

## BCG-VACCINATION PROGRAMME IN PAKISTAN

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### SYNOPSIS

The authors outline the development and organization of the BCG-vaccination campaign that was launched in August 1949 by the Government of Pakistan, with assistance from the International Tuberculosis Campaign. They present some statistical data on the work done up to the end of December 1954 and briefly discuss the pattern of tuberculin sensitivity found in various parts of the country.

### Development of the Programme

In August 1949, a BCG-vaccination training and demonstration project was launched by the Government of Pakistan, with assistance from the International Tuberculosis Campaign (ITC).<sup>a</sup> This project, which was planned originally to last for only one year, gradually developed into a mass vaccination campaign, covering the rural and urban population of the entire country. When the ITC closed down in June 1951, the responsibility for international assistance was taken over jointly by the United Nations Children's Fund and the World Health Organization.

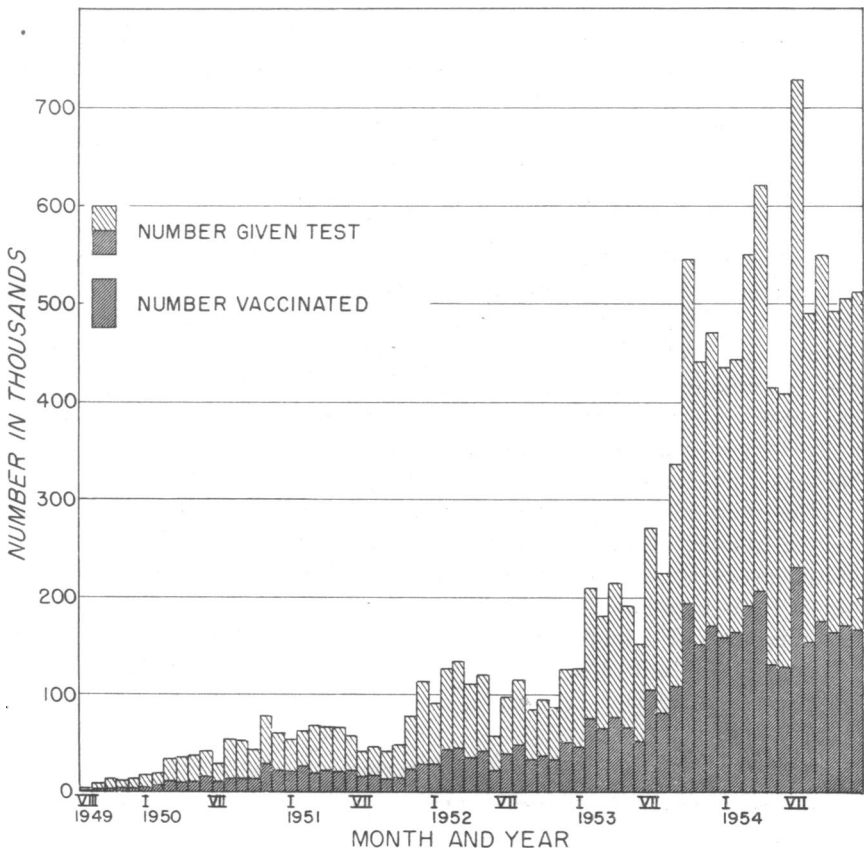
The international team which was placed at the Government's disposal for the training of national staff and for the organization and supervision of the programme varied in strength from one medical officer and two nurses to as many as three medical officers and four nurses. In addition, an international administrative officer was attached to the team from December 1951 until the end of 1954, and a WHO statistician joined the staff in August 1953.

<sup>a</sup> The International Tuberculosis Campaign—a joint enterprise of UNICEF and certain Scandinavian voluntary organizations (the Danish Red Cross, the Swedish Red Cross, and the Norwegian Relief for Europe)—was established in March 1948, primarily with the object of assisting national health authorities in the execution of mass BCG-vaccination campaigns and in introducing BCG vaccination as one of the tools in their long-range tuberculosis-control programmes.

The international team arrived in Pakistan late in July 1949 and began its training and demonstration work in schools in Karachi, the Federal capital. Shortly afterwards, vaccination centres were set up in the city and, later, in refugee camps in the district. In November 1949, some members of the team moved to Dacca, in the Province of East Bengal, and a training and demonstration programme was put into operation there late in the same month. Two provincial teams of vaccinators were trained, and these, from June 1950 onwards, continued the demonstration work on their own, concentrating mainly on the urban areas of the Province.

