolates were obtained from patients from Somalia in 2000. KEMRI had also isolated wild polio type 3 virus from the only virus-confirmed poliomyelitis case in southern Sudan in 1999.

5. QUALITY OF LABORATORY PERFORMANCE

5.1 Report on proficiency test programme

Dr H. van der Avoort, RIVM, Netherlands

In 2000 separate panels of samples were distributed to evaluate proficiency in virus isolation and serotyping (I&T panel), intratypic differentiation (ITD) by ELISA (ITD-ELISA), and ITD by probe hybridization (ITD-probe). The I&T and the ITD-ELISA test panels were distributed by RIVM, Netherlands, and the ITD-probe panel by CDC, Atlanta.

The I&T panel consisted of 5 samples that were distributed to the 12 regional laboratories in May 2000. Assigned scores were 100% (4), 90% (1), 80% (2), 70% (2), 65% (1), 60% (1) and 0% (1). The proficiency test revealed substantial problems in the laboratory that scored 0% and a consultant virologist was assigned for 1 month to assist with staff training. The proficiency test also revealed that several laboratories experienced problems in identifying all viruses that were present in 2 samples that contained mixtures of polioviruses. Individual feedback was provided to all laboratories about their performance, and recommendations were given by the regional laboratory coordinator to laboratories to perform additional testing that could assist in identifying all viruses in samples with mixtures of viruses. All laboratories showed ability to detect previously missed viruses.

Subsequently 7 laboratories received another I&T proficiency test panel of 5 samples, including the 5 national poliovirus laboratories that had scored less than 80% and 2 reference laboratories that scored less than 90% on the first test. Six laboratories scored 100% and 1 scored 95% on the repeat test.

Eighteen laboratories around the world evaluated an ITD-ELISA panel of 18 samples that was distributed by RIVM in 2000. Seventeen of 18 laboratories scored 100%, including 5 laboratories in the regional network, located in Egypt, Islamic Republic of Iran, Kuwait, Pakistan and Tunisia. All laboratories were asked to submit their worksheets with the results.

Review of these worksheets showed that only 11 of the 18 laboratories around the world should have received a true 100% score because 4 laboratories experienced problems with the test for polio type 3 viruses and 2 others had other problems. In all instances feedback was provided to laboratories to assist them in obtaining reliable and reproducible results that meet standard validation criteria for the test.

Dr Mark Pallansch, CDC, provided feedback on the ITD-probe panel that was distributed in 2000 and indicated that all regional network laboratories performed satisfactorily. Scores were not assigned by CDC for the ITD-probe panel of 2000 as there had been only qualitative evaluation of results.

5.2 Report on accreditation of laboratories

Dr E. de Gourville, WHO/EMRO

In 2000, WHO fully accredited the poliovirus laboratories in Egypt, Islamic Republic of Iran, Iraq, Jordan, Kuwait, Oman, Pakistan, Saudi Arabia, Sudan and Tunisia. The laboratory in Morocco showed good technical performance and accuracy, but was designated as provisionally accredited by WHO in 2000, with the only deficiency being delays in reporting virology results for investigated samples from AFP cases. The Morocco laboratory subsequently improved its performance and was fully accredited by WHO in 2001. The laboratory in the Syrian Arab Republic was provisionally accredited by WHO in 2000. The Syrian laboratory showed good technical performance and ability to provide timely results. However, it was found that there was inadequate quality control of cell lines used for virus isolation, and, that there were unacceptably long delays in referring poliovirus isolates from AFP cases to reference laboratories to determine whether the viruses were wild or vaccine like. Evaluation of the Syrian laboratory was pending for 2001.

Accreditation data were presented for each laboratory for the period 1998 to 2001. It was evident that the regional poliovirus laboratory network had generally improved its performance over the years, particularly with respect to providing timely virology results. It was noteworthy that the laboratories in Iraq, Pakistan and Sudan coped well when they experienced significant increases in workload between 1999 and 2000 as a result of improvements in AFP surveillance in those countries.

It was emphasized that laboratories should expect a much lower poliovirus isolation rate with the declining incidence of poliomyelitis as a result of the eradication programme action. Therefore high priority should be given in every laboratory to monitoring the NPEV isolation rate, and sensitivity testing of cell lines at least once every 3 months and. whenever new cells are received. Such actions are vital to provide reassurance of the laboratory's ability to detect virus, even if present at low titre.

5.3 Is quality of laboratory and surveillance performance sufficient to guide efforts to interrupt virus transmission? The example of Sudan

Dr F. Kamel, WHO/EMRO

All countries should critically evaluate the recommended indicators for monitoring field surveillance and laboratory performance to determine whether the trends in detection of wild poliovirus confirmed cases are truly indicative of the level of poliovirus transmission. In

Sudan, there has been a decline in the reported number of wild virus confirmed cases from 10 in 1999 to 4 in 2000. However, there were 50 and 72 clinically confirmed poliomyelitis cases in the Sudan in 1999 and 2000, respectively, and these cases were widely distributed geographically, with evidence of clustering of cases in some districts. A minority of clinically confirmed cases in 1999 and 2000 were so designated because of loss to follow-up. The reasons for the clinical polio classification of the 50 cases in 1999 were: 31 had paralysis that persisted beyond 60 days; 12 were lost to follow-up and 7 died. The reasons for the clinical polio classification of 72 cases in 2000 were: 45 had paralysis that persisted beyond 60 days; 8 were lost to follow-up and 17 died.

It was known that there were deficiencies in the surveillance system for detection of paralytic cases in Sudan in 1999 because the non-polio AFP detection rate was only 0.42 per 100 000 children less than 15 years of age. The performance standard for a sensitive surveillance system in the global poliomyelitis eradication programme is ability to detect at least 1 per 100 000 non-polio AFP cases in children less than 15 years of age. Indeed this performance standard was attained in Sudan in 2000, with a reported increase in non-polio AFP case detection to 1.42 per 100 000 in 2000. However, because of the large number of clinically confirmed cases that were still reported in 2000, it was possible that wild poliovirus transmission was underestimated. The only wild virus confirmed cases were restricted to the states of Khartoum (2 cases), Gezira (1 case) and White Nile (1 case).

Factors that are known to affect wild virus isolation are: timing of sample collection, conditions during sample storage and transport, and technical proficiency of the laboratory that analyses samples. Deficiencies in any of the previously mentioned factors can result in failure to isolate viruses.

In Sudan, an analysis was made of the above standard programme monitoring indicators affecting virus isolation in the country and in each state. The Sudan poliovirus laboratory was fully accredited by WHO in 2000 and has good technical performance with proven ability to isolate viruses if they are present in samples. All performance standards (i.e. adequate sample collection; sample transport to laboratories within 3 days of collection; and good stool condition on receipt in the laboratory) were met for only 23% of samples analysed in the laboratory in 2000. It was noted that the best surveillance and field performance standards were found in Khartoum and Gezira states, which together accounted for 3 of the 4 wild virus confirmed cases. Furthermore, the rate of isolation of any virus (polio or non-polio) was highest when all standard performance criteria were met. Cool condition of the sample on receipt in the laboratory was a better predictor of ability to isolate virus than was the time taken for sample delivery to the laboratory. The practical implications of the analysis of data from Sudan for 2000 were as follows.

- Although the AFP case detection rate was high, there were weaknesses in other areas of field performance that can impact adversely the ability to isolate wild polioviruses. Greater emphasis should be placed in increasing the collection of adequate faecal samples from patients, and to delivering samples to the laboratory as soon as possible after collection. Deficiencies are known to exist in cold chain in the Sudan because of frequent failures in electricity supply. Therefore fast delivery of samples to the

laboratory is of high priority since there is no guarantee that samples can be maintained at low temperature under prevailing field conditions.

