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REPORT ON THE SMALLPOX VACCINATION CAMPAIGN CARRIED
OUT DURING THE PERIOD OCTOBRE 1950 - DECEMBER 1955¹

by

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On 23 September 1950 an agreement was signed between the Government of Peru and the Pan American Sanitary Bureau for carrying out a smallpox vaccination programme.

It was estimated that by immunizing 80 per cent. of the population over a five-year period, smallpox cases would be reduced to insignificant figures and that it might even be possible to eradicate the disease.

The following factors were taken into account in the carrying out of the programme:

- (1) the importance of the disease and its extent;
- (2) the vaccine which should be used;
- (3) the technique and equipment for its application;
- (4) the conditions which the medical and auxiliary personnel should satisfy;
- (5) the method of work;
- (6) the funds necessary for implementing the programme and the regularity with which they are supplied;
- (7) statistics and evaluation of results.

¹ Paper presented at the Seminar on Smallpox Vaccination held at Lima, Peru, from 20 to 25 August 1956

1. The importance of the disease and its extent

Smallpox appears to have existed in Peru ever since the arrival of the Spaniards. It is believed that the armies of Huayna Capac were destroyed by the first epidemic of this disease, even the Emperor having died from it. This smallpox epidemic is thought to have occurred about the year 1529.

Afterwards the disease became endemic, with periodic epidemic outbreaks ravaging the whole country. We shall not go into the history of this period since it has already been dealt with by Dr Juan B. Lastres in "The history of smallpox in Peru" (Volume 3 of the journal Salud y Bienestar Social). However, Fig. 1 shows all known smallpox cases during the period 1940 to 1955, namely 29 779, with an annual average of 1861, influenced strongly by the extreme figures during epidemic outbreaks. The median figure for these 16 years is 959 cases.

It should be borne in mind that all these data are incomplete since the notification area does not cover more than about 40 per cent. of the population.

From Fig. 1 it will be seen that in 1940 an epidemic period commenced which continued for four years, with a total of 7979 notifications, corresponding to an annual average of 1992 cases; the maximum was 3143, in 1941, and the minimum, 446, in 1940. This period was followed by four years during which smallpox took on an endemic nature, with 1889 cases in all and an average of 472.

In 1948 the most serious epidemic outbreak recorded during the 16 years commenced, 19 600 cases being notified in the five-year period 1948-1952, with an average of 3920 and a median of 3612. The maximum was in 1948, with 7105 cases and the minimum in 1951, with 1218 cases.

This five-year period was followed by three years during which there were only 308 cases, namely 172 in 1953, 136 in 1954, and none in 1955.

On referring to the rates per 100 000 inhabitants rather than the absolute figures as previously, we see that the maximum rate observed was in 1948 and the minimum in 1955, namely zero, as mentioned above.

