

## The Sabin Live Poliovirus Vaccination Trials in the USSR, 1959

DOROTHY M. HORSTMANN, M.D.

*WHO Consultant, and Departments of Epidemiology and Public Health and Pediatrics,  
Yale University School of Medicine, New Haven, Connecticut*

Received August 29, 1991

---

Widespread use of the Sabin live attenuated poliovirus vaccine has had tremendous impact on the disease worldwide, virtually eliminating it from a number of countries, including the United States. Early proof of its safety and effectiveness was presented in 1959 by Russian investigators, who had staged massive trials in the USSR, involving millions of children. Their positive results were at first viewed in the United States and elsewhere with some skepticism, but the World Health Organization favored proceeding with large-scale trials, and responded to the claims made by Russian scientists by sending a representative to the USSR to review in detail the design and execution of the vaccine programs and the reliability of their results. The report that followed was a positive endorsement of the findings and contributed to the acceptance of the Sabin vaccine in the United States, where it has been the polio vaccine of choice since the mid-1960s.

---

Too often the field of health policy is considered the exclusive domain of governmental actions, whether legislative or executive. As a result the private sector, whether represented by voluntary organizations or professional associations, is either ignored or considered a well-organized but inadequate proponent of enlightened public action. An exception to such patterns lies in events leading to the acceptance of the two vaccines for immunization against poliomyelitis. Here, policy was influenced by a variety of bodies and diverse factors. Two important considerations influencing the scientific community and public reaction were the sites and sponsorship of large field trials. The killed virus vaccine developed by Dr. Jonas Salk had been tested in the United States largely under the sponsorship of the National Foundation for Infantile Paralysis. Its success was widely heralded (particularly by the Foundation), and it was promptly licensed in 1955.

By 1957, Dr. Albert Sabin's live attenuated poliovirus vaccine had undergone a number of successful field tests and had reached the stage when large trials were indicated. Such trials were recommended by the World Health Organization Expert Committee on Poliomyelitis in July of 1957. But in the United States the Salk vaccine was proving to be successful, reducing the incidence of poliomyelitis to several thousand cases per year. Leaders of the National Foundation were therefore satisfied and not interested in supporting a trial of the Sabin oral vaccine, nor was the United States Public Health Service. Dr. Sabin then turned to his colleagues abroad, including those in the USSR and Czechoslovakia [1]. He supplied enough vaccine to immunize many thousands of children in these places and also provided seed lots

from which the Russians quickly prepared some ten million doses. By the fall of 1959, millions of children in the Soviet Republics had received the Sabin vaccine.

Strongly positive results in terms of safety and effectiveness of the oral vaccine were reported by the Russian scientists at the First International Conference on Live Poliovirus Vaccines, held in Washington, DC, at the Pan American branch of WHO in June 1959 [2,3]. The findings stimulated great interest and lively discussion at the meeting, but in the United States there was some skepticism concerning reliability of the data, particularly in relation to surveillance of vaccinees and their contacts, a necessity for assuring vaccine safety. The fear concerned the stability of the live attenuated virus. In the course of multiplication in the intestinal tract, some mutation was known to occur. The frequency of contact infections raised the possibility that serial passage might ultimately result in emergence of neurovirulent virus strains. Although the Russian investigators had reported no significant changes in pathogenicity for monkeys after ten human passages [3], there was still some unease about the problem.

It was at this point (August 1959) that I was asked by WHO to visit the USSR, Czechoslovakia, and Poland to engage in a detailed evaluation of the quality of work in the laboratories involved, the care with which vaccinees were followed, and the standards employed to assure the vaccine's safety. After a six-week investigation of these aspects in several Soviet Republics, Czechoslovakia, and Poland, a detailed analysis was submitted to WHO. While this report was not published, it was distributed widely. Its positive assessment contributed to a rebirth of interest in the oral vaccine and paved the way for large field trials in the United States, leading to licensure of oral vaccine in 1961–62. Because of the importance of this 124-page report, and because of Arthur Viselstea's interest in the background of policy decisions concerning preventive programs, as illustrated in his work on swine influenza [4], a précis of the findings in several USSR Republics appears in this paper. It is presented in the present tense, as it was written, recording observations made in the fall of 1959. As one can deduce from the report, the extraordinary massive immunization programs developed in the various Republics were possible because of the strengths of the then-existing sociopolitical organizations of the USSR.