- There is likely to be underestimation of the occurrence of wild poliovirus transmission in Sudan if weaknesses in field performance are not appropriately addressed. The clustering of clinically confirmed poliomyelitis cases in some states in Sudan in 2000 is strongly suggestive of ongoing wild poliovirus transmission.

5.4 Is quality of laboratory and surveillance performance sufficient to guide efforts to interrupt virus transmission? The example of the Islamic Republic of Iran

Dr H. Jafari, WHO/EMRO

The Islamic Republic of Iran has a strong EPI programme with routine OPV3 coverage in excess of 95 %. NIDs were conducted up to 1999 and always achieved very high coverage. Since 1999 the country shifted to immunization campaigns with a house-to-house approach to reach children, but restricted campaigns only to the high-risk areas that border Pakistan and Afghanistan, and to high-risk groups in other parts of the country. The reduction in the scope of immunization campaigns was based on evidence of interruption of indigenous wild virus transmission in the Islamic Republic of Iran, economic concerns, and the realization that the country remained at significant risk of wild virus importation from neighbouring poliomyelitis endemic countries. Statistics were presented showing population density, the non-polio AFP detection rate and the rate of collection of adequate stools, by province for the Islamic Republic of Iran for 2000. Particular concerns were expressed about Sistan va Baluchistan province, which borders poliomyelitis endemic countries of Afghanistan and Pakistan. In this province there was a non-polio AFP rate that exceeded 1 per 100 000 in 2000, but the rate of collection of adequate stool samples from AFP cases was less than 50%. Furthermore, 3 wild poliovirus confirmed cases occurred in this province in 2000 in the district of Char Bahar, which has a population of approximately 200 000. All 3 cases had a history of receiving 3 or more doses of OPV, 2 had paralysis that persisted beyond 60 days of disease onset, and none had a history of travel outside of the Islamic Republic of Iran or close personal exposure to travellers from poliomyelitis endemic countries in the 30 days preceding paralysis. Epidemiological investigations revealed that there is close social and trade contact between the population of Char Bahar and communities across the border in Pakistan. Two other AFP cases were found in Char Bahar with clinical symptoms consistent with poliomyelitis, and paralysis onset around the same time as the 3 wild virus confirmed cases in 2000. The conclusion of field investigations and genetic characterization of polioviruses from Char Bahar poliomyelitis cases was that there had been indigenous transmission of an imported virus in 2000. The limited transmission of the virus following introduction was probably due to the low number of immunological susceptibles within the population, as the reported OPV3 coverage was 80% to 95% in Char Bahar district.

There is a sufficiently high quality of surveillance and laboratory performance to guide efforts to interrupt poliovirus transmission in the Islamic Republic of Iran, but it is important that wild virus importation into the country can be detected early. For the wild virus confirmed polio cases from Char Bahar in 2000, there had been early notification of cases and collection of adequate samples. However, the number of days that elapsed between sample collection and receipt of samples in the laboratory were 18, 24 and 2 days for the 3 wild virus confirmed cases. Laboratory results were provided in a timely manner, but combining field

and laboratory performance, wild virus confirmation was available more than 3 months, 2 months and 7 weeks after paralysis onset for the 3 cases. To maximize the potential for early detection of virus importation emphasis should be placed on increasing the collection of adequate stool samples from AFP cases and rapid delivery of samples to the laboratory as soon as possible after collection. This is especially critical in Sistan va Baluchistan province, which borders 2 poliomyelitis endemic countries.

6. DATA MANAGEMENT–AN ONGOING CHALLENGE

6.1 Development of regional laboratory database and impact of data management practices at subnational and national levels

Ms A. Middelkoop, STC/WHO

Significant progress has been made in the development of the regional laboratory database. During 2000, training workshops in data management were held for nationals supporting the poliomyelitis eradication programmes in Afghanistan, Egypt, Islamic Republic of Iran, Iraq, Kuwait, Libyan Arab Republic, Pakistan, and Sudan. Where possible, both laboratory and surveillance staff were joint participants in workshops and databases were adjusted to meet country-specific needs. Regional databases have been established for dealing with the weekly surveillance and laboratory reports received from countries. At present, the regional data management systems have the capability to perform automated error checks, merge incoming files into a single 'master file', perform standard analyses to generate the weekly polio fax issued by WHO/EMRO, and provide capability for feed-forward of weekly reports to WHO/HQ and other partners. There is also capability to produce standard outputs in the form of maps for some countries.

There is need for strengthening data management practices at national and subnational levels. It sometimes appears that the data are recorded solely for submission to WHO. Therefore, in some instances, the computerized data management system is being used simultaneously alongside the pre-existing manual system, rather than having gradual replacement of cumbersome manual systems by computerized systems. Additionally, greater use can be made of the data at country level to analyse trends and provide feedback on field or laboratory performance and to identify areas of the programme that can be strengthened. It can also be useful for persons working at provincial level to know how their performance compares to other provinces, or to have an idea of the national progress in the poliomyelitis eradication programme. Laboratory and surveillance staff should meet and resolve discrepancies in their recorded data before submitting their reports to the WHO Regional Office.

6.2 Challenges in maintaining regional databases

Ms H. Safwat, WHO/EMRO

The availability of a regional laboratory database fulfils multiple needs. It allows rapid assessment of the status of virological investigations of individual samples and coordination of sample referral and reporting among laboratories. It facilitates ongoing monitoring of trends in the occurrence of wild polioviruses. It provides data for planning of immunization campaigns. It can be used to monitor the quality of laboratory performance, and facilitates the preparation of reports for feedback to regional and international partners involved in the

poliomyelitis eradication programme. The following are the challenges of maintaining and using the regional laboratory database.

- Data are received from multiple sources, i.e. 12 different laboratories. This challenge has been overcome by having all laboratories use a standardized defined format for recording core data variables.

- Data must be current and rapidly transmitted. All laboratories have been provided with communication mechanisms (i.e. e-mail access) to transmit weekly up-to-date reports as standardized electronic files with cumulative data for multiple years. These weekly reports are merged together to form the regional database. Laboratories should avoid changing the data format without prior consultation or notification of involved parties, since this caused problems in using their report.

- There is a need to link laboratory data on individual cases to epidemiological data that may be useful in case investigations e.g. location, immunization history, clinical outcome etc. The most important constraint is the failure to use a consistent format for individual case identification (i.e. IDCODE) by both laboratory and surveillance personnel. For example case number 23 for the year 2001 can be identified as 23/2001, 23/01 or 23–01 by 3 different users and these will be considered as 3 different individuals in some computerized analyses. The problem with the use of different formats for the IDCOE is reflected in the following: 98% of cases in the regional laboratory database have IDCODEs recorded, but only 45% of cases can be matched to epidemiological data in the regional surveillance database.

- Laboratories track and report results for individual samples in their database, whereas surveillance personnel record information for an individual case. This difference can be readily resolved during analysis.

- Complete and correct data should be recorded for each sample. Yet it has been found that many reports lack information on the date of last vaccination of individual cases. Additionally, 20% of polio positive samples in the laboratory database have the date of culture results recorded, but no date is entered in a separate variable which is to be used for the date of receipt of intratypic differentiation results. Complete data are needed for tracking reporting times.

- Feedback should be provided to reporting laboratories. Feedback is given to individual laboratories, e.g. as a letter commenting on trends in performance or requesting clarification of data elements etc.

- Data must be disseminated to interested parties, e.g. policy-makers, funding and partner agencies. This is done in an ongoing manner through the polio fax, but the data are also used for the preparation and dissemination of written reports, meeting presentations etc.

Decisions in the poliomyelitis eradication programme are both time and data critical. It is important to ensure that there is ongoing compilation, processing, and analysis of data at the local level to rapidly identify and resolve problems. Additionally, regular, complete, timely and accurate reports should be submitted in the agreed format to the WHO Regional

Office for monitoring of programme performance, for planning and targeting of technical and/or financial support to countries. Laboratories are encouraged to designate staff with responsibility for reporting; to be systematic and complete in their reporting, and to ensure that staff have the necessary technical skills for handling data.