Fig. 1 Total smallpox cases known during the period 1940-1955

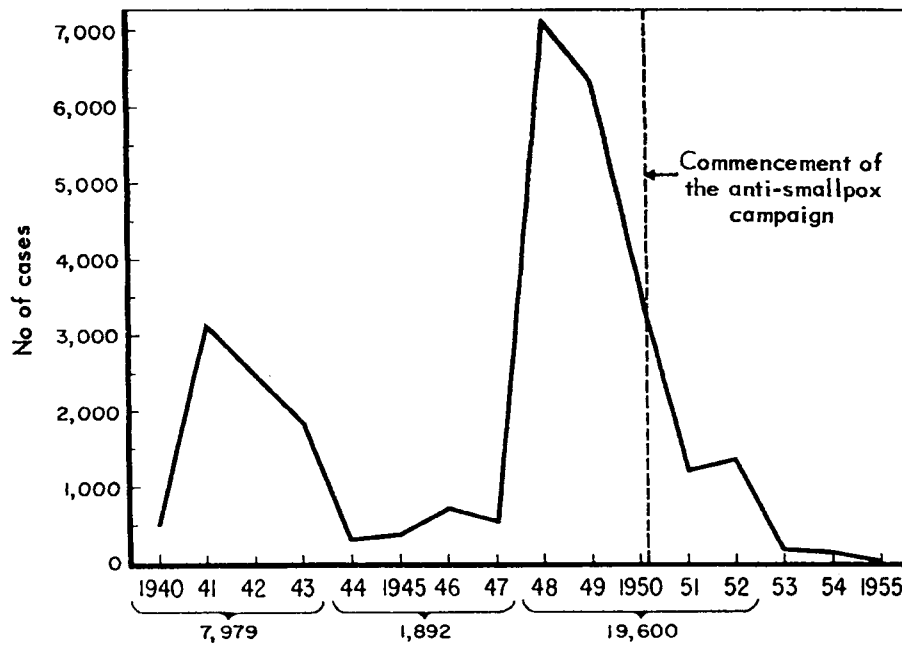


TABLE 1. NO. OF SMALLPOX CASES IN PERU FROM 1940 TO 1955

| Year | No. of cases | Rate per 100 000 inhabitants | Population covered by notification |
|------|--------------|------------------------------------|--|
| 1940 | 466 | 16.3 | 2 850 123 |
| 1941 | 3 143 | 108.5 | 2 896 466 |
| 1942 | 2 514 | 85.4 | 2 943 562 |
| 1943 | 1 856 | 62.0 | 2 991 425 |
| 1944 | 296 | 9.7 | 3 043 159 |
| 1945 | 359 | 11.6 | 3 095 787 |
| 1946 | 700 | 22.2 | 3 152 532 |
| 1947 | 537 | 16.7 | 3 210 317 |
| 1948 | 7 105 | 217.0 | 3 275 833 |
| 1949 | 6 305 | 188.6 | 3 342 686 |
| 1950 | 3 612 | 107.1 | 3 373 290 |
| 1951 | 1 218 | 35.0 | 3 500 833 |
| 1952 | 1 360 | 40.0 | 3 412 977 |
| 1953 | 172 | 4.6 | 3 738 859 |
| 1954 | 136 | 3.4 | 3 977 066 |
| 1955 | 0 | 0 | 4 052 630 |

From Table 1 it can be seen that the maximum rate corresponded in 1948 to 217 per 100 000 inhabitants among that part of the population covered by notification. It can also be clearly seen that the notification system has continued to improve through the years, since in 1940 only 2 800 000 inhabitants were covered, while in 1955 this number had increased to 4 000 000.

It should be taken into account that the Immunization Department investigates all notifications of smallpox cases so that it may be said that the notification area covers almost all the country.

On studying this disease in relation to its extent, it can be seen that the majority of the cases notified are located in two large foci: one in the north, including the Departments of Piura, Cajamarca and Lambayeque, and the other in the south, consisting of Cuzco, Ayacucho, Apurimac and Puno. The existence of these two large smallpox foci is noteworthy, separated as they are by a central area which is less affected, while in the Forest Departments there are very few cases. In this respect there is a possibility that vaccination has been more extensive in the central

Departments, owing to the fact that the mining firms inoculate all their personnel and the members of their families. There is also the possibility of frontier contacts. As regards the Forest Departments, there can be no doubt that the lower incidence is influenced by the low population density.

On referring to the smallpox situation in 1950, when the eradication campaign commenced, we find that during that year 3612 cases were reported, 1247 of which were in Cuzco, and 589 in the Amazonas Department. The map (Fig. 2) indicates the total number of cases per 100 000 inhabitants. Amazonas occupies the first place but, in view of the earthquake which occurred in the city of Cuzco in October 1950 and the consequent overcrowding and displacement of the population, it was decided to start the vaccination programme in that city and other provinces in the Department. It was also considered that the means of communication are better and the population denser than in the Amazonas Department, which made the position more dangerous from the epidemiological viewpoint.

2. The vaccine which should be used

One of the basic points considered before commencing the programme was the type of vaccine which should be used. In 1950, the National Hygiene Institute produced only glycerinated vaccine which, since it required refrigeration, was difficult and costly to employ in rural areas.

The Pan American Sanitary Bureau supplied dried vaccine for an experiment in a predominantly rural area with characteristics found in tropical climates. The Department of Tumbes was selected, since it satisfied these requirements, and the experiment consisted in comparing glycerinated with freeze-dried vaccine, without refrigeration, over a period of 31 days.

