CHAPTER 6

DEVELOPING SURVEILLANCE SYSTEM IN THE WESTERN PACIFIC REGION
The two major technical components of the surveillance system – surveillance for acute flaccid paralysis and laboratory surveillance for wild poliovirus – like other activities of the polio eradication initiative, were far simpler in theory than in practice. Making sure that the two components were integrated and ran smoothly together, and that the system as a whole extended to all parts of the Region, was an amazing feat of organization and management. The Western Pacific Region, following on from lessons learned in the Americas, was able to fine-tune the system and provide a working demonstration to all other regions of an extremely effective surveillance network.

**Situation at the beginning**

When the decision was made in 1988 to eradicate polio, the basic infrastructure needed for the job was not present in the Western Pacific Region. The goal of polio eradication required that poliovirus be detected and identified wherever it was circulating – yet there were no universally accepted criteria for diagnosis of polio; no consistent system for reporting of cases or suspected cases of polio; and no standardized methods for investigating such cases or following them up. Many countries had no access to laboratories which could test for poliovirus. Even where laboratories were available, it could be extremely difficult to arrange for samples to be transported there quickly enough and under the correct conditions – especially from more remote areas.

Systems for all the varied operations of surveillance had to be planned and developed at the same time, or the system as a whole would not be functional. Even 100% detection of AFP cases would not be useful if the appropriate follow-up was not carried out for each case. The most accurate and advanced laboratories could not detect poliovirus if they did not receive samples from patients with paralysis. Thus, although different parts of the system were given emphasis at different times, none could be dropped at any stage. Coordinating them required vision, planning and a lot of hard work.

**Introducing surveillance for AFP**

One of the most important parts of the surveillance system designed for polio eradication was the simple decision to request reporting of acute flaccid paralysis rather than of polio or “suspected polio”. AFP was much more easily defined, and could be identified by a simple clinical examination. Cases could be reported immediately upon detection, rather than waiting for confirmation.
It took a little time for the strategy of AFP surveillance to become clear. The original Plan of Action for the Region provided case definitions for “suspected” and “confirmed” polio: a suspected case was “any patient with acute flaccid paralysis... for which no other cause (could) be immediately identified”. That final clause was what confused the issue and prevented clinicians from reporting all cases of AFP. By 1992, however, the polio-endemic countries in the Western Pacific Region had begun surveillance for AFP specifically, rather than for polio or suspected polio.

However, the concept of reporting all cases of AFP, regardless of cause, was not easy to teach to clinicians used to deciphering the root of any symptom. Their natural tendency was to investigate any case of paralysis to determine what lay behind it. Some cases were clearly not polio, but due to some other cause. Many clinicians could not see the point of reporting such cases to a system designed to track polio, or of taking stool samples to look for the poliovirus when they were sure it would not be found. A considerable amount of explanation and education was needed to convince the people who would be seeing the cases of AFP – primary care and emergency room physicians, paediatricians, neurologists and other health staff – that it was important that they take part in the surveillance system by reporting all AFP cases.
Population as compared to individual

The reasoning that it was better to pick up all polio cases among all AFP cases – even if most proved not to be polio – than to miss some polio cases by not reporting some AFP cases – was on a level with which many health care workers were not familiar: the level of the population. Health workers are trained to think first and foremost about the patient in front of them, rather than about groups of people: their question would be “Does this patient have polio?” If the answer was no, in their estimation, they would see no need to report the case.

Thinking on the level of the population, however, there was a good reason to report cases of AFP even if they were not, or were very unlikely to be, polio. The reason had nothing to do with whether a given individual case of AFP turned out to be polio or not. The reason was: the rate of AFP reporting was a way of measuring whether the system was sensitive enough to pick up polio if it were circulating.

Monitoring surveillance: the non-polio AFP rate

The “background rate” of AFP of at least one case per hundred thousand children under 15 provided the AFP surveillance system with its strongest asset – the ability to be monitored. When the system was first being established, the rates of detection of non-polio AFP were much lower than the target in almost every country. Some countries argued that the standard rate found in the Americas might not apply to their populations, who were from different backgrounds and living in different environments. As surveillance improved, however, it was found that every country could indeed find at least one case of AFP per 100 000 children under 15. That, therefore, came to be the universally accepted benchmark of AFP surveillance performance: when a country or area fell below that rate, it was a sign that further work was needed.