By the end of 1950, the programme had expanded to include all the provinces of the country. Wide publicity was given to the work, through the radio and the Press, and the interest shown everywhere by the public and by the local health officers was so keen that it became apparent that

**FIG. 1. NUMBER OF PERSONS TUBERCULIN-TESTED AND VACCINATED WITH BCG IN PAKISTAN, BY MONTH, AUGUST 1949 TO DECEMBER 1954**



what had originally been planned as a training and demonstration scheme of limited scope could be developed into a major vaccination campaign, covering rural as well as urban areas. Accordingly, in April 1951, a full-scale rural vaccination campaign was launched in Rawalpindi, Punjab. The success of this pilot project led the Government, in co-operation with the two international organizations, to draw up a plan of operations for the whole country. Under this plan it was proposed to tuberculin-test 20 million children and young adults between 1 and 20 years of age, and to vaccinate the non-reactors with BCG, before the end of 1956.

The new plan of operations was put into effect during 1952 and 1953. By the end of the latter year, there were more than 200 vaccinators in the field and nearly 500 000 persons were being tested and 175 000 vaccinated each month. This level was maintained throughout 1954 (see Fig. 1). Of the 12 million tuberculin tests and 4 million vaccinations carried out from August 1949 to December 1954, half were done in 1954.<sup>a</sup>

### Organization of the Mass Vaccination Campaign

The work of co-ordinating the operations is undertaken by the Government, with assistance from the international team, but the organization of the campaign in each province is the responsibility of the provincial authorities. Usually, the field personnel work in units of four teams, each team having three or four vaccinators and each unit being supervised by one or two medical officers, who report directly to the provincial authority concerned. In some provinces, however, other arrangements have been made to meet local needs. In the Punjab, for instance, the personnel work in a total of ten teams, each comprising one medical officer or sanitary inspector and eight vaccinators; these teams are independent, but work in close co-operation with each other. Each province is covered systematically, district by district, by the teams.

Owing to the shortage of qualified medical personnel of all categories in Pakistan, the vaccinators are recruited from young men who have recently completed their secondary studies. They are trained by instructors on the international team for a period of 6-8 weeks and then work on their own, under the supervision of the medical officer in charge of the unit.

Hardship is an almost permanent feature of mass campaign work in Pakistan. For eight months of the year the temperature lies in the range 90°-120°F (30°-50°C). The roads off the highways are rough and long distances often have to be covered on foot to reach a village. Accommodation in rural districts is scarce and primitive. All these facts must be taken into account when planning the daily programme and when attempting to assess the field performance.

<sup>a</sup> During 1955 a further 4½ million tests and 1½ million vaccinations were carried out.

Before sending out his team of vaccinators, the team-leader visits the various villages in the district, contacting the headman and other influential persons in each and discussing with them ways and means of assembling the local population, as well as consulting them about the site for the vaccination centre. This preliminary planning, although time-consuming, usually pays handsome dividends in terms of goodwill for the campaign. Experience has shown conclusively that lack of planning invariably results in indifferent attendance at the vaccination centres.

On the basis of the information collected during the planning visits, the team-leader draws up the weekly vaccination programme and distributes copies to all the members of his team. The programme gives the names of the villages to be visited, listing under each the approximate population, the dates of the visits, the working hours, the names of the headman and influential persons, the places chosen as vaccination centres, the names of the vaccinators and, lastly, information on road conditions and possible distance to be walked.

The vaccinators visit the villages the week after the team-leader's preliminary survey. At the first visit the tuberculin-testing is carried out, and at the second—three days later—the reactions are read and the non-reactors vaccinated. From their records during the first visit the vaccinators can tell whether or not the attendance is satisfactory, and if it is not they can make an extra effort to win the support of the public.

### Technique of Tuberculin Testing and BCG Vaccination

#### *Tuberculin testing*

In 1949, when the BCG programme was started in Pakistan, very little information was available about the pattern of tuberculin sensitivity in Asiatic populations. The WHO Tuberculosis Research Office, Copenhagen, had a pilot team in India at that time, collecting data on the problem. Meanwhile, it was decided to use the same tuberculin-testing technique in Pakistan as that employed in the European BCG campaigns.