6.3 Experiences of maintaining a database in the Oman laboratory

Dr S. Busaidy, Department of Laboratories, Oman

In the past a manual system was used for handling data in the Oman poliovirus laboratory. However, this was cumbersome, and, it was a challenge to decipher different handwriting and ensure accuracy in recorded information. Data analysis was also time consuming. The computerized data management system in use in the regional poliovirus laboratory network has adequately addressed all of the previously mentioned weaknesses. However, as in other laboratories, there is need to maintain data integrity and to limit the number of persons with authority to change recorded information. Data should be archived in an ongoing manner with appropriate attention given to periodic back-up of the database. There should be anti-virus software installed to guard the system against computer viruses. Arrangements must be in place to ensure timely reporting with appropriate designation of authority for this activity and standard operating procedures in place so that reports can be sent even if there are staff changes in the laboratory for any reason. There is need to keep up with changing computer technology and to have access to the necessary expertise to assist in resolving problems, should they arise. There is therefore a need for regular staff training to remain up-to-date with changing technology.

6.4 Experiences of maintaining a database in Saudi Arabia

Mr M. Al Amri, National Poliovirus Laboratory, Saudi Arabia

A computerized database is maintained using Access software to record data and generate routine reports. The Access database is exported into EPI Info for standard analyses that are used in the poliomyelitis eradication programme. The laboratory sends the standard weekly report to WHO by e-mail and has experienced only 1 problem recently when the format of the IDCODE variable was changed by 1 character. The laboratory reverted to the original format after feedback was received from WHO/EMRO. Prior to October 2000, the laboratory submitted its weekly reports on time to the EPI programme and to WHO. However, the activities of the poliovirus laboratory were temporarily disrupted for 3 months between October and December 2000 because of the occurrence of a Rift Valley fever (RVF) outbreak that affected Saudi Arabia. The resources of the poliovirus laboratory were temporarily diverted to provide support during the RVF outbreak, and even the e-mail communication with WHO and the EPI programme was disrupted. During the RFV outbreak samples received for polio investigations were shipped to the Kuwait laboratory for analysis.

7. MEETING THE CHALLENGE OF PROVIDING TIMELY VIROLOGY RESULTS

7.1 Total quality management: perspective of the WHO Regional Office

Dr E. de Gourville, WHO/EMRO

In the poliomyelitis eradication programme high quality laboratory performance is defined in terms of accuracy and timeliness. Many components of the laboratory's activity impact the generation of an accurate and timely final result, e.g. equipment performance, quality of reagents, technical proficiency of staff, accuracy of the typist who prepares the final report etc. Total quality management (TQM) focuses on all factors involved in generating the product, i.e. the report, and advocates continuous monitoring of performance to identify problems and take early corrective action. Furthermore all persons involved in carrying out any task relevant to the process should be involved in discussions about how improvements can be made. Effective management is the responsibility of the laboratory director, but quality should be the concern of everyone working in the laboratory. Directors were encouraged to review the Quality Assurance module in 2000 edition of the WHO polio laboratory manual.

All of the following impact on laboratory performance: staff, space, equipment, supplies, standard operating procedures, and safety. A summary list was shown of the responsibilities of the laboratory director for each factor and a comparison was given of the regional laboratory coordinator's role. The coordinator is the director's partner and advocate for high quality performance. However, each laboratory director is accountable for the daily activities performed in his/her laboratory. Examples were provided of poor quality performance based on the coordinator's evaluation visits to some network laboratories. An analysis was also presented of how solutions were found to delays in obtaining intratypic differentiation results, a problem that was identified in the year 2000 meeting. The laboratory directors themselves identified the bottlenecks to sample referral as lack of funds for payment of shipping charges and lack of appropriate packaging to meet the safety standard specifications of commercial couriers. These problems were addressed through collaboration between national authorities and WHO, and there has been more timely referral of polio isolates for analysis by 6 out of 7 laboratories. Laboratory directors were encouraged to empower their staff to continuously monitor performance and to involve them in finding solutions to problems. The impact of corrective actions should also be monitored to ensure that they lead to resolution of the identified problem. It was emphasized that a laboratory's reputation for high quality performance is not self-imposed, but reflects the opinion of its clients. All persons involved in the regional poliovirus laboratory network were encouraged to keep their clients satisfied, to strive for excellence and to embrace the philosophy of total quality management.

7.2 Total quality management: experiences in Oman

Total quality management (TQM) can be considered to take a preventative approach to management, and has been used very successfully in industry. TQM addresses problems before they arise and handles concerns with a studied long-term commitment to continuous improvement in product and services. The key elements of TQM are quality improvement and employee involvement. The concept of 'Doing it right every time' necessitates that all personnel are oriented to the need for quality and that each employee possesses the appropriate qualifications, knowledge, skills and attitude to do their job. Laboratory services are vulnerable to the forces of competition, changing technology and to dwindling resources, and laboratories that emphasize quality and improvement are likely to overcome these challenges. TQM recognizes that the individual is the focal element on which service depends. TQM places trust in employees as knowledgeable, responsible and accountable, with an in-depth understanding of their job. In TQM, employees are encouraged to give opinions

on the quality of a product or service and their opinions are valued. It has been found that employees are highly motivated if they operate as members of collaborative and well-integrated teams.

Success in TQM often necessitates a cultural change within institutions. It requires creation of an atmosphere of trust in which open communication is encouraged among staff in all levels of the organization. TQM uses problem solving teams or quality circles to address product and service related issues. TQM recognizes the concept of employee accountability and encourages the use of facts, figures and data in identifying problems and finding solutions. Education and training of staff are given high priority. In the laboratory, performance standards should be set for each job, inclusive of job description with specific expectations, and clearly stated educational standards. Quality assurance indicators should be established for all units. Standard operating procedures and quality manuals should be prepared and constantly updated to reflect current methods and quality concerns. Participants were encouraged to adopt and put into practice the basic principles of TQM as the experience in Oman has been that TQM is an effective mechanism to significantly improve laboratory performance.

7.3 Handling and transportation of specimens and isolates –experiences in Egypt

Mrs I. El Maamoun Naser, VACSERA, Egypt

VACSERA has experience as both a shipper and receiver of samples. VACSERA routinely refers samples and isolates to laboratories in USA, the Netherlands and Finland. Few difficulties have been experienced with shipping materials via commercial couriers. Packaging of samples is done in accordance with IATA regulations for biosafety and follows the guidelines provided in the WHO poliovirus laboratory manual. Receiving laboratories are always notified ahead of time about the date of shipping, the contents of packages and transportation details. VACSERA receives samples for testing from regional network laboratories. There is no 'door-to-door' delivery of materials by commercial couriers in Egypt because of customs regulations. Since VACSERA has to send personnel to the airport to collect packages, it is important that VACSERA receives early notification about the details of shipments that are being sent. Occasionally attempts to retrieve packages have been unsuccessful and VACSERA has provided feedback about problems when they arose. VACSERA routinely acknowledges the receipt of packages and the condition of samples on receipt.

7.4 Handling and transportation of specimens and isolates–experiences in the Syrian Arab Republic

Ms H. Saba, National Poliovirus Laboratory, Syrian Arab Republic

Problems have been experienced with shipping materials to the reference laboratory in Egypt. In 1999 approval for shipping had to be received from the Syrian Ministry of Health and all administrative arrangements were made by the national manager for the expanded programme on immunization (EPI). In 1999 long delays in shipping samples arose because of lack of readily available funds for payment of courier charges. Financial support for shipping of samples was provided by WHO in 2000 and funds are accessed from the WHO country office directly by the national poliovirus laboratory. A few shipments went well and on time in 2000. However the last 2 batches of samples in 2001 were received in Egypt, but the RRL was unable to clear the package through customs. It was unclear what was the reason for this. The courier claimed that the RRL did not sign some necessary documents and the RRL was told by representatives of the courier that the packaging did not meet standards for biosafety. Shipping problems remain unresolved.