As time went by and the system was refined further, the area to which the target was applied was progressively reduced. Thus, rather than simply requiring that countries meet or exceed the rate overall, each province and then each district had to individually reach the target.
Passive surveillance

In “passive” surveillance systems, health authorities wait for reports to come in of cases of a given disease. There may be some requirement or incentive for health workers to file such reports when they see cases of the disease, but there is no follow-up to ensure that all cases are indeed reported. When the polio eradication initiative began in the Western Pacific Region in the early 1990s, all countries already had a passive surveillance system in place, with polio as one of a number of notifiable conditions. There was, however, no rapid collection of that information at the regional level.

The first step, therefore, was to implement a passive surveillance system in the Region. Starting in March 1991, all polio-endemic countries - with the initial exception of Cambodia - were asked to report to the Regional Office every week, by telex or fax, on the number of suspected, confirmed and discarded cases of polio, as well as the number of cases which had had stool samples taken. Reports were expected every week, even if no cases had been detected. The polio-free countries did not have to submit weekly reports, but were required to report any suspected cases of polio to the Regional Office immediately. That arrangement was recognized from the beginning as only the first phase. Later stages would include weekly reporting by all countries (including zero reporting) and computerization of the system.

In order to collect the information required by the Regional Office, countries had to establish their own internal chains of communication. Clinicians at each level needed to know how to notify the relevant health authorities when they found a suspected case of polio, and often had to be reminded of the importance of doing so. National-level authorities had to develop systems for monitoring the reporting rates. Meanwhile, the object of reporting was clarified so that clinicians began to report AFP *per se*, rather than suspected polio. Gradually, the rates of reporting improved in each country, as did the timeliness of reports and the proportion of cases investigated.

A passive surveillance system, however, was not enough for the work of polio eradication. Despite widespread publicity about the polio eradication strategies, many AFP cases were still going unreported, and AFP rates were well below the target of one case per 100 000 children aged under 15. In many countries, hospitals were outside the routine public health reporting system – yet hospitals were prime locations for people to present with paralysed children. Therefore, a more active system, including hospitals as reporting sites, had to be developed.
Active searches for AFP cases: development of active surveillance

One of the early projects for improvement of surveillance in the Region was carried out in Shandong province, China, by the Provincial Epidemic Prevention Station in association with the Japan International Cooperation Agency (JICA). The project began in 1991, at the request of the Chinese Government, in the midst of an outbreak of polio. JICA experts, together with Chinese staff, visited about 1000 health facilities in cities, villages and even remote areas in the mountains to help health workers learn to diagnose AFP. They re-examined cases reported as AFP, and checked clinical records in hospitals for cases of paralysis which might not have been reported. The active searches of hospital records revealed that many cases of AFP associated with conditions other than polio were not being reported. The visits and training sessions by the teams educated and encouraged the local health workers, and the rates of reporting of AFP improved considerably. Afterwards, the project was extended to four neighbouring provinces and another five southern provinces which included border areas between China and its neighbours, such as the Lao People’s Democratic Republic, Myanmar and Viet Nam. That long-term cooperation at the grassroots level contributed greatly to polio control in China, while also fostering increased understanding between the Chinese and Japanese peoples.

At the fourth meeting of the Technical Advisory Group in Manila in 1994, the results of active searches in Shandong and the Philippines were presented. Following that, the TAG formally recommended that countries improve surveillance methods, including active surveillance, and use active searches to assess AFP surveillance.
There is an important difference between active searches and active surveillance. An active search is an isolated, often retrospective, study looking in hospital records for AFP cases that have been missed over the preceding (relatively long) period. Active surveillance is an ongoing activity in which hospitals and other health facilities are visited regularly on an ongoing basis for the specific purpose of searching for AFP cases. Early active searches in a few countries led to the initial recognition of the need for active surveillance. Thereafter, special active searches were used on occasion when the active surveillance system appeared weak in an area.

Establishment of active surveillance in polio-endemic countries

Gradually, active surveillance systems were established in all the polio-endemic countries in the Region, superseding the previous passive reporting systems. Specially designated AFP surveillance officers were trained and set to work visiting all hospitals, rehabilitation centres and other facilities where children with paralysis would be likely to present. Their job was to visit health facilities to review medical records, interview physicians and check patients once every week, follow up each reported case of AFP, and ensure that the appropriate investigations were done. Often they would take the stool samples, and arrange for their transport to the laboratory, themselves. At sixty days after the onset of paralysis, each child with AFP had to be re-examined to determine whether residual paralysis was present. The AFP surveillance officers made sure that happened and that the result of the examination was reported to health authorities.

In addition to following up reported cases, the surveillance officers would scour admission records, looking for mention of conditions which could possibly be AFP, but might not have been reported as such. If confirmed as AFP, they would be recorded and investigated in the same way.