The intradermal Mantoux test was used as a screening test. A dose of 1 tuberculin unit (TU)<sup>a</sup> was given, followed—if the reaction was negative—by 10 TU. The reaction was defined as positive to the given dose if an induration of 6 mm<sup>b</sup> or more in diameter was present at the end of three days. Only persons who reacted negatively to both 1 TU and 10 TU were selected for BCG vaccination.

This cumbersome procedure necessitated making three visits to each group under test, and resulted in a considerable loss of time and a serious

<sup>a</sup> 1 tuberculin unit = 0.00002 mg of reference standard PPD (purified protein derivative) = 0.01 mg of the International Standard of Old Tuberculin.

<sup>b</sup> This limit was lowered to 5 mm, following the recommendation of the WHO Expert Committee on Tuberculosis, in September 1950 (see *Wild Hlth Org. techn. Rep. Ser.* 1951, 32, 10).

decrease in attendance between the first and the third visits. It was therefore a great improvement when a single-dose test—at first with 10 TU and from August 1950 with 5 TU—was introduced in Pakistan, as a result of the studies carried out by the WHO Tuberculosis Research Office.

During the first few months after the start of the project, a Moro patch-test was given to all children under 12 years of age simultaneously with the Mantoux 1 TU test. As the Moro test was found to be considerably less sensitive in Pakistani children than the Mantoux 1 and 10 TU tests and, at the same time, had several practical disadvantages, some of them peculiar to a hot climate, it was abandoned in June 1950. None of the results presented in this report are based on the Moro patch-test.

PPD solutions, ready for use, were sent weekly from the King Institute, Madras, until December 1949, when a tuberculin-dilution laboratory was established at Karachi. This laboratory was supplied with PPD stock solutions from the Statens Seruminstitut, Copenhagen. The following batches of PPD were sent : between January and August 1950, one consignment of batch RT 18 and two consignments of RT 12 b. Since September 1950 all the PPD sent to Pakistan has been from batch RT 22.

### *BCG vaccination*

Persons with a negative tuberculin reaction were given 0.1 ml of BCG vaccine, injected intradermally into the left deltoid region. The vaccine was prepared to contain 0.75 mg,<sup>a</sup> moist weight, of BCG per ml.

The BCG vaccine (as well as the diluted PPD) was kept at a temperature of about 2-4°C from the time it was received from the laboratory until it was actually used in the field. Since May 1952, following the conclusive demonstration of the rapidly deleterious effect of sunlight on the allergenic potency of BCG vaccines,<sup>1</sup> every effort has been made to impress upon the technicians the necessity of protecting the vaccine against exposure to direct and indirect sunlight, both during storage and when handling it in the field.

The project was supplied with vaccine from the King Institute, Madras, during the first months. From late January 1950, BCG vaccine was sent weekly from the Statens Seruminstitut, Copenhagen. A BCG-production laboratory was established at Karachi with assistance from the ITC and production was started in the autumn of 1951. This laboratory was approved by the WHO Expert Committee on Biological Standardization in November 1952. The first batch of Pakistani vaccine to be used in the campaign was lot no. 71, produced in February 1953. Since then, Pakistani vaccine has been used exclusively in the campaign.

<sup>a</sup> The Indian BCG vaccine supplied to the project from August 1949 till January 1950 contained 0.50 mg, moist weight, of BCG per ml.

### Procedures for Recording and Reporting Statistical Data

The experience gained during the course of the campaign has been gradually utilized to introduce increasingly simplified—but still effective—procedures for the collection of statistical data.

During the earlier part of the campaign a standard individual card was filled in for each person tested, giving identification data, size of tuberculin reaction, date of BCG vaccination, etc.; from these cards tabulations could be made of test and vaccination results according to district, sex, age, etc. In the spring of 1951 the system was modified; the filling-in of individual cards was postponed until the time of reading the tests, and identification data were limited to sex and age. To ensure that the tests were read after the specified interval of 3-4 days, a coloured mark, varying in shape with the day of the week, was made on the arm when the test was given. For further details of this recording system, the reader is referred to the instructions issued by the ITC.<sup>2</sup>

An even more simplified system was gradually introduced in the different provinces between April 1952 and March 1953. This is the system still in use, on which over 80% of the statistical material for the period 1949-54 is based; it will therefore be described in more detail. The procedures differ for *selected* groups, where each individual can be fully identified by name, sex, age and place of residence and can be found months or even years later (schoolchildren, factory workers, etc.), and *general* groups, where this is not possible (people examined in public centres). Only groups of more than 200 persons are considered selected groups.