7.5 Handling and transportation of specimens and isolates–experiences in Jordan

Dr N. Al Najar, National Polivirus Laboratory, Jordan

Few difficulties have been experienced with shipping materials. Packaging of samples is done in accordance with IATA regulations following the WHO guidelines. The WHO country office coordinates between the laboratory and the shipper to make all necessary arrangements, including notification of the receiving laboratory.

7.6 Handling and transportation of specimens and isolates–experiences in Pakistan

Dr H. Asghar, Regional Reference Poliovirus Laboratory, Pakistan

The laboratory receives samples from within Pakistan and from Afghanistan. Within Pakistan a business contract has been made with a commercial courier for sample delivery to the laboratory within 24 hours of receipt of packages from field surveillance units. The laboratory disinfects and cleans the stool carriers, and places sterile stool collection kits inside the clean carriers, which are then returned to the courier for delivery to the referring field surveillance unit. The system works quite efficiently and the majority of samples are received in good condition. There are a few problems occasionally, mainly due to unlabelled carriers, thawed and leaking ice packs, and/or misplaced carriers. But such problems are easily addressed. A tracking system has been developed to log shipping details and payment vouchers.

Samples from Afghanistan are shipped on United Nations flights and are sent directly to the laboratory on arrival in Pakistan. There is usually a high NPEV isolation rate for samples analysed from Afghanistan, which provides reassurance that the cold chain is maintained during sample storage and transport. Referral of virus isolates from the Pakistan laboratory to CDC in the United States of America has been very problematic. In the past the most effective method seemed to be to have travelling colleagues take the packages to the country. However, efforts are currently under way to arrange regular shipments of samples via a commercial airline.

8. CERTIFICATION OF POLIOMYELITIS ERADICATION

8.1 Progress toward regional certification

Dr M. Wahdan, WHO/EMRO

It is anticipated that the world will be certified as wild poliovirus free by 2005, and that certification will be based on a number of basic principles. Regions will be certified as polio-free only after 3 years have passed without detection of indigenous wild polioviruses, in any country, and in the presence of effective surveillance. Global certification of eradication will only occur when all regions are certified as polio-free, and, until such time, all countries and regions must continue AFP surveillance. The process of certification requires action at three levels.

- Every country must prepare its own documentation for certification of poliomyelitis eradication. The documentation should be endorsed and submitted by an independent National Certification Committee (NCC), whose members are appointed by the government. The NCC should comprise persons involved in public health, epidemiology, virology, paediatrics, neurology or other related disciplines. The NCC members should not have direct responsibility for implementing the country's polio eradication programme. The NCC guides national surveillance and immunization personnel with the preparation of documentation required for certification, and may conduct site visits to clinical, immunization or laboratory facilities to verify information. The NCC may request implementation of additional programme activities to strengthen the proof of the country's polio free status. Once the NCC is satisfied with the documentation it submits it to a Regional Certification Commission (RCC). The

NCC may be required to provide annually updated documents until the region is certified as polio-free.

- Regions are certified as polio-free by their own RCC, and only when documentation from all countries have been reviewed and found satisfactory. The RCC reviews the work of each NCC. The RCC is appointed by the WHO Regional Director, and its members represent a wide range of skills, but none have direct responsibility for polio eradication in any of the countries of the region.

- A Global Commission (GCC) reviews the work of Regional Commissions and provides guidelines to ensure uniformity throughout the certification process.

Several activities have been implemented in the Region related to the certification of polio eradication. All countries in the Region have appointed NCCs, except some countries in conflict whose certification activities will be the responsibility of WHO and other United Nations partners. A RCC has been appointed. Regional guidelines for certification have been developed, as well as a manual of operations for national documentation. The RCC has held 6 meetings, has reviewed documentation submitted by 11 countries and found 10 country reports to be satisfactory. The RCC has endorsed a regional plan for laboratory containment of polioviruses as well as guidelines for developing national plans for preparedness for wild poliovirus importation. RCC members have visited a few countries to review certification activities and available documentation.

8.2 The certification manual and the laboratory

Dr H. Jafari, WHO/EMRO

A manual of operations for preparing national documentation for certification of poliomyelitis eradication, has been prepared by the WHO Regional Office and endorsed by the RCC. Countries record information in the manual in a standard format providing data on the country, immunization, surveillance and laboratory performance, and actions to achieve laboratory containment of poliovirus containing materials. The completed manual is the main part of the report submitted by the NCC to the RCC. Within the manual are sections in which laboratory data are recorded, and an electronic copy of the manual was distributed to all network laboratories for review. Laboratory personnel must be prepared to provide the following information relevant to laboratory performance when the country report is prepared.

- A summary of wild polioviruses isolated since 1995, as total number by serotype and source e.g. from AFP cases, contacts or other sources

- Date of last detection of each wild poliovirus serotype and details about the last wild virus isolate

- A table and a map providing information on the last 10 to 15 wild poliovirus isolates, or, on any wild virus isolates detected since 1995

- Accreditation history of the laboratory since 1997, and, information on any specimens/isolates that were investigated for polioviruses in any laboratory that was not accredited by WHO

- Summary of number of specimens tested since 1995 by sample type and source, and, data on completeness of sample testing

- Summary data on any polioviruses isolated and characterized since 1995

- Data on completeness and reliability of intratypic differentiation of poliovirus isolates from the country

- Inventory of poliovirus infectious or potentially infectious material stored in the laboratory to be included in the country's data on laboratory containment of polioviruses

- Infrastructure and practices in the laboratory with respect to biosafety.

Polio network laboratories may be visited by members of the NCC or RCC as part of the certification process.

8.3 The Hispaniola outbreak and its implications for immunization, surveillance, laboratory performance and certification

Dr M. Pallansch, CDC, USA

The Region of the Americas was certified as polio-free in 1994 and the last poliomyelitis case was reported in 1991. However an outbreak of poliomyelitis occurred on the island of Hispaniola in July 2000. Hispaniola belongs to the Region of the Americas, and is made up of the countries of Haiti and Dominican Republic. Prior to 2000, polio cases were last detected in Haiti and Dominican Republic in 1989 and 1985, respectively. Between July 2000 and April 2001 there were 14 confirmed polio cases, 10 polio-compatible cases and 4 cases pending final classification in the Dominican Republic. During the same period there were 4 confirmed polio cases, 2 polio-compatible cases and 4 cases pending final classification in Haiti. In the Hispaniola outbreak, polio cases occurred in children up to 15 years of age, approximately 60% of cases were between 1 and 4 years old, and 70% of cases had received less than 3 doses of OPV. The outbreak was controlled through mass-immunization with OPV in both Haiti and the Dominican Republic. Investigations revealed that factors that contributed to the occurrence of the outbreak in Hispaniola were low immunization coverage and poor surveillance for paralytic disease. After polio-free certification in 1994 the reported OPV3 coverage in Haiti fell substantially, and coverage ranged between 70% and 80% in the Dominican Republic between 1994 and 2000. The non-polio AFP case detection rate fell to below 0.7 per 100 000 in children less than 15 years of age in both countries since 1998. No stool samples were collected from AFP cases in Haiti after 1995 and the collection of adequate stools from AFP cases in the Dominican Republic fell from approximately 80% in 1998 to around 35% in 1999.