#### ITINERARY AND AIMS

The period between August 30 and October 11 was spent in the Soviet Union, largely in Moscow, with visits to other areas, including Leningrad, Tashkent, and Riga. An attempt was made to review and evaluate the following features in connection with vaccination programs in the different areas:

1. Standards and quality of laboratory work
2. Selection of areas to be vaccinated
3. Selection of vaccinees
4. Pre-vaccinal serological surveys
5. Conduct of vaccination
6. Surveillance, clinical and laboratory
7. Preliminary results, as of October 1959<sup>1</sup>

<sup>1</sup>Some additional data have been received from the USSR since October 1959.

## HISTORY OF POLIOMYELITIS IN THE USSR

Published accounts on this subject are rare indeed, and few statistics were available. The following information was obtained from a recent report by Dr. O.V. Baroian, epidemiologist of the Ivanovsky Institute.

Beginning in the latter part of the nineteenth century, the first sporadic cases and small outbreaks of poliomyelitis were registered in Latvia, Estonia, and in St. Petersburg. Small epidemics continued in these and other areas, increasing gradually in size during the first quarter of the twentieth century. By 1929, however, compared with European countries, the USSR still had much the lowest incidence of the disease—0.54 per 100,000, compared with rates of 1.7 in Germany, 6.3 in Denmark, and 15.4 in Sweden. There was no significant change in the picture until shortly after World War II, when suddenly large first epidemics began to appear in various Republics, and the annual rate rose steadily. Between the years 1954–1959, poliomyelitis was reported in virtually all Republics of the Soviet Union, the highest incidence being in the central and northwest, particularly the Baltic Republics, and the lowest in the southern and southeast regions. In spite of marked differences between various Republics, there had been a steady overall increase, from 2.8 per 100,000 in 1954, to 8.7 in 1955, and 9.4 in 1957.

## LIVE VIRUS VACCINE WORK DIRECTED BY DR. M.P. CHUMAKOV

*Institute for Poliomyelitis Research, Academy of Medical Sciences, Moscow*

The major activities concerning the live poliovirus vaccination program in the Soviet Union are now carried on in Moscow at this Institute, under the direction of Dr. M.P. Chumakov. Various aspects of field and laboratory work were discussed in detail at the Institute with Dr. Chumakov and his associates.

The Poliomyelitis Research Institute was established in Moscow in 1955 because of the increasing importance of poliomyelitis, the sudden appearance of first epidemics in various parts of the USSR, and a steadily rising incidence of the disease generally. Dr. Chumakov, who had been head of the Viral Disease Section of the Institute of Neurology, became the director, his laboratory forming the nucleus of the new Institute. The Institute was visited in 1956 by members of the American Medical Mission on Microbiology and Epidemiology [5]; since then, work on poliomyelitis has been greatly expanded, and the Institute now consists of three large divisions, widely separated physically, all in temporary and makeshift quarters. Much of the virological work is done at Sokolinaya Gora, where the laboratories are in a separate building on the grounds of the Second Infectious Disease Hospital of Moscow. The director's office and the administrative unit are here, and the first Salk-type vaccine was produced here in 1957. Another laboratory is at Shipok, a 40-minute drive to the other side of the city. This site is Dr. Chumakov's original laboratory, and some of his early colleagues, such as Dr. Belajeva, still work there. There are about six physicians plus their technicians, doing virological and serological work connected with the vaccination program in different parts of this laboratory. Dr. S.G. Drosdov, an extremely able and dynamic person, has recently been made chief of the Epidemiology Laboratory at Shipok. In addition, the Department of Neuropathology, which is responsible for the examination of monkeys used in safety tests of the oral vaccine, is also at Shipok, with Dr. Robinzon as director; her staff consists of five neuropathologists, including Dr. Tufanov, who visited the U.S.A. in

1959. The third laboratory is in Vnukovo, approximately 30 kilometers from the city, and five kilometers from the main Moscow airport. At Vnukovo, in a clearing in a birch forest, the new home for the Institute is under construction. This structure will be an enormous building, with three or four wings extending from the main section, and many carefully planned laboratories. The several animal houses are in separate smaller buildings. They are well designed and well equipped indeed. The new building should be completed within a few months, and the three units of the Institute will then be brought together.

### *Laboratory Work*

A striking feature of laboratory work at the Poliomyelitis Research Institute and generally in the Soviet Union is the large staff available, both scientific and technical. It is the usual practice for two technicians to work together, sitting on opposite sides of a table, one assisting the other at every step. My impression was that there were at least two persons for every one in our laboratories.