For the general groups the use of individual cards has been abolished and a group card has been introduced instead. At the first visit each test given is recorded on the front of the card by a stroke in the box for the appropriate age-group (0-6, 7-14, 15-19, and 20 years or more); separate cards are used for males and females. At the second visit the number of participants found to be positive, the number vaccinated and the number of negatives not vaccinated are recorded by strokes on the back of the same card. As before, each person tested is marked on the forearm to ensure that the test is read after the appropriate interval of 3-4 days (and read only once).

For the selected groups more detailed data are collected so that information can be obtained on the pattern of naturally acquired tuberculin sensitivity and, later, on that of post-vaccination allergy. In these groups an individual card is therefore filled in for each person tested. Detailed identification data are entered on the cards in advance by the group leader (e.g., the teacher), who at each visit of the team distributes the cards to the participants. There is thus no need for coloured markings in the selected groups. The results of the tuberculin tests are recorded by giving the size

of the indurations and not, as for the general groups, simply by classification into positives and negatives. On the back of the cards space is provided for data on re-testing, vaccination lesions and re-vaccination. For statistical purposes a group card is also prepared for the selected groups, on the basis of the individual cards.

The group cards serve as daily work records. They are forwarded each week to the BCG Statistical Office in Karachi, where monthly statistical reports are prepared. The reports show the number of tests made and the number of positives, the number of negatives vaccinated and the number of negatives not vaccinated, according to administrative division. Statistics by age-group and sex are prepared annually. The individual cards are also sent to Karachi, where they are filed for use later in follow-up work.

### Population Tested and Vaccinated

Of the total population of 76 million (1951 census), 12 million were given a tuberculin test between August 1949 and December 1954. Of these, however, only 9 million returned for the reading of the test; thus, one-fourth of the tests were made in vain. Four million, or slightly less than half of the persons completing the test, were found to be tuberculin-negative and almost all of these (99%) were vaccinated.

The percentage of tuberculin-tested persons who returned to have the test read varied in the different parts of Pakistan (see Table I).<sup>a</sup> In the Karachi area, the Punjab and Bahawalpur State as few as 67%, 68% and 57%, respectively, completed the test, while in the other areas the proportion ranged from 80% to 88%.

The 9 million persons who completed the tuberculin test constitute 12% of the total population of Pakistan. The figures for the percentage of the population completing the test were found to vary, however, with sex and age (see Table II). For example, while 13% of all males and 10% of all females completed the test, the corresponding figures for the males and females under 20 years of age were 16% and 12%, respectively. Also, although the campaign was specially aimed at children and young adults, a sizeable proportion (8% for females and 9% for males) of the people over 20 years old attended for testing and for reading of the result.

It should be remembered that the campaign in Pakistan was not completed by the end of 1954, when "only" 12 million tests had been given. The target is 20 million tests by the end of 1956. It can therefore be expected that the figures for the coverage of the population will have almost doubled by that time.

<sup>a</sup> In addition to the three tables included in this paper, a set of tables giving the corresponding data for each district has been prepared; these detailed tables have been deposited in the WHO Library and photostat copies of them may be obtained on request.

**TABLE I. NUMBER OF PERSONS TUBERCULIN-TESTED AND VACCINATED WITH BCG IN DIFFERENT PROVINCES AND STATES OF PAKISTAN, 1949-54**

Province or State	Number of persons (in thousands)					Percentage completing test <sup>a</sup>	Coverage of age-group 0-19 years <sup>b</sup> (%)	
	in the general population	with test given	with test read		vaccinated		males	females
			total	negative				
Baluchistan Districts	622	240	211	128	127	88	52	52
Baluchistan States Union	552	0	0	0	0	—	0	0
East Bengal	42 063	2 297	1 896	800	767	83	7	4
Federal Capital Area (Karachi)	1 126	299	200	62	65 <sup>c</sup>	67	24	19
North-West Frontier Province	3 253	1 559	1 245	635	634	80	50	38
Frontier Regions	2 647	8	7	3	3	— <sup>d</sup>	0.4	0.3
Punjab	18 828	6 109	4 138	1 950	1 937	68	27	22
Bahawalpur State	1 823	463	265	164	162	57	16	14
Sind	4 608	716	599	237	234	84	18	13
Khairpur State	320	60	48	31	31	80	28	18
Azad Kashmir	—	328	283	168	167	86	—	—
Total	75 842 <sup>e</sup>	12 079	8 892	4 178	4 127	74	16 <sup>e</sup>	12 <sup>e</sup>

<sup>a</sup> Number of persons with test read as percentage of number of persons with test given

<sup>b</sup> Number of persons with test read as percentage of general population (1951 census) within the same age-group; the distribution by age and sex of the persons tested has been estimated on the basis of data for 90% of the material.