Viruses isolated from polio cases during the Hispaniola outbreak possessed unusual and surprising properties. Polio serotype 1 viruses were obtained from 4 cases in Haiti, and from

11 cases and 11 contacts in the Dominican Republic. The outbreak virus had approximately 97% genetic sequence homology in the VP1 gene to Sabin serotype 1 vaccine virus, and were unrelated to past wild viruses from Hispaniola or the Americas or to current wild polioviruses from other parts of the world. Three genetic lineages were distinguished corresponding in geographical distribution to Northern Haiti, Southern Haiti and the Dominican Republic. The entire genome was sequenced for outbreak viruses and analysis revealed that the Hispaniola viruses recombined with non-polio enteroviruses during circulation, based on sequences found in the non-VP1 regions of the genome. Despite great genetic similarity in the VP1 gene to Sabin viruses, the Hispaniola viruses were similar to wild polioviruses in having: capacity for sustained person-to-person transmission; a significant paralytic attack rate; replication at 39.5°C; and reversion or recombination at genetic sites that are critical for attenuation of paralytic properties. It was estimated that the Dominican Republic and Haiti lineages arose in mid-1998 and that they diverged from each other in mid-1999. In intratypic differentiation tests the Hispaniola viruses reacted as non-Sabin like in tests with an antigenic principle (e.g. ELISA) and as Sabin-like in genetic-based tests (e.g. PCR). The Hispaniola outbreak viruses have been described as vaccine-derived polioviruses (VDPV). There have been other examples of circulation of VDPV, although of serotype 2, in Egypt between 1988 and 1993 and in Guizhou, China in the mid-1990s. In both instances increasing immunization coverage prevented further spread of the vaccine-derived viruses.

The occurrence of the poliomyelitis outbreak in Hispaniola has several implications for the poliomyelitis eradication programme. Countries must continue to achieve high immunization coverage and high quality AFP surveillance at least until global polio eradication. There is need for strengthening of field and laboratory surveillance to detect circulating VDPV. It is reassuring that current WHO-recommended strategies for intratypic differentiation detected the vaccine-derived viruses in Hispaniola, Egypt and China. All Sabin-like viruses isolated since 1997 in the Region of the Americas have been sequenced and no highly genetically divergent viruses have been detected. Sequence studies are under way on Sabin-like viruses from all parts of the world, focusing on current isolates and retrospective analysis of isolates obtained since 1994.

8.4 Issues in stopping OPV immunization

Mr D. Featherstone, WHO/HQ

Epidemiological evidence from poliomyelitis outbreaks Hispaniola, Egypt and China due to Sabin viruses suggests that there is an increased risk of vaccine-derived poliovirus (VDPV) transmission in situations of declining wild poliovirus circulation and concomitant low coverage levels of polio vaccination. Therefore the occurrence of VDPV reinforces the need to stop OPV use after polio-eradication and necessitates development of a method for stopping OPV that minimizes the risk of sustained VDPV circulation. Two overlapping phases are likely in stopping OPV immunization: an OPV cessation phase in which immunization strategies move from current widespread use to no use of OPV; a post immunization phase in which there will be need for outbreak response strategies for potentially unimmunized populations. Already a research agenda has been set and studies are being carried out to assist in decision-making on stopping immunization in the post-polio eradication era. The main issues to be addressed are as follows. The frequency of occurrence of sustained VDPV circulation is currently unknown.

- Determination of the risk of sustained transmission of VDPV via chronic excretors (e.g. immunodeficient persons) or because of reintroduction of OPV into areas that have discontinued OPV, from OPV-use areas.

- Obtaining data on potential strategies for use pre-OPV cessation. Potential strategies include: systematic replacement of OPV by IPV; targeted OPV pulse campaigns in low coverage densely populated areas or countries; or combinations of the previously mentioned strategies. There are some current unknowns that preclude wide-scale use of IPV in the pre-eradication era. Programmatic concerns are capacity for IPV delivery to achieve high vaccination coverage, manufacturing capacity to provide large quantities of IPV, and cost. Scientific concerns are whether IPV immunogenicity is the same in all hygiene settings, whether IPV use can interrupt polio transmission in poor hygiene settings, and the lack of reliable data from developing countries on whether IPV promotes better humoral immunity but worse mucosal immunity compared to OPV.

There will be a need to continue surveillance for polioviruses for some time post-certification of polio eradication. It is uncertain that certification-level AFP surveillance will be sustained post-certification, or, whether supplementary surveillance strategies will be added. Environmental surveillance for polioviruses holds promise but the sensitivity limit of this approach is unknown. Laboratory-based surveillance for VDPV will also continue post-certification and an efficient method for rapid screening and detection must be quickly identified. There is need to expand current efforts at laboratory containment of polioviruses to include containment of Sabin and Sabin-derived strains.

In the post-immunization era vaccine stockpiles will be needed as a safeguard in the unlikely event of outbreaks. Perhaps monovalent OPV (mOPV) or IPV will be used to minimize the potential for occurrence and transmission of VDPV. However the efficacy of IPV for control of polio outbreaks is currently unknown and the feasibility of registration of mOPV must be explored.

9. SUPPLEMENTARY SURVEILLANCE FOR WILD POLIOVIRUS

9.1 Review of experiences with environmental surveillance for polioviruses in different parts of the world

Dr T. Hovi, National Public Health Institute, Finland

The optimal arrangement for environmental surveillance for polioviruses is one in which multiple households are connected via pipes or appropriate channels through which sewage flows to a single sewage collection plant where samples can be collected periodically for analysis. Poliovirus has also been successfully isolated through less optimal situations for sampling (e.g. pit latrines or lagoons) but there are inherent inefficiencies with such systems and a potential for non-representative sampling. Targeted use of environmental sampling in suspected high-risk communities might be successful in detecting silent wild virus circulation and may be beneficial in programme planning to achieve polio eradication.

In 2000 pilot projects on environmental surveillance for polioviruses were implemented in the polio-free countries of Georgia and Turkey, and in Egypt where low numbers of polio cases were still being reported from a few suspected high-risk communities. All countries

used the same approach and: collected grab samples of sewage from selected sites; concentrated sewage samples in the laboratory by 2-phase separation procedure; inoculated sewage concentrates into L20B and RD(A) or Hep-2 cell cultures to isolate polioviruses; and, attempted direct detection of poliovirus in reverse transcriptase-PCR (i.e. RT-PCR). The experiences in each country were as follows:

- In Georgia, sampling sites were selected in the capital, and in communities with refugee populations from Chechnya and Abkhazia, where OPV coverage was low. During summer and winter 2000, a total of 93 specimens were collected in Georgia, and each sample comprised 0.35 litres of sewage. There was a low rate of virus detection with only two Sabin serotype 2 virus isolates and 7 NPEV isolates obtained during the study. It was unclear whether the low virus isolation rate was due to failure to analyse all of the sewage concentrate for each sample. Additionally the size of the target population was unknown. The study will be repeated in 2001.

- In Turkey sewage samples were collected in Diyarkabir, a region where there was wild virus circulation in the past and which was thought to be at high risk of virus importation from neighbouring countries. Sewage samples were obtained from 4 collector sewers in Diyarkabir city and from Bismil. One litre samples were collected from each site every 2 weeks and were analysed at a laboratory in Turkey. No wild polioviruses were isolated.

- In Egypt, 6 sample collection sites were chosen from suspected high-risk areas in Al Minya and Assiut governorates. A schedule of sampling was established based on each site's population size, and the laboratory capacity for testing. Samples were tested in parallel in laboratories in Egypt, Finland and the United States of America. The study started in September 2000 and continued into 2001. There was a high rate of virus isolation although the rate was highest when cold chain was maintained during sample transport and storage, when samples were processed within a few days of collection, and when multiple cell cultures were inoculated for each sample. By April 2001 there had been detection of non Sabin-like (NSL) viruses, Sabin viruses and NPEV. The study was successful in isolating NSL viruses in the presence of SL viruses in some samples. Genetic characterization showed that the NSL viruses were indigenous to Egypt and belonged to the same genetic lineage of viruses that had been isolated from AFP cases from the same communities that were sampled. The laboratory analyses were resource demanding and an uninterrupted supply of reagents was a constraint that is still to be addressed. The study is to be expanded to include sampling of other high-risk communities.