Although the present laboratories of the Institute are old and dark, the standards of sterile technique are universally high. In all, space is divided into sterile cubicles, or "boxes" as they are called, each with a work table in the middle, often a sink, and with ultraviolet light overhead. Access to the sterile cubicle is usually through an intermediate, glass-enclosed passageway, separated from the open area of the laboratory or from the corridor. Sterile gowns, caps, and masks are worn at all times by all personnel entering the work cubicles. Apparently very little contamination of tissue cultures, either bacterial or fungal, is encountered, using this system.

In connection with the live virus vaccine programs, much discussion centered around methods employed in the collection, storing, shipping, and testing of various materials. The methods in all these areas were standard, with the usual minor variations which occur from one laboratory to the next. Stool specimens were employed for virus isolations rather than rectal swabs. All specimens collected in Estonia were taken or sent to a central poliomyelitis laboratory in the Microbiology Institute in Tallinn, where they were made into 20 percent suspensions and frozen. Some specimens (a few hundred) were tested in this local laboratory, but the majority—several thousands—were shipped to Moscow by air. During the winter, it was not necessary to ice the shipments, but, beginning in April, all were packed in dry ice for the trip. In Moscow, the work was carried out at Sokolinaya Gora under the direction of Dr. Drosdov and 11 members of his group, five physicians and six technicians. The method of preparation and testing of fecal material was the same as that employed in United States laboratories.

### *Neutralization Tests*

The pH (metabolic) test for neutralizing antibodies is employed using MK cells, and Earle's media with lactalbumin and calf serum. Small, flat-bottomed insulin bottles are being substituted for tubes, a great saving in incubator space. The tests that I saw were clear-cut with good, sharp color end points.

## VACCINATION PROGRAMS IN DIFFERENT REPUBLICS

As reported by Chumakov et al. at the Washington Live Poliovirus Conference, in June 1959, the first large-scale programs were carried out by his group in Estonia, Lithuania, and Kazakhstan. Subsequently, a number of programs have been set up,

TABLE 1  
Administration of Sabin Oral Poliovirus Vaccine in  
Soviet Republics, January–October 1959

Republic	Approximate Number Vaccinated
Estonian SSR	716,000
Lithuanian SSR	547,952
Kazakh SSR	1,500,000
Uzbek SSR	1,867,000
Khirgiz SSR	500,000
Tadzhik SSR	Not known
Russian Federation	2,250,000
Ukrainian SSR	1,000,000
Trans-Caucasian Republics	
Georgian SSR	1,600,000 (in progress)
Armenian SSR	
Azerbaijan SSR	
	8,380,952+

vaccinating chiefly persons under 15 years. As of October 1959, part, or almost the entire designated age group of the population within most of the Republics, had been vaccinated. The total number of vaccinees was approximately 10,000,000, as indicated in Table 1.

Planning for vaccination was greatly facilitated by the availability of accurate population data obtained in January 1959, when a census of the entire country was carried out. Although age-specific statistics are not yet complete, information on total child population is known, and more complete information was expected to be available by the end of 1959.

#### *Conduct of Vaccination*

A preliminary propaganda campaign is carried out immediately before beginning a vaccination program. To many areas, Dr. Chumakov himself goes with one or more of his staff members. He addresses first the assembled physicians of the area, explaining the program, the organization, the role of the physicians, their responsibilities, both during the actual vaccination period and, subsequently, the importance of close surveillance, and so on. At the same time, there are radio and television broadcasts (by Dr. Chumakov) explaining to the people the necessity for their full cooperation if the program is to be successful. Newspapers and billboards carry notices of where and when vaccine will be distributed.

The organization for vaccine distribution varies slightly, depending on the nature of the area, but the principles are the same. In Estonia, for instance, a main town in each region of the Republic was selected, a town in which there was a laboratory with adequate refrigeration facilities. From these centers, teams went out daily, carrying the vaccine in iced thermos jugs. For rural distribution, teams, usually of three persons—two nurses and a “feldtscher” or assistant physician—went out to cover an assigned area. In towns, teams were set up in schools, nurseries, kindergartens, outpatient clinics, factories, and the like. A physician (*vrach*) supervised the activities of several teams. Preliminary lists of vaccinees had been prepared, and data on every vaccinated person was recorded. In the field, the data were usually in the form of a

list, giving name, address, age, type of vaccine administered, and date of vaccination. This information was then collected by the physician and referred to the local sanitary-epidemiological station, from whence it travelled to the regional sanitary-epidemiological station. The data were also transferred to the card kept by each local pediatrician on every child in his district.