The sites visited by surveillance officers had to be facilities where AFP cases could present. They also had to reflect the population distribution in the area. Initially, in some countries, “sentinel” surveillance sites were established: in other words, certain hospitals or facilities were chosen to represent larger areas. Searches at those locations could give an indication of the AFP rate for the area, but would not detect every case, since not every potential presentation site was searched. Although that was a necessary first step in some countries, active surveillance was rapidly extended to all relevant facilities that could be identified.
Active surveillance in polio-free countries: the “lesson of Malaysia”

Countries which had been polio-free for some time were also encouraged to set up active AFP surveillance systems, and almost all of them did so, even although the urgency was not as great there as for the recently-endemic countries. The importance of continuing surveillance in those countries was underscored in 1992, when wild poliovirus was isolated from two cases of AFP in Malaysia, with one further case of AFP thought to be polio, based on epidemiological linkage.

Malaysia had been considered polio-free for some time, having had its last case of polio – clinically confirmed – in 1986. Overall immunization coverage rates were very high, but as it turned out there were groups in the country with much lower coverage. The poliovirus was detected initially in a child living in a minority population group with low immunization rates and frequent contacts with travellers returning from polio-endemic countries – prime conditions for importation and re-establishment of indigenous transmission. The second confirmed case, occurring just a month after the first, was a child who lived next door to a family from the same minority group.

Genomic sequencing of the virus confirmed that it was related to polioviruses circulating in the Indian subcontinent – the virus had indeed been imported. All children in the communities and districts where the cases had occurred were offered immunization. At the same time, the coverage in those areas was assessed.

Fortunately, as no further cases were detected despite further investigations, it appeared that only the three children had been affected and that the imported virus had not spread far. Nevertheless, it was a wake-up call for Malaysia and for many other polio-free countries.

Monitoring of follow-up of AFP cases: link to the laboratory

Active surveillance for AFP was monitored using other criteria in addition to the overall AFP detection rate: for example, the percentage of stool specimens collected within 14 days of the onset of paralysis and the percentage of specimens arriving at the laboratory in useable condition (intact, at temperatures less than 8°C Celsius, not dried out). As the polio eradication initiative went on, progressively higher standards were required with respect to those
indicators. With a great deal of effort, and under difficult circumstances in many countries, standards were improved to previously inconceivable levels as the AFP surveillance system developed. With more and better samples thus arriving at laboratories throughout the Region, the laboratory network had to be prepared to deal with the increased workload.

Establishment of the laboratory network in the Western Pacific Region

By the time samples began arriving in large numbers, and the ability to accurately identify and track the poliovirus had become crucial to the progress of the polio eradication initiative, the laboratories were ready. The importance of a highly functioning laboratory network had been recognized from the very beginning of the initiative, and work on its development had commenced early. By the end of 1991, the first two regional reference laboratories and the first five national laboratories had been designated as the laboratory network. The network was eventually to grow to include three regional reference laboratories, ten national and thirty-one subnational laboratories, covering the whole Region. One of the regional reference laboratories also became a global specialized laboratory, with responsibilities which extended beyond the Western Pacific Region.

Laboratories at each level were given clearly defined roles. The national and subnational laboratories were primarily responsible for testing samples for the presence of poliovirus, and for determining the serotype of any virus detected. Any poliovirus samples found were to be sent to the nearest regional reference laboratory, where they would undergo intratypic differentiation to determine which were wild poliovirus and which vaccine virus. Any wild poliovirus found would be referred further, to one of the global specialized laboratories, where genomic sequencing would be carried out in order to investigate the genetic relationships between poliovirus strains.

Situation at the beginning

In 1991, only China and Viet Nam carried out laboratory diagnosis of polio. Laboratories in some other countries had the capability to isolate poliovirus, although most did not routinely do so. Members for the polio laboratory network were thus chosen from among the existing laboratories in the Region.
on the basis of potential, as well as actual capacity and experience. In order to cover every country in the Region, some national laboratories would have to serve several countries.

The concept of a public health network on that scale was new, and very few of the laboratories selected had any real appreciation at the beginning of what would be required of them. Many were primarily research laboratories; some were clinical diagnostic laboratories; others played a part in national public health systems, but many were underfunded, understaffed and ill-equipped. Very few of the laboratories were prepared for the exacting requirements that the polio eradication initiative would impose on them.