The pilot projects conducted in Georgia, Turkey and Egypt have demonstrated that environmental surveillance for poliovirus is feasible but that there are several limitations. The approach should be targeted at communities of highest risk, sampling sites should be carefully chosen, cold chain must be maintained and samples should be rapidly transported to the laboratory, and virology should be performed in laboratories technically and operationally capable and capacitated. Interference of wild virus isolation by OPV-derived strains present concomitantly in samples was not a significant problem in Egypt. Finally, countries

embarking on environmental surveillance for polioviruses should have a clear plan for responding should wild poliovirus be detected.

9.2 Laboratory support to investigate environmental samples collected in Egypt

Mrs I. El Maamoun Naser, VACSERA, Egypt

Environmental surveillance for detection of poliovirus was initiated in 2000 as a collaborative study of the Ministry of Health and Population of Egypt, CDC/USA, Finnish Public Health Laboratory (KTL) and WHO. The study was targeted at specific governorates in Egypt where there ongoing silent transmission of poliovirus was suspected. Appropriate sampling sites were initially selected in the governorates of Assiut and Al Minya, and subsequently expanded to include sites in Beni Suef, Fayoum and Sohag. The sites were selected because of risk assessments based on population immunization coverage, population size, significant birth rate, and availability of optimum sample collection sites based on observations made during field visits. A sample collection schedule was developed for each site in consultation with the VACSERA laboratory to ensure capacity to handle the projected workload. Samples were concentrated by a 2-phase separation procedure at VACSERA and sample concentrates were analysed in parallel at VACSERA, CDC and KTL.

Between September 2000 and 30 April 2001, a total of 86 environmental samples were analysed at VACSERA. Results at VACSERA were as follows.

- 48 samples with no viruses isolated
- 6 samples with polio serotype 1 non-Sabin like viruses (P1NSL) with or without Sabin-like polio viruses or NPEV
- 9 samples with Sabin-like polioviruses (SL) with or without NPEV
- 18 samples with NPEV only
- 5 samples with polioviruses pending differentiation

Overall virus isolation rate was 44% (38/86). Results were available from KTL for 34 of the 86 samples tested in Egypt. The overall virus isolation rate was similar in both laboratories. P1NSL samples had been collected from Al Minya City (4), and Assiut City (2) Genetic sequences of the VP1 gene of P1NSL viruses from environmental samples were compared to sequences of viruses previously isolated from AFP cases. All viruses were indigenous to Egypt and had more than 98% sequence homology in the VP1 gene. The Ministry of Health and population of Egypt has conducted targeted governorate-wide immunization campaigns in the high-risk governorates of Al Minya, Assuit and others using a house-to-house strategy to vaccinate children. The environmental surveillance study will continue as an adjunct to routine AFP surveillance to assist in identifying communities with silent circulation of wild polioviruses.

9.3 Lessons learned from investigating contacts of AFP cases in Kuwait

Dr S. Al Mufti, National Poliovirus Laboratory, Kuwait

Between 1995 and April 2001, a total of 69 samples from AFP cases were analysed in the laboratory, along with samples from 99 contacts of AFP cases. No wild polioviruses were ever detected, although 6 samples yielded Sabin-like polioviruses, and 7 samples yielded NPEV. Between 1995 and 2000 there was also virology investigation of 1362 stools of healthy children with isolation of Sabin-like polioviruses from 82 (6%) and NPEV from 65 (5%) of stools. No wild polioviruses were isolated from healthy children. In Kuwait sewage samples are routinely tested for viruses because recycled sewage wastes are used in agriculture. Approximately 900 hundred sewage samples have been tested since 1995 but no wild polioviruses have been detected. The workload in the laboratory from testing of samples from non-AFP sources is significant. Kuwait receives significant numbers of expatriate workers and their families originating from the Asian continent and from polio-endemic countries. Supplementary surveillance of contacts, healthy children and the environment reassures health authorities about the absence of silent circulation for wild polioviruses in Kuwait. It also helps laboratory workers to maintain their technical proficiency and the laboratory to meet the workload requirements for annual accreditation by WHO. A small number of AFP cases are detected annually in Kuwait because of the small population size, and only 20 to 30 samples would be tested per year if the laboratory only relied on samples referred from AFP cases.

10. CONTAINMENT OF WILD POLIOVIRUSES AND POTENTIALLY INFECTIOUS MATERIALS

10.1 Global and regional progress toward containment of wild polioviruses

Dr E. de Gourville, WHO/EMRO

A global action plan for laboratory containment of wild polioviruses was prepared by the World Health Organization in 1999, because of international recognition that while viruses do not ‘escape the laboratory’, they can be transmitted to communities through wilful or negligent actions. Such events could seriously jeopardize current investments in poliomyelitis eradication. In theory wild poliovirus may be transmitted from the laboratory via contaminated clothing, liquid effluents, air exhaust or improper virus disposal. In practice, transmission usually occurs from an infected laboratory worker who may go unrecognized because of asymptomatic disease. Absolute containment of polioviruses within laboratories is probably unrealistic, as it will never be possible to rule out intentional or unintentional noncompliance with the actions recommended to prevent poliovirus transmission.

There are strategies that can be used by laboratories to identify stored materials that may harbour polioviruses, and measures that can be taken to minimize the risk of infection through handling of those materials. The WHO global containment plan, which has already been adopted by the Eastern Mediterranean Region, outlines actions to be taken in 3 phases that are linked to achieving the goals of poliomyelitis eradication.

- Phase 1 is already being implemented and requires that each country make a national inventory of all laboratories that handle or store poliovirus isolates or potentially infectious materials, and ensure that biosafety level 2 requirements are met.

- Phase 2 of the containment plan is to be implemented 1 year after the detection of the last poliovirus case in the world, and will require that laboratories implement their chosen option for containment of materials. Laboratories continuing to handle polioviruses will be required to do so under biosafety level 3 conditions.

- Phase 3 will be implemented after global cessation of OPV immunization and will require destruction of OPV stocks, (including clinical and manufacturing stocks), and implementation of maximum biosafety standards in any facility that continues to handle polioviruses or potentially infectious materials.

In the WHO Western Pacific Region (WPR), 9 countries have submitted national inventories of stored materials and all other countries are expected to do likewise by December 2001. In the European Region (EUR), all countries have appointed a national containment coordinator and some have started a national laboratory survey to identify laboratories storing materials of interest. In the Region of the Americas (AMR) the United States and Canada have started implementing containment plans. In the African Region (AFR), the priority is on interrupting poliovirus transmission in the population and implementation of laboratory containment plans is only being given high priority in polio-free countries in the southern part of the continent. In the Eastern Mediterranean Region, 18 of 23 countries have appointed a national containment coordinator and 16 countries have prepared a national containment plan. National laboratory surveys have been completed in 132 laboratories in Oman and 5 laboratories in Qatar, and surveys are being implemented in the additional countries of Jordan, Morocco, Saudi Arabia, Syrian Arab Republic and Tunisia. Eleven of the 12 WHO designated poliovirus network laboratories in the Region have submitted inventories of stored materials. It is anticipated that by December 2001, 14 polio-free countries in the Region would have prepared and submitted national inventories of laboratories storing poliovirus infectious materials.