### *Selection of Vaccinees*

Since the program was set up as an effort at mass vaccination, there was no selection of vaccinees, nor were there any selected control groups. This organization was deliberate, based first on humanitarian principles, the desire to eliminate paralytic poliomyelitis completely, and, second, on the idea that spread of the attenuated strains would destroy the validity of the control group by involuntary vaccination of an unknown number of contacts. There is therefore no claim by Dr. Chumakov that a controlled trial has been carried out, but rather that a mass program has been put into effect. As in any mass program, however, a certain number of persons living in designated areas were missed, either due to absence, illness, or reluctance to take part.

### *Vaccine Administration Schedules*

The plan of vaccination has varied slightly in different Republics. Serial administration, starting with Type I, then Type III, then Type II, at monthly intervals was used in the beginning; the populations in Lithuania and Estonia were vaccinated in this manner. In Lithuania, a comparison was made between those vaccinated serially with the three types given in different order, and with groups receiving a triple vaccine, given either once or repeated after one month. The serologic tests to be carried out on the vaccinees are as yet incomplete, but preliminary data based in part on studies of nursery populations indicated no significant difference in the end result if the conventional I—III—II scheme was used, or if a trivalent vaccine was given. In many Republics, therefore, trivalent vaccine was used, and, by October 1959, some 5,000,000 children had received this form. Preliminary results with candy vaccine given to small groups of nursery children indicated that infection and serological responses were satisfactory. Most recent communications from Dr. Chumakov, however, indicate that the current plan for vaccinating the entire country will call for four doses of vaccine: three of the monovalent, Type I, Type III, and Type II at four- to six-week intervals, followed by one dose of trivalent vaccine after an interval of three to 18 months.

### *Pre-Vaccinal Immune Status of the Population*

In all areas where the live poliovirus vaccine programs were carried out, serological surveys of varying size were made, but in most instances they do not represent a random sampling because, for the younger age groups, too much reliance seems to have been placed on so-called "organized children," i.e., children aged 0–3 years *living* in nurseries. These children are orphans or have been placed in such institutions because their parents are away or unable to take care of them for one reason or another. Another group heavily represented is a day nursery group of children (aged eight months to three years) who are deposited by their mothers at the nursery each morning at 8 A.M. and collected at 4 P.M. Children attending such institutions represent about 15 percent of the population, aged six months to three years. These

two groups make up 100 percent of the 0–3-year age group surveyed, but obviously are not representative of the population at large. The age group four to seven was also drawn from institutionalized children to a great extent and from kindergartens. School children account for the age groups seven to 14, and factory workers largely for the adults. Blood specimens are usually collected by nurses, specially trained, but in some instances by physicians. Ordinary syringes are used, and 3–5 ml taken from antecubital or scalp veins and occasionally from neck veins.

### *Surveillance*

Follow-up to identify poliomyelitis cases, particularly those which might develop in vaccinated children, seems to be very good. As an infectious disease, it has a priority, and, following the propaganda associated with the live virus vaccine program, it has particular prominence. In each area, the teams responsible for vaccination were also concerned with surveillance. In Tashkent, where vaccine was administered beginning on July 19, during an epidemic, each home was visited every five to six days until mid-September, in order to check on possible cases. In general, however, the pediatrician responsible for the area is the one who sees the sick child, makes a diagnosis, and notifies the local sanitary-epidemiological station of the case. An epidemiologist then visits the home of the child, fills out an elaborate epidemiological history chart, enquires about illness among contacts, sometimes collects specimens from those with suspicious illness, and the like.

The Ministry of Health in Moscow has set up a special notification system for poliomyelitis cases, which requires that the local physician notify by telephone or telegraph the regional sanitary-epidemiological station, which in turn telephones or telegraphs the central sanitary-epidemiological station of the Republic. There is no difficulty in establishing whether the child has been vaccinated or not, since this information is on file in the local pediatrician's records and also at the sanitary-epidemiological station. All suspicious cases, i.e., all cases with signs of acute infection of the central nervous system, are hospitalized; in remote areas, transportation to the hospital may be arranged by plane.

### *Reporting of Cases*

A special—and complicated—form has been provided for the reporting of poliomyelitis cases. As in most reporting systems, there is some variation from place to place in the completeness and speed with which cases are notified. Under the USSR system, however, it would seem that all paralytic cases are seen and reported. It is probable that some mild cases of aseptic meningitis might slip through, but, in general, overreporting rather than underreporting seems to be the rule. The team of specialists which is sent to confirm the diagnosis not infrequently eliminates the case as “not poliomyelitis.”