Both vaccines came from the same source (State of Michigan Laboratory) and had the same potency when the test was commenced. Each subject was inoculated with both vaccines, one in each arm and the results read four times (in each vaccinated subject) as follows:

Fig. 2 Smallpox morbidity in Peru in 1950, by Department,
Rates per 100 000 inhabitants

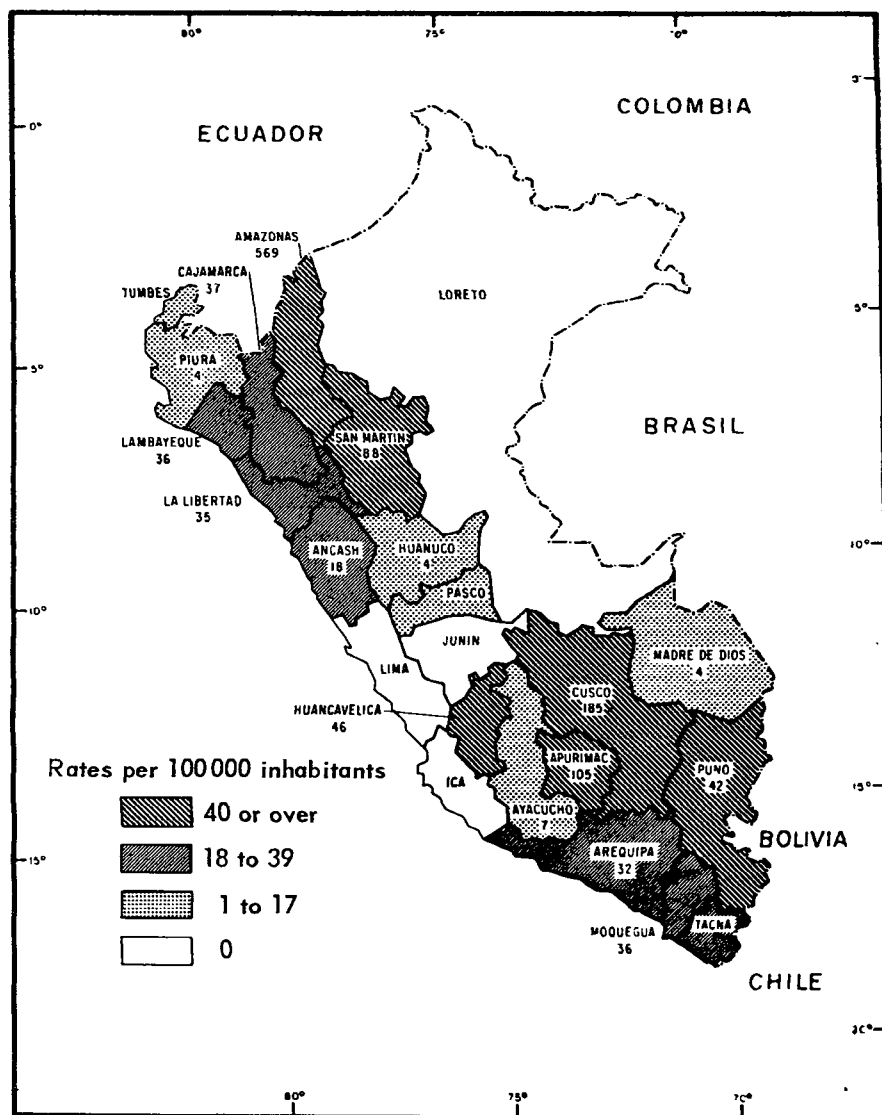
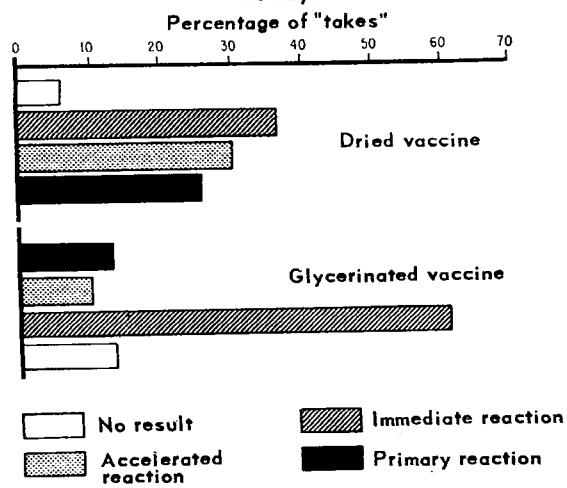