The limited experience to date suggests that there is no single approach that can be used by all countries in the world to achieve laboratory containment of wild polioviruses. The national authority with responsibility for all containment activities can vary. For example, in Oman, Hong Kong and Singapore only a single person has been appointed as national containment coordinator with sole responsibility for overseeing implementation of the national plan. In Australia one organization is responsible, while in Indonesia a 10-member committee with multisectoral representation is being used. In Saudi Arabia and Tunisia two committees are being used. Despite the format of the national authority, it is becoming clear that greatest progress is being made in countries in which:

- the responsible persons have official approval and authority to do the job

- there is multisectoral involvement

- the national containment authority is accountable to a National Certification Committee for poliomyelitis eradication

- resources are made available in the form of staff and money to do the job

- there is commitment to complete the duties assigned in all 3 phases of containment.

The creation of a national laboratory list has also proven to be very challenging because few countries maintain national laboratory registries. However it is of the utmost importance that a list of laboratories be developed before implementation, as it is a useful tool for monitoring and follow-up. A thorough and systematic approach should be used for preparing the list even if a variety of resources are used (e.g. multiple registries in different government departments).

10.2 Laboratory containment of polioviruses in Tunisia

Dr H. Triki, Institut Pasteur, Tunisia

The last poliomyelitis case in Tunisia occurred in 1992 and the last wild poliovirus isolate was detected in 1994. Since 1996, surveillance for cases of AFP has attained a high quality. In 1998, preparation began to document the evidence for interruption of indigenous wild poliovirus transmission in Tunisia. In 2000, activities began toward laboratory containment of polioviruses. A national containment coordinator was appointed in August 2000 by the Minister of Health. In September 2000 two WHO consultants visited to advise national authorities and assist in preparing a draft national containment plan. In October 2000 the national containment coordinator met with the National Committee for Certification (NCC) of poliomyelitis eradication and briefed them on the containment issue and received their recommendations for membership on a National Containment Committee (NCCt). In November 2000 the containment coordinator met with the Minister of Health and requested that members of a NCCt be officially appointed based on the recommendations of the NCC. The NCCt has been appointed and comprises two subcommittees:

- *A technical subcommittee* has 4 members made up of the national containment coordinator (a virologist), the national manager for the expanded programme on immunization (EPI), a bacteriologist and a virologist.

- *A facilitator subcommittee* has 6 members made up of representatives of the Ministry of Health (Chief Laboratory Directorate), and the Ministries of Higher Education and Research, Agriculture, Defence, Industry and Environment.

The NCCt met in February 2001 and discussed and endorsed a national plan on containment and questionnaires proposed for use in a national laboratory survey. Members of the NCCt were asked to provide a list of laboratories operating in their respective jurisdiction. Up to April 2001 a total of 462 laboratories were listed, which included: 249 public and 169 private sector laboratories in the Ministry of Health; 21 Ministry of Higher Education and Research laboratories; 19 laboratories in the Ministry of Agriculture; and 4 Ministry of Environment laboratories. Distribution of survey questionnaires began in March 2001 and responses were received from 160 (34%) laboratories up to May 2001. Eight laboratories

were identified as storing potentially infectious materials. Follow-up has started with the 8 laboratories and will involve discussions/and or visits.

Two virology laboratories in Tunisia have started preparing inventories of their stored materials, as a separate, but related, activity to the national laboratory survey. It has been decided that Tunisia will include in its national inventory wild polioviruses, materials potentially infected with wild polioviruses, and Sabin-related poliovirus strains stored in laboratories in the country. Sabin-related polioviruses are being included for 2 reasons:

- because they are infectious and can cause paralytic disease
- because they may be incorrectly characterized as Sabin-derived if testing was done in a non-WHO accredited laboratory or if recommended methods were not used, or technical problems occurred in testing.

At the Clinical Virology Laboratory at the Institut Pasteur of Tunis, a detailed inventory of stored materials has been completed. A separate research laboratory that does not belong to the WHO poliovirus laboratory network has been identified in Tunisia that conducts research on enteric pathogens. The laboratory stores viruses isolated from specimens collected since 1991 from wastewater or healthy children. Viruses had been isolated in Hep 2 cells and serotyping and intratypic differentiation was done using antisera and reagents provided by a collaborating laboratory in Strasbourg, France. The laboratory reported that it held isolates characterized as follows: 4 poliovirus, 39 non-typed enterovirus and 74 non-polio enterovirus. Since the research laboratory wanted to retain its collection and non-WHO recommended methods had been used to grow and characterize viruses, Institut Pasteur of Tunis and the research laboratory started a collaborative study to rule out the possibility that the isolates harbour wild polioviruses. Isolates were passaged into RD and L20B cell lines and any L20B positive isolates were characterized by WHO recommended methods. Up to May 2001 a total of 117 isolates were tested. Surprisingly, 45, rather than 4, isolates were found to grow in L20B cells, and these culture results were reproducible on retesting. The 45 viruses were all identified as poliovirus serotype 1 and testing of 15 isolates showed that they all reacted as Sabin-like by probe hybridization and non Sabin-like by ELISA, similar to a positive control poliovirus strain that has been in use in the research laboratory for several years. The surprising intratypic-differentiation result has prompted further investigation to rule out the possibility that some isolates arose because of contamination by the poliovirus positive control strain.

11. REVIEW AND DISCUSSION OF NEW LABORATORY MANUAL

Participants were provided with the 2000 version of the WHO polio laboratory manual. An opportunity was provided for review and discussion.

12. CONCLUSIONS

The poliovirus laboratory network in the WHO Eastern Mediterranean Region continued to improve its performance in support of the poliomyelitis eradication programme, and this was reflected in the full accreditation status of all twelve laboratories as of May 2001.

Particular improvement was noted in the provision of timely results by the Morocco laboratory.

Noteworthy progress has been made in network laboratories towards containment of wild polioviruses and potentially infectious materials as 11 of 12 laboratories have submitted inventories of their stored materials to the WHO Regional Office. The process of making the inventory has been instructive for the polio eradication programme and will be of benefit for other programmes since it has directed attention to this important activity for improving management of stored materials.

A major challenge to be met in the final stages of the poliomyelitis eradication programme is the need for speed and accuracy in reporting of laboratory results. It was of serious concern that some national laboratories are yet to meet the challenge of speedy delivery of known poliovirus isolates to reference laboratories for differentiation as wild or vaccine like, even though differentiation of viruses is of critical importance for programme planning

13. RECOMMENDATIONS

Timeliness of final laboratory results

The role of the laboratory in polio endemic countries is to provide timely and accurate information on the circulation of wild polioviruses to guide and focus immunization activities to achieve eradication of the virus. In countries in which transmission of wild poliovirus has ceased, the role of the laboratory is to provide timely and accurate information on wild polioviruses imported from remaining polio-endemic countries, and to make available documented virological evidence that will permit certification of polio eradication. As the programme reaches the final stages of eradication, it is becoming increasingly important that laboratory results are available as soon as possible both to assist in immunization response in the remaining reservoirs of endemic virus circulation and to respond to virus importations. To accomplish this goal, efforts should be encouraged to decrease the interval of time between paralysis onset in AFP patients and final virology results.

1. The collection of samples as soon as possible after paralysis onset in patients and rapid delivery of specimens to laboratories immediately after collection are the first steps towards improving the speed of obtaining final virology results for individual cases. Laboratory and field surveillance staff should implement routine analysis and sharing of information on performance indicators that impact on potential for virus isolation. Such analyses should be made down to district level to identify and resolve weaknesses in performance. Particular attention should be given to field performance in high risk areas for polio transmission, ensuring that the cold chain is maintained during specimen storage, and that specimens are transported to laboratories as soon as possible after collection.

2. Field surveillance staff should be encouraged to ‘flag’ specimens from AFP cases that are strongly suspected to represent poliomyelitis cases. Flagging of specimens can

assist laboratories in setting priorities for processing. In particular, the following categories of samples should be flagged:

a. patient has clinical signs strongly suggesting poliomyelitis
b. patient is unimmunized
c. patient has history of travel to or contact with persons from poliomyelitis endemic area
d. patient belongs to 'high risk' community or minority group.