### *Laboratory Confirmation of Cases*

The collection of specimens from suspected poliomyelitis cases also varies somewhat, depending on the area. In Karaganda, Tashkent, Moscow *city*, the collections are good; though in Moscow *region*, for example, which is largely rural, delays and failures to collect specimens are problems. The routine is to collect at least two fecal specimens during the acute phase of illness and at least an acute and a convalescent blood specimen. Specimens are sent first to the local sanitary-epidemiological

station, then to whatever laboratory has been designated for testing—a regional one, or the Moscow laboratories of Dr. Chumakov. In some areas, fecal specimens are divided, part being tested in the regional laboratories and part being sent to Moscow. Serological tests are performed largely in the Moscow laboratories, although, in a few areas, the regional laboratories also perform some of the tests. It is hard to visualize any state, particularly the larger ones in the United States, where the laboratory confirmation of the clinically diagnosed cases of poliomyelitis is so universally carried out.

### EXAMPLES OF DIFFERENT VACCINATION PROGRAMS

Details on the conduct of vaccination and preliminary results were available for only some of the Republics at the time of my visit. These particulars are given in the following sections.

#### VACCINATION IN ESTONIA

Estonia has had one of the highest rates of poliomyelitis in the Soviet Union. The largest epidemic recorded occurred in 1958, when the attack rate reached 89 per 100,000. The age distribution was not unlike that of Sweden, with 20 to 30 percent of cases in adults over 20 years. Killed (Salk-type) vaccine has been used in the past few years on a modest scale by the Ministry of Health of the Republic; exact data on the percentage vaccinated in each age group were not available.

##### *Serological Survey*

In spite of the tremendous epidemic of 1958, a considerable number of susceptibles to one or more types of poliovirus remained in the population, as shown by data presented by Dr. Chumakov in June 1959 [2]. Of the 519 children and adults surveyed, the percentage lacking antibodies to all three types was close to 50 percent for children under ten; for the individual types, the figures were 44 percent, 25 percent, and 51 percent for Types I, II, and III, respectively. Such results indicate a large segment of susceptibles in this population.

##### *Vaccination Program*

Estonia was the first Republic in which Dr. Chumakov and his team undertook a mass vaccination. By May 10, 1959, a total of 657,000 of the population of 1.1 million had been vaccinated, including about 60–70 percent of the children up to age 15, and 50 percent of those 16–50 years. Vaccination continued throughout the summer of 1959, chiefly among the youngest children, so that the total number of vaccinees by September 1 was approximately 716,000. The schedule used was Type I, followed at monthly intervals by Type III, and Type II. Coincidentally an extensive program was set up for following virus excretion and serological conversion in vaccinees and their contacts in a number of groups, including children in nurseries, school children, and young adult students. In all, some 10,000 fecal specimens and several thousand bloods were collected. Dr. Drosdov, Dr. Shirman, and two technicians went from the Moscow Institute for Poliomyelitis Research to the Laboratory in Tallinn, where they remained for several months, through the vaccination period. The bulk of the specimens are now being tested in Moscow.



### *Clinical Surveillance*

In Estonia, a center for the Republic was established for this purpose in Tartu, under the direction of Professor Randam, who has had many years of experience with poliomyelitis. In addition, a special epidemiological bureau was organized to survey all poliomyelitis cases, suspected cases, and contacts. An effort was made to obtain three fecal specimens during the acute phase, and two to three acute and convalescent blood specimens. Laboratory tests are currently under way.

### *Effect of the Vaccination Program*

The vaccination campaign completed in May was followed by a reduction in the number of cases and, most striking, absence of the usual summer rise. Furthermore, there was no suggestion on clinical or epidemiological evidence that the vaccine virus in spreading among susceptible contacts had acquired enhanced virulence after multiple passages.

## VACCINATION IN TASHKENT

This region is an area of particular interest because a mass vaccination program was carried out there in July and August 1959, during the course of a sharp outbreak of poliomyelitis. Discussions of various aspects of the activities were held in Tashkent with the Director of the Uzbek Serum and Vaccine Institute, Dr. Inogamov, and his staff and Dr. Boito, head of the Sanitary-Epidemiologic Department of the Republic.

The population of Tashkent has grown sharply in recent years. The estimated number of inhabitants in 1924–26 was 200,000. The January 1959 census listed 911,000. The rise is largely natural growth, but reinforced by great migrations from the west during the war years, 1941–42. The way of life and standards of living until recently were similar to those of underdeveloped countries of the Middle East. Over the course of the last 40 years, however, there has been a steady change. Tashkent has become a center of the textile industry, and with industrialization have come higher living standards, better housing, better medical care, and so on.