Fig. 3 Summary of results obtained with dried vaccine and glycerinated vaccine without refrigeration during 30 days



| | | | | |
|--------------------------|---|---|---|---|
| 1st reading after 2 days | | | | |
| 2nd | " | " | 4 | " |
| 3rd | " | " | 7 | " |
| 4th | " | " | 9 | " |

Fig. 3 shows that, whereas very good results were obtained with freeze-dried vaccine, those with the glycerinated vaccine were mediocre.

As from October 1953, the freeze-dried vaccine produced by the National Hygiene Institute was used in the field. An average of 90.4 per cent. positivity was obtained in primary vaccinees. The batch which gave the lowest positivity reached 77.4 per cent. and that giving the highest, 97.4 per cent. Some batches were in use for 21 months but nevertheless retained their potency.

We can consider these results as very good for a field project; for work in rural areas preference is given to the use of the freeze-dried vaccine, glycerinated vaccine being reserved for use in towns or centres where it is easy to keep it refrigerated. It is probable that differences noted between vaccine tubes from the same batch are due to capillary cracks in the glass (not visible to the naked eye), so that these differences should be rounded off.

3. Technique and equipment for its application

At the beginning of the campaign, the scarification method was used, but once the personnel had been trained, the multiple pressure method was employed exclusively.

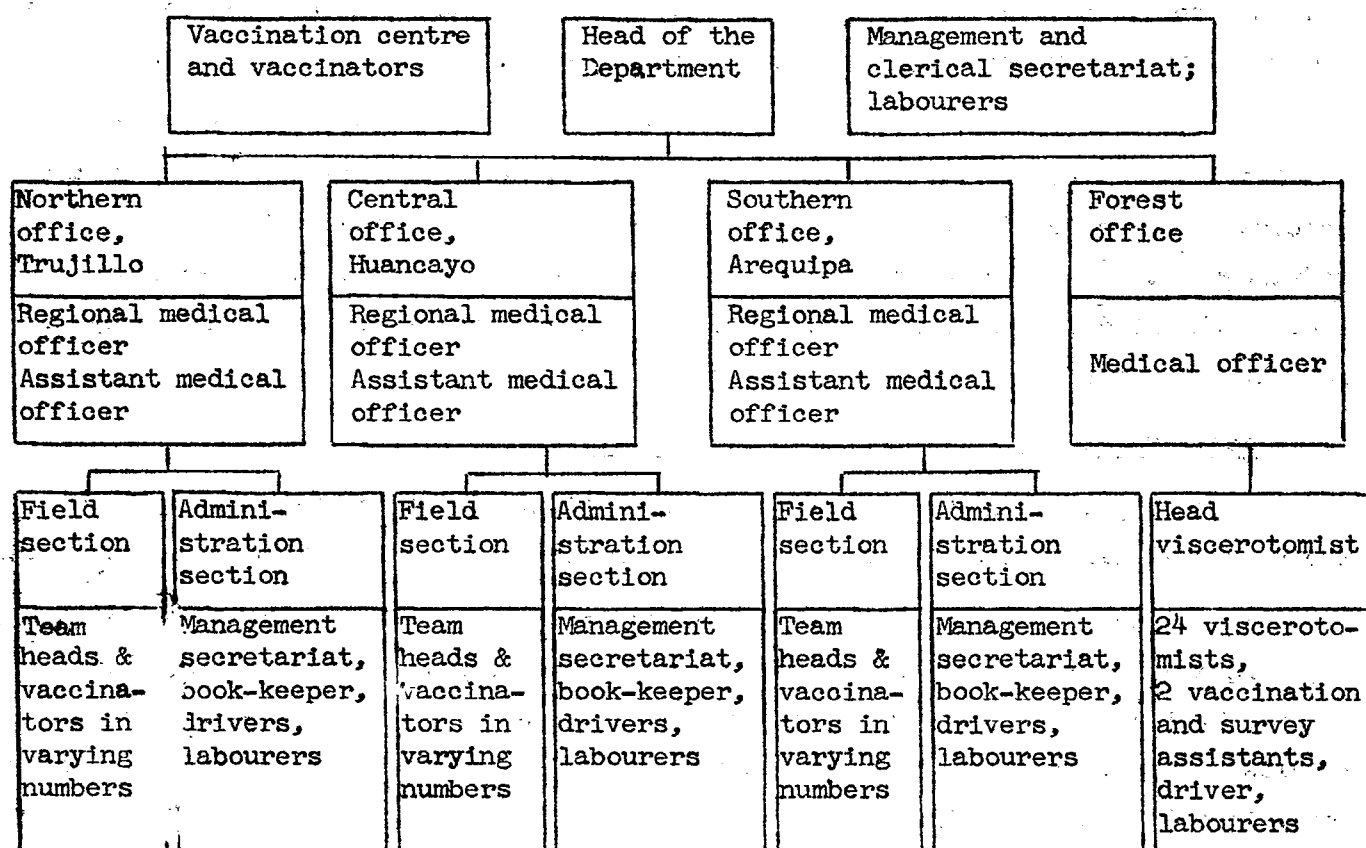
The equipment employed is as follows: (1) a surface for setting out the equipment; (2) two alcohol dropping bottles; (3) dissecting forceps; (4) two metal boxes; (5) two 2-ml syringes; (6) two intramuscular needles; (7) 300 multiple pressure needles; (8) two ampoules of vaccine, with their needles; (9) envelopes with cotton wool, in sufficient quantity.