<sup>c</sup> Including 6000 newborn babies who were vaccinated without previous testing

<sup>d</sup> Percentage not given because of the insufficient number of observations

<sup>e</sup> Excluding Azad Kashmir, for which no general population figure is available



**TABLE II. NUMBER OF PERSONS (IN THOUSANDS) TUBERCULIN-TESTED AND VACCINATED WITH BCG IN PAKISTAN, 1949-54, BY SEX AND AGE**

Category	Sex	Age-group (years)				All ages
		0-6	7-14	15-19	20 and over	
General population <sup>a</sup>	M	7 662	9 209	4 211	19 127	40 209
	F	7 440	8 017	4 159	16 017	35 633
Persons with test read <sup>b</sup>	M	1 023	1 623	785	1 804	5 235
	F	805	955	592	1 305	3 657
Persons vaccinated <sup>b</sup>	M	748	928	297	386	2 359
	F	587	549	256	375	1 767
Coverage (%) <sup>c</sup>	M	13	17	18	9	13
	F	10	12	14	8	10

<sup>a</sup> Excluding Azad Kashmir. Figures for age-groups 0-6 and 7-14 years have been estimated on the basis of figures for the groups 0-4, 5-9 and 10-14 years

<sup>b</sup> Age and sex distribution has been estimated on the basis of data for 90% of the material

<sup>c</sup> Number of persons with test read (excluding Azad Kashmir) as percentage of general population

As Table I shows, the coverage attained by the end of 1954 varied markedly in the different parts of Pakistan. Of the population under 20 years of age, about half had been tested (and read) in the North-West Frontier Province (NWFP) and in the Baluchistan Districts; 15%-25% had been reached in Punjab and Sind Provinces, in Bahawalpur and Khairpur States and in Karachi; and 6% had been tested in East Bengal. Little or no work had been carried out in the Baluchistan States Union and the Frontier Regions. The coverage is in most areas somewhat lower for females than for males, the difference being particularly noticeable in East Bengal, Sind and Khaipur, where the coverage for females is only about two-thirds of that for males.

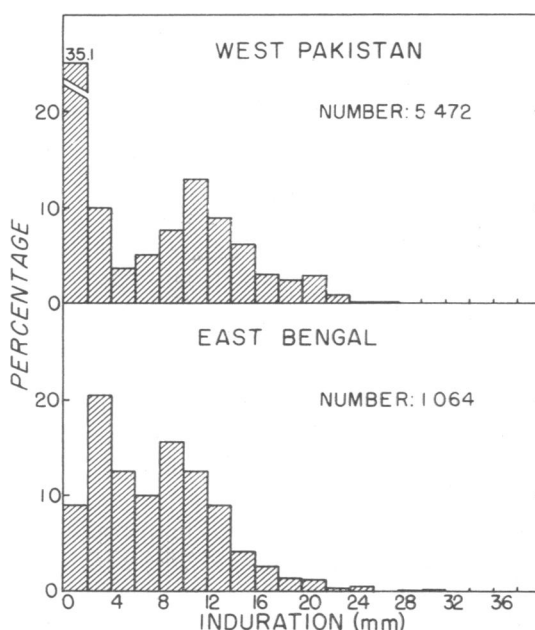
The age distribution of the persons who completed the test (see Table II) shows that 21% were under 7 years of age, 29% were 7-14 years old, 15% were 15-19 years old, and 35% were 20 years or over. The corresponding figures for the vaccinated are 32%, 36%, 13% and 19%. The vaccinated population is thus, on the average, younger than the tested population. This is because a relatively large proportion of the older persons were positive reactors to the tuberculin test and were therefore not eligible for vaccination; at ages under 20 years 60 out of every 100 tested are eligible for vaccination, whereas the corresponding proportion for those of 20 years or over is only 25%.