### *History of Poliomyelitis in the Area*

Uzbekistan has had one of the lowest poliomyelitis attack rates of any Republic. Only sporadic cases in young children have been notified in the past, but, as in neighboring Kazakhstan, there has been a gradual increase in their number in the past decade. Beginning in June 1959, the first epidemic appeared. It centered in Tashkent, but an increased incidence was noted throughout the Republic. As previously, the youngest age group was involved; 80 percent of cases were in children under four years. By mid-July, the number of cases was increasing rapidly; at this time, it was decided to try to check the epidemic by a rapid mass application of trivalent live poliovirus vaccine covering all children under 15 years of age. This program was begun on July 19, under the personal direction of Dr. Chumakov.

### *Organization of the Vaccination Program*

Because of the emergency nature of the vaccination program in Tashkent, a vigorous propaganda campaign was carried on for several days via the television, radio, and press, with Dr. Chumakov playing a prominent role. The 2,000 physicians

of the city, regardless of their specialties, were asked to assist. The city is divided into 23 districts, and the health station in each provided a list of children in its area.

July 19 was a Sunday. All families with children were urged, through media communications, to remain at home until visited by a vaccination team. Vaccine was given by ordinary medicine dropper in a spoon (provided by the family) with water; the oral dose was two drops, which amount had been calculated to contain approximately 100,000 TCD<sup>50</sup> of each of the three types. The number of children vaccinated on July 19 was 182,000; on July 22–23, 122,000, and on August 12, 160,000. The total number of vaccinees was >400,000, which represents almost the entire estimated population of Tashkent under 15 years, according to the January 1959 census. Although the vaccination was voluntary, considerable pressure was exerted in the course of television and radio propaganda, taking advantage of the fear experienced by all parents in the face of a poliomyelitis epidemic. The response was thus quite close to 100 percent. Approximately six weeks after initial vaccination, a second dose was given to virtually all who had received the first; the administration of the second dose covered a period of four days.

#### *Collection and Testing of Specimens*

Fecal specimens were collected from about 100 cases during the early part of the epidemic, before vaccination was carried out. Few of them had been tested by September 1959, but five strains of Type I, one of Type III, and a mixture of Types I and III had already been isolated. Several untypeable agents—possibly mixtures—had also been encountered. It would seem likely that in a population such as that of Tashkent, inapparent infections with various enteroviruses would be common in the youngest age group.

After vaccination, specimens were collected from all definite and suspected cases of poliomyelitis; throat swabs were taken from some, and fecal samples were obtained twice during the first week of admission. Acute and convalescent blood samples were also collected.

Laboratory studies, including virus isolations from fecal specimens and flies, and serological tests, are in progress in the newly established poliomyelitis unit at the Tashkent Serum and Vaccine Institute. Preliminary results indicate that Type I was active, but all isolates had not yet been typed. The extensive laboratory program planned is ambitious for a small unit; it will doubtless be some time before results are available, in spite of the constant advice and support of Dr. Chumakov's laboratory in Moscow.

#### *Course of the Epidemic*

A total of approximately 400 cases occurred, 80 percent of which were in children under four. Following vaccination, the epidemic fell off sharply. It was short, lasting only some two and a half months. This duration was in contrast to the experience of nearby Alma Ata, Kazakhstan, a city of similar size and type, where a first epidemic occurred in 1954 and lasted over a six-month period. The difference suggests that oral vaccine may have played a role in shortening the Tashkent epidemic. Furthermore, it is clear that mass vaccination of the child population in the middle of a summer outbreak did not increase the incidence of poliomyelitis.

## LIVE VIRUS VACCINE WORK DIRECTED BY DR. A.A. SMORODINTSEV

Several days were spent in Leningrad, reviewing with Dr. A.A. Smorodintsev the vaccination programs under his direction in Latvia, Moldavia, and Byelorussia.

### *Laboratories*

Dr. Smorodintsev is head of the Virology Department of the Institute of Experimental Medicine of the USSR Academy of Medical Science. The Department occupies a floor of the Institute, which was built in the 1930s. The building seems older than this, and the rooms are apt to be dark and cold. The staff, which seemed very able indeed, consists of 16 physicians, 43 technicians, and a number of bottle washers. Laboratory techniques were similar to those elsewhere in the USSR. In some of the pH neutralization tests, plastic plates obtained from Denmark were being used. The CF test is performed according to the drop method, utilizing a complicated mechanical dropper designed by Dr. A. Selivanoff.