All breakable objects were duplicated in the equipment, since it is not possible to replace them easily.

Apart from this, each vaccinator carries in a haversack, for his personal use: one tablet of soap, one towel, one nail brush and, for identification and drawing up statistics: one metal plate with the corresponding number, one identity card, one diary, one file for work record cards, forms, vaccination certificates in sufficient number, one small flag, two pencils, one pencil sharpener, three wax pencils, one rubber and one whistle.

Vaccinators have been instructed to keep these objects in a given order so as to avoid errors and loss of time as far as possible.

FIG. 4. ORGANIZATION OF THE IMMUNIZATION DEPARTMENT



Note: The Forest Office will be organized this year, budget permitting.

4. Conditions which medical and auxiliary personnel should satisfy

It has been found that this type of campaign should be supervised by doctors doing this work full time. They should be able to exercise authority and be sufficiently hardy for life in the field, since the regional medical officers spend at least 40 per cent. of their time in the field, while the assistants are there permanently.

The medical personnel is appointed on the proposal of the Chief of the Department.

Initially the vaccinators were selected by the Department for the Selection and Training of Ministry Personnel, and trained by external health bodies (this occurred in the case of the first group of vaccinators). Subsequently, training and selection has been the responsibility of the regional medical officers in charge of field work. Candidates are selected by competitive interview and, after they have undergone rigorous theoretical and practical tests, all those are eliminated who, in the opinion of the instructor, do not satisfy the conditions necessary for carrying out work of such responsibility.

The team chiefs are selected from the vaccinators showing an ability to command, as well as discipline, loyalty and dedication to the work. Before their final appointment they undergo an efficiency test during which they are in charge of a team for a certain time.

As regards office staff, drivers, etc., the regional medical officers are authorized to propose them, their proposals always being accepted. We feel that this is the only way in which the heads of a programme can make the personnel actually in charge in the field carry responsibility for the results obtained.

5. Method of work

In order to execute the programme, the Department was organized as shown in Fig. 4. The Department Chief (Jefatura) lays down the rules of work. These rules are periodically discussed with the regional chief medical officers and in some cases with the assistant medical officers, since this is the best way of carrying out all stages of field work with the knowledge of those who are to direct it. For it should be borne in mind that if the rules are not understood and accepted, the work will be a failure because of lack of interest in a plan in whose drawing up those responsible for its execution have not taken part.