3. All network laboratories should ensure the availability of sufficient material resources to meet testing needs to avoid unnecessary disruptions in their service. In particular, supply needs should be assessed in relation to the anticipated workload; this is especially critical in countries that are implementing strategies to improve AFP surveillance. Greater efficiency in supplies delivery and savings on purchases can be made if laboratories provide a complete list of their annual needs once per year.

4. All network laboratories should procure and have available stocks of packaging materials that meet international standards for transporting of infectious materials. WHO should assist with provision of such materials, where necessary. Appropriate packaging of stool samples and isolates and adherence to international regulations reduce the potential for delays due to refusal of packages by commercial couriers.

5. Experience shows that the majority of viruses showing cytopathogenic effects (CPE) in L20B cells will be polioviruses, that 3–5 days are required for obtaining virus serotyping results, and that 2–3 days are usually required for making administrative arrangements for shipping of polioviruses to reference laboratories via commercial couriers. Therefore national laboratories should begin making arrangements for shipping of isolates as soon as characteristic CPE is detected in L20B cells, and should not wait for serotyping results to become available before starting to make such arrangements.

Beginning poliovirus containment activities

Laboratory containment of wild polioviruses is critical to the success of the poliomyelitis eradication initiative. Certification of global poliomyelitis eradication will not be complete until the circulation of wild polioviruses in human populations has been interrupted and all laboratory sources of wild polioviruses have been destroyed or stored in facilities that meet internationally accepted standards for biosafety. The poliovirus network laboratories can be a starting point to initiate containment activities and serve as a model for other laboratories in their countries and within the Region. Network laboratories are encouraged to start making decisions about containment of poliovirus infected and potentially infectious materials.

6. Laboratories are strongly encouraged to destroy any stocks of wild poliovirus infectious or potentially infectious materials not critical to the laboratory mission or programmatically important, including unneeded non-polio enteroviruses (NPEV).

7. Vaccine-like polioviruses can be destroyed if they have been tested by at least 2 WHO-recommended intratypic differentiation methods, one of which must be an antigenic and the other a genetic method. Polioviruses that have not been tested by these two methods of ITD, and are less than three years old, should be screened for vaccine derived polioviruses (VDPV), as noted below.

8. Poliovirus network laboratories must keep current their written inventory of stored materials. Therefore the written inventory should be updated with the date of destruction when materials are destroyed, or with a date and description of any new materials that are added.

9. National poliovirus laboratory directors should be actively involved in implementing containment activities in their host institution and collaborate with designated national containment coordinator to provide technical guidance and assistance where possible.

10. National poliovirus laboratory directors should encourage the use of L20B cells by any non-network laboratory that is identified as routinely characterizing non-polio enteroviruses (NPEV).

Certification of poliomyelitis eradication

11. An electronic copy of the certification manual should be distributed to all poliovirus network laboratories so they can become familiar with and prepare the laboratory data in the necessary format for inclusion in the manual.

12. Laboratories should be prepared to receive visits to their facilities by representatives of their National Certification Committee or the Regional Certification Commission. Such persons may be particularly interested in the quality of the documentation of the laboratory's routine work, the adherence to international standards of biosafety and the arrangements that are in place for containment of poliovirus infectious materials.

Implications of Hispaniola outbreak

In 2000 and 2001, a poliomyelitis outbreak caused by a vaccine-derived poliovirus serotype 1 (VDPV) occurred on the island of Hispaniola. This was the third recognized example of such an outbreak in the world and emphasized the possibility that VDPV may pose significant risks for stopping OPV immunization strategies. Because there is only limited information about the rate of occurrence of such viruses, the global technical consultative group (TCG) recommended that all polioviruses be screened to identify VDPV. Even though the primary focus of the laboratory network must remain the detection and characterization of indigenous wild polioviruses, additional activities will be necessary to assure that VDPV are also identified.

13. All poliovirus isolates must be tested by two WHO-recommended intratypic differentiation methods, one of which must be an antigenic, and the other a genetic method. Any poliovirus not tested by this approach must be referred to a reference

laboratory where the genome should be sequenced using the WHO-recommended methods.

14. All vaccine-like polioviruses isolated since 1998 and not tested by an antigenic method should be retrospectively screened using a WHO-recommended method.

Testing of samples from non-AFP sources

15. Surveillance for wild poliovirus through the testing of stool samples from cases of acute flaccid paralysis remains the gold standard for certification of poliomyelitis eradication. However, it is recognized that polioviruses may be derived through routine laboratory work that may not necessarily be undertaken as part of the eradication initiative. All poliovirus isolates should be subjected to testing by WHO-recommended methods for intratypic differentiation, including polioviruses detected through testing of samples from non-AFP sources.

Annex 1

PROGRAMME

Monday 21 May 2001

8:30–9:15	Registration Opening session RD's message Election of chairperson Adoption of agenda
9:15–11:00	SESSION 1–Overview of progress Global overview Regional progress towards poliomyelitis eradication/Dr F. Kamel Regional surveillance for wild polioviruses/Dr E. de Gourville Update on genetic characteristics of polioviruses from countries of the Eastern Mediterranean Region/Dr M. Pallansch
11:00–14:30	SESSION 2–Reports From laboratories serving countries with wild virus circulation in 2000 and/or 2001 Egypt Islamic Republic of Iran Iraq Kenya (data on southern Sudan and Somalia) Pakistan Sudan
14:30–16:00	SESSION 3–Quality of laboratory performance Report on proficiency test programme/Dr H. Van der Avoort Report on accreditation of laboratories/Dr E. de Gourville Is quality of laboratory and surveillance performance sufficient to guide efforts to interrupt virus transmission? The example of Sudan/Dr F Kamel The example of the Islamic Republic of Iran/Dr H. Jafari

Tuesday 22 May 2001

8:30–11:00	SESSION 4–Data management, an ongoing challenge Demonstration of regional laboratory database/Ms A. Middlekoop Impact of data management practices at subnational and national levels/Ms A. Middlekoop Challenges in maintaining regional databases/Dr H. Safwat Challenges in maintaining country databases Experiences in Oman Experiences in Saudi Arabia
11:00–14:30	SESSION 5–Meeting the challenge of providing timely virology results Part 1: Total quality management

Perspective of the WHO Regional Office/Dr E. de Gourville
Experiences in Oman
Discussion
Part 2: Handling and transportation of specimens/isolates within countries and to/from reference laboratories
Experiences in Egypt
Experiences in the Syrian Arab Republic
Experiences in Jordan
Experiences in Sudan
Experiences in Pakistan

14:30–16:00 SESSION 6–Certification of poliomyelitis eradication
Progress towards regional certification/Dr M. Wahdan
The certification manual and the laboratory/Dr H. Jafari
The Hispaniola outbreak and its implications for immunization, surveillance, laboratory performance, and certification/Dr M. Pallansch
Issues in stopping OPV immunization

Wednesday 23 May 2001

8:30–9:30 SESSION 7–Supplementary surveillance for wild poliovirus
Review of experiences with environmental surveillance For polioviruses in different parts of the world/Dr T. Hovi
Laboratory support to investigate environmental
Samples collected in Egypt
Lessons learned from investigating contacts of AFP cases in Kuwait

9:30–11:00 SESSION 8–Containment of wild polioviruses and potentially infectious materials
Global progress toward containment
Containment in regional network laboratories/Dr E. de Gourville
Laboratory containment of polioviruses in Tunisia
Experiences in making inventory of stored materials
Experiences as national containment coordinator

11:00–13:00 SESSION 9–Review and discussion of new laboratory manual

13:00–14:00 SESSION 10–Discussion of meeting conclusions and recommendations

14:00 Closing session

Annex 2

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Note: Representatives from the Islamic Republic of Iran, Iraq, Morocco and Sudan were invited but were unable to attend.

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