## THE POLIOVIRUS VACCINATION PROGRAMS IN BYELORUSSIA AND MOLDAVIA

The organization of the programs in Moldavia and Byelorussia was similar to that in other Republics, taking advantage of the same type of extensive medical and other facilities. The period of mass vaccination was March to June 1959. Vaccination teams were set up in various schools, clinics, and the like. About 14 days were required for completing the administration of Type I vaccine; after two weeks, the second round was given, Types II and III together. Registration of vaccinees and reporting of cases was as in other Republics.

### *Laboratory Tests*

All pre- and post-vaccinal serological and virological tests on materials from Moldavia and Byelorussia have been performed in Dr. Smorodintsev's laboratory in Leningrad. In some instances, the fecal specimens were divided, part being sent to Leningrad, and part being tested locally, in Minsk (Byelorussia) or in the virus laboratory of the Institute of Epidemiology in Kishinev (Moldavia). In these two laboratories, monkey kidney cells are received by air from the Moscow Institute for Poliomyelitis Research; in addition, human embryonic fibroblast cultures from specimens obtained from local hospitals are also used.

Serological surveys carried out in both Republics were among nursery school children for the younger age groups, and at schools and factories for older individuals. The results of the tests were not yet available at the time of my visit.

### *Poliomyelitis in Moldavia and Byelorussia in 1959*

In both Republics following the March–June 1959 vaccination program, there was a marked reduction in the numbers of cases compared to previous years. The rates in the cities where oral vaccine had been given were significantly lower than in similar unvaccinated areas. Furthermore, there was no indication that spread of the vaccine strains had resulted in enhanced virulence and the appearance of cases.

## VACCINATION IN LATVIA

Vaccination in Latvia was also carried out under Dr. Smorodintsev's direction, during April and May 1959. At the poliomyelitis laboratory of the Institute of Microbiology of the Latvian SSR, discussions were held with the Director, Dr. A.M. Kirchenstein and his associates, and at the Children's Hospital in Riga with Dr. N. Pakalnin, chief of the neuroinfection ward, and his clinical staff.

### *History of Poliomyelitis in Latvia*

Epidemic poliomyelitis in Latvia has followed a pattern similar to that in the nearby Scandinavian countries, with increasingly severe outbreaks. The population of the Republic is about 2,000,000, and of the capital city, Riga, 600,000. Attack rates have always been highest in the cities, particularly Riga. The most severe epidemic occurred in 1956, in which there were 528 cases, an attack rate of 88 per 100,000. During 1957, an extensive program using the Salk-type vaccine had been undertaken, and 82,000 children under 15 were given two doses followed by a third dose in 1958. In the city of Riga, virtually all children of this age group were so vaccinated; in the rest of the Republic, approximately 10–15 percent of the child population had received two or more doses. Although cases in older children and young adults continue to occur, there has been some shift recently toward a higher incidence in young children, i.e., under five years, particularly in the cities.

### *The Microbiology Institute in Riga*

This institute, which operates under the auspices of The Latvian Academy of Medical Sciences, was constructed in the early 1930s. It consists of three or four small stucco laboratory and administrative buildings, three stories high, and a number of animal quarters. The laboratories are simple and well kept; there are many glass-partitioned working units. In the biochemistry and biophysics building, there is an electron microscope and, in addition, a variety of electronic equipment.

The Poliomyelitis Department was set up in 1956, at which time several of the senior staff spent some time in Moscow at the Institute for Poliomyelitis Research under Dr. Chumakov in order to obtain training in tissue culture and poliomyelitis work. The present staff consists of nine physicians and 15 technicians. The physicians are knowledgeable, young, conscientious, and enthusiastic. They look forward eagerly to continued work in the enterovirus field.

### *Laboratory Tests*

Virus isolation is performed using human embryonic tissue, which is received twice weekly from abortions performed at the hospitals in Riga. In serologic tests, the methods employed are the same as those used in Moscow and other laboratories.

### *The Children's Hospital in Riga*

This institution is an 800-bed hospital, probably about 25 years old, on the outskirts of the city. The deputy director, Dr. N. Pakalnin, is also the chief of the neuroinfection ward and has long been particularly interested in poliomyelitis. It is obvious that he has had great experience with the disease; he speaks English fluently and is thoroughly familiar with the clinical literature on poliomyelitis in English. The

medical staff, in addition to Dr. Pakalnin, are experienced physicians, and the standards of medical and nursing care are high.