The Department Chief is also responsible for the secretariat and administration. The latter sees to the ordering of vaccines, their distribution to the various centres, storage of equipment and supervision of labourers. There is also a section responsible for packing cotton wool in separate envelopes, and needles for multiple pressure inoculation in capillary tubes.

The immunization centre. This is the direct responsibility of a full-time physician in charge of vaccine testing in human beings, a special form being used for this inspection. It includes the various symptoms which can occur in a vaccinal reaction over the course of time, and in this way it is possible to describe them as primary, accelerated or immediate.

In addition, the personnel are trained in the Centre, and vaccination of an experimental type is carried out, as well as routine immunization and the dispatch of international certificates.

Regional offices. These are situated in strategic points so as to cater for a number of adjoining departments.

At present there are three regions, namely, the north, centre and south.

This year it is intended to establish an office in the forest area which, apart from smallpox vaccination, will carry out other programmes.

There are two medical officers in each region: one regional, responsible for the execution of programmes and the administrative functioning of his district, and an assistant medical officer, engaged exclusively in field campaigns, for which he has at his disposal a varying number of chiefs of teams, vaccinators and labourers.

For vaccination, the unit of work is the district, consisting of a given number of centres of population occupying an area to which a ten-man team can almost always be allocated without any overlapping, and with the possibility of proper supervision. In all cases, work proceeds in a complete district, the different places being visited house by house and the total number of persons sleeping in each house being recorded. This makes it possible to draw up a population census and determine whether the number of vaccinations reaches 80 per cent., regarded as the figure ensuring success in this type of programme.

On commencing work, an itinerary is drawn up; to do this, one of the medical officers and the team chief go to the district a sufficient time in advance in order to make a preliminary study and assign a zone to each vaccinator, so that the latter cannot avoid his responsibility for the said zone.

This also facilitates supervision and makes it possible to see in the course of time whether the itinerary has been correctly drawn up, whether the programmes are being satisfactorily implemented, and, finally, whether all the necessary measures are being taken.

The vaccinator, on finishing his work in a house, affixes a "seen" form inside the door, or in any other place where it is visible, thus showing what work has been carried out in the house.

The work cycle adopted is a rigid one, the odd weeks being devoted to inoculation and the even ones to reading the results and to the re-inoculation and vaccination of those who were not present on the first occasion. The same vaccinator makes both visits, which greatly facilitates matters.

With this rhythm of work, reading takes place every eighth day, so that the results are comparable as between the different regional offices.

Supervision is carried out by medical officers and team chiefs in various ways, since the system described makes it possible to see what has been done even after a certain period has elapsed.

In brief, it is claimed that this system standardizes the procedure rigidly, so that the number of chance factors or improvisations is reduced to a minimum and inspection of the programme facilitated to the utmost extent.

6. Funds necessary for implementing the programme and the regularity with which they are supplied

When the programme was established, the budgets necessary for completing it in a five-year period were drawn up but, owing to a series of unforeseen circumstances, the allocations received were not in proportion to the work which had to be carried out.

7. Statistics and evaluation of the results

The standard record cards used in the programme help in drawing up statistics as accurately as possible, with the aim of assessing the results and the cost per vaccination. From October 1950 to December 1955, 5 138 740 persons were vaccinated against smallpox at an approximate cost of 2.00 soles per vaccination.

Of the total vaccinated, 570 585 were primary vaccines, with a positivity of 84 per cent.

A total of 1 134 906 revaccinations were read, 75 per cent. being positive. This shows the low level of immunity existing in the country, since reading after eight days eliminates immunity or immediate reactions.

The number of departments which have been covered is 16, including 88 provinces and 23 642 inhabited places; allowing five inhabitants per house, it has been necessary to visit more than 1 400 000 houses to carry out the number of vaccinations indicated.

The results have been very good, for since December 1954 not a single case of smallpox has been reported, for the first time since 1932.