In July 1992, the first training courses in the standard method of isolation and identification of polioviruses were held for all laboratory staff involved in the network. By now there were ten national laboratories and twenty-eight subnational laboratories, as well as the two regional reference laboratories and one global specialized laboratory. The WHO manual for the virological investigation of poliomyelitis was used and distributed. Laboratories took their first proficiency tests, with excellent results. That was an important step: laboratories could begin carrying out their primary function as network members with confidence, knowing that they were using the methods recommended and used throughout the Region.

Early meetings and training

The nascent laboratory network held its first regional meeting in December 1991, alongside the second meeting of the Technical Advisory Group. In attendance were staff of the two regional reference laboratories in Australia and Japan, and representatives of CDC, as well as Dr Sima Huilan of the original Polio Eradication Task Force. A tradition was started of smaller meetings of laboratory experts being held alongside the TAG meetings.

Coordination of AFP surveillance and laboratory activities

One of the early issues highlighted by the small group of laboratory experts at the TAG meetings was the importance of communication between laboratory staff and EPI epidemiology units in each country. The task of those two groups of people had traditionally been seen as quite separate, but the polio eradication initiative was forcing them together.
EPI epidemiology units in each country carry out a number of functions related to many different diseases. In the polio eradication initiative, they were entrusted with several important tasks, including monitoring coverage with routine and supplementary doses of OPV; organizing, implementing and monitoring AFP surveillance activities; and keeping track of the AFP cases and which ones were confirmed as polio. In the early stages of the initiative, many cases were confirmed as polio by clinical examination or through epidemiological linkage alone. It was only later in the initiative that laboratory diagnosis gained in importance. The EPI epidemiology units were not, therefore, accustomed to having much interaction with the polio laboratories.

Laboratory staff, for their part, had traditionally viewed their work as separate from the activities in the “field”. They received specimens, carried out tests and reported results. Rarely did they hear anything about the public health implications of what they had found. If specimens arrived at the laboratory in unusable condition, laboratory staff could not be held responsible, and neither did they see it as their job to ensure that specimens reached them intact. Most virologists and laboratory technicians are not trained to work as part of a disease eradication initiative. For them to see their role in a broader context required a shift in culture.

In the Western Pacific Region, however, the two groups managed to develop a close and effective working relationship and also to collaborate well with those planning and implementing the supplementary immunization activities. The integration of the two essential arms of the surveillance system, achieved to an impressive degree in the Western Pacific, was perhaps one of the greatest feats of the polio eradication initiative in the Region and a major factor in its success.

**Coordination of the laboratory network**

A key factor in the successful collaboration of AFP surveillance, laboratory and immunization programme staff was that, from 1994, the Region gained a full-time laboratory coordinator. That allowed continuation and expansion of the work that Sima Huilan had begun on a less than full-time basis, while attending to other important responsibilities. The laboratory network received greatly increased attention at a crucial time, when the surveillance system was gaining in importance in the polio eradication initiative.
As the network developed, it became important for laboratory staff in the Region to meet and consult on directions and developments, and to plan the strategies for further development of the network. Regional meetings on laboratory surveillance for poliomyelitis eradication were held from 1995 onwards, and were attended by representatives of all laboratories. Meetings were also held in China by the Chinese Academy of Preventive Medicine (CAPM) each year for staff from the provincial polio laboratories. Those laboratory meetings were essential in strengthening the sense of collaboration and ownership of the network by the laboratory staff involved.

Laboratory accreditation and monitoring

Although the laboratories chosen for the network were working to generally high standards, by 1997 it became necessary to document the performance quality of each laboratory through a laboratory accreditation system. That required laboratories to document the procedures they were using and report on their performance, as well as passing an annual proficiency test. Site visits were also undertaken as part of the accreditation process. Laboratories were accredited on an annual basis, and each year the expected level of performance was raised a little so that, by the time of regional certification in 2000, the overall performance of the network was high enough to meet the requirements of the Regional Certification Commission.

Once granted, the accreditation status of each laboratory was formally reviewed each year. As part of the accreditation process, proficiency test panels were sent out. Laboratories had to test those samples and achieve 80% accuracy. Various performance indicators—such as percentage of results reported within 28 days of receipt of specimen, percentage of intratypic differentiation results reported within 28 days of specimen receipt in regional reference laboratory, and percentage of specimens from which non-polio enteroviruses were isolated—were also monitored on an ongoing basis.

The accreditation process itself led to an improvement in laboratory standards, as extra efforts and resources were dedicated to strengthening weak areas. By the end of 1999, all laboratories in the Region had been reviewed for accreditation and the accreditation system, developed and piloted in the Western Pacific, had been adopted by the Global Polio Laboratory Network and was in use in all WHO regions.