#### *The Live Virus Vaccination Program in Latvia*

The Republic is divided into 44 provinces, or regions; vaccine was administered in 21 of these, the other 23 being left as controls. In the past, the 21 vaccinated regions, which include the five cities, accounted for approximately 88 percent of the poliomyelitis cases, while in the control, non-vaccinated regions an average of only 12 percent of the total cases occurred.

During April and May 1959, approximately 413,000 individuals received monovalent Type I oral vaccine; one month later, 376,464 of these received Types II and III combined. The focus was primarily on children under 15 and on young adults; approximately 65 percent of these groups were vaccinated. As elsewhere, the regions to be vaccinated were divided, and teams consisting of one physician and two nurses covered a given population group. The vaccine was administered at polyclinics, nurseries, schools, and various special vaccine clinics. Each vaccinee was registered, and the records were forwarded to the Chief Epidemiologist in Riga.

#### *Serological Surveys*

A pre-vaccinal survey was carried out in seven selected regions in different parts of the Republic, exclusive of Riga. The sera were tested in Leningrad, in Dr. Smorodintsev's laboratory. Details of the results are not presently available, but Dr. Smorodintsev has reported that in Latvia "serological examination of selected groups of children of various ages prior to vaccination showed that 42 percent of them were negative to Type I, and about 40 percent to Types II and III." The results of a post-vaccinal survey of 500 persons—not necessarily the same ones as those in the pre-vaccinal survey—are not yet available.

#### *Surveillance*

Since Latvia is small, the most distant point from the capital being 200 kilometers, virtually all suspected cases of poliomyelitis could be referred to the special poliomyelitis ward set up in the Children's Hospital in Riga; such was the practice in 1959. During the months June–October, following completion of the vaccination program, there were 14 cases of paralytic poliomyelitis scattered throughout the Republic. Use of Salk vaccine in 1957 and 1958, following the large 1956 epidemic, and the high oral vaccine coverage in 1959 no doubt contributed to this low incidence. No clinical or epidemiologic evidence emerged that live virus vaccine contact spread enhanced the virulence of the virus or caused paralytic cases.

#### SUMMARY: USSR

Extensive mass programs of poliomyelitis vaccination using Sabin's strains of virus have been carried out in the USSR, beginning in January 1959. To date, some 10–15,000,000 persons have been vaccinated. The evidence seems conclusive that these strains are safe, both to the vaccinees and to their communities. Surveillance of cases is good, and it seems very unlikely that paralytic cases of poliomyelitis would have been missed. The marked reduction of cases in 1959 in orally vaccinated Republics suggests that the vaccine may have played a significant role in reducing the

incidence of paralytic poliomyelitis. Compared to the pattern of rising incidence in the past few years, and the five-year averages, the low incidence in 1959 stands out.

The standards of laboratory work in the areas evaluated are high. The facilities are adequate, and the laboratory personnel, both at the professional and technical levels, is extensive; however, there is often some delay in carrying out laboratory investigations of cases occurring in vaccinated areas. In view of the enormous amount of laboratory work to be completed in a year of many vaccination programs, it is understandable that final results are slow in coming. When completed, pre- and post-vaccinal serological surveys should aid greatly in estimating the effectiveness of the Sabin strains of attenuated live virus vaccine administered in various ways and under various epidemiological circumstances.

#### REFERENCES

1. Sabin AB: Oral poliovirus vaccine: History of its development and use and current challenge to eliminate poliomyelitis from the world. *J Infect Dis* 151:420-436, 1985
2. Chumakov MP, Voroshilova MK, Vasilieva KA, et al: Preliminary report on mass oral immunization of population against poliomyelitis with live virus vaccine from A.B. Sabin's attenuated strains. First International Conference on Live Poliovirus Vaccines. Washington, DC, Pan American Sanitary Bureau Scientific Publication No. 44, 1959, pp 517-529
3. Smorodintsev AA, Davidenkova EF, Drobyshvskaya AI, et al: Part 3. Material for the study of the harmlessness of the live poliomyelitis vaccine prepared from Sabin strains. First International Conference on Live Poliovirus Vaccines. Washington, DC, Pan American Sanitary Bureau Scientific Publication No. 44, 1959, pp 325-332
4. Viseltear AJ: A short political history of the 1976 swine influenza legislation. In *History, Science, and Politics. Influenza in America, 1918-1976*. Edited by JE Osborn. New York, Prodist, 1977, pp 29-57
5. United States-USSR Medical Exchange Mission 1956. Part II. American Medical Mission on Microbiology and Epidemiology to the Soviet Union, February 27-March 28, 1956. Public Health Monograph No. 50. Washington, DC, U.S. Department of Health and Welfare