### Distribution by Size of Tuberculin Reactions

Tuberculin testing in the mass campaigns serves primarily the purpose of selecting persons for vaccination. The test results may, however, also be used for obtaining an estimate of the prevalence of tuberculous infection

in the community. For both purposes it is essential that the population be separated into two groups: the infected and the non-infected. How well this separation is achieved with the intradermal tuberculin test used in the campaign may be gauged by studying the frequency distribution of the tuberculin reactions according to size. Fig. 2 gives examples of such distributions, based on the results of intradermal testing with 5 TU of schoolchildren in different parts of West Pakistan and East Bengal.

**FIG. 2. DISTRIBUTION, BY SIZE, OF REACTIONS TO INTRADERMAL 5 TU TEST AMONG UNVACCINATED SCHOOLCHILDREN IN WEST PAKISTAN AND IN EAST BENGAL**



The distribution for West Pakistan shows a characteristic bimodal form, with the small or zero reactions of the presumably non-infected persons forming a group to the left on the scale and the larger reactions of the presumably infected forming a group to the right. The two groups are not completely separated and it is impossible to determine whether a person with a 4-mm or a 5-mm reaction belongs to the infected or the non-infected group. Persons with such doubtful reactions constitute, however, only 4% of the whole distribution; for the remaining 96% the classification into infected and non-infected individuals seems to be quite reliable. In the early days of the campaign, persons with reactions of 6 mm or more were considered positive (infected) but during the major part of the campaign

the borderline has been drawn at 5 mm. Both criteria, it is seen, give a good separation of the two groups in the distribution for West Pakistan and the change from 6 mm to 5 mm affects only a small percentage of the persons tested.

The distribution for East Bengal differs markedly from that for West Pakistan. The left-hand group of reactions is shifted to the right and tends to merge with the right-hand group, medium-sized reactions being much more frequent in East Bengal than in West Pakistan. This is interpreted as indicating that two different kinds of sensitivity to tuberculin are present in East Bengal: as in West Pakistan, a high-grade sensitivity due to tuberculous infection, and in addition a low-grade, non-specific sensitivity appearing as small to medium-sized reactions to the 5 TU test. Evidence of non-specific tuberculin sensitivity has been found in many countries throughout the world;<sup>3</sup> the presence of non-specific sensitivity seriously limits the usefulness of the tuberculin test, as it is impossible to distinguish the largest non-specific from the smallest specific reactions. While in West Pakistan it is doubtful whether persons with reactions of 4-5 mm to the 5 TU test belong to the uninfected or the infected group, in East Bengal the same doubt arises for persons with reactions from 4 mm to about 10 mm, that is, for about 40% of all persons tested.

The following conclusions can be drawn from the distributions in Fig. 2:

(a) In West Pakistan testing with 5 TU provides a fairly efficient separation of infected and non-infected individuals, and thus practically all non-infected persons are vaccinated and the percentage of positive reactors can be used as a fairly accurate measure of the prevalence of tuberculous infection.

(b) In East Bengal the tuberculin test gives a much less satisfactory separation; owing to the occurrence of non-specific sensitivity many non-infected persons are classified as positive. As a result, far from all non-infected persons are vaccinated and the percentage of positives gives an exaggerated measure of the frequency of tuberculous infection.

While the Mantoux 5 TU test has been used for the major part of the campaign in Pakistan, there was a period at the beginning when 10 TU was used as a final dose. A comparison made in Denmark<sup>4</sup> shows little difference between the results obtained with the two tests. This probably applies also to West Pakistan; in East Bengal, on the other hand, the difference in reaction size between persons with specific sensitivity and those with non-specific sensitivity is presumably even smaller for the 10 TU test than for the 5 TU test.

### Tuberculin Sensitivity

The prevalence of tuberculous infection in the different parts of West Pakistan will now be discussed on the basis of the percentages of positive reactors among persons completing the tuberculin test; East Bengal is not included in the analysis because of the presence of non-specific tuberculin sensitivity in this area. Before the percentages were calculated certain data were excluded from the material. When a locality was visited several times, the data for all visits except the first have been excluded, so as to avoid the inclusion of re-test results. For the same reason data from tuberculosis dispensaries or permanent BCG centres have not been included. But even after this screening of the material, the results must be regarded with some reservation. The persons completing the tuberculin test may not be fully representative of all those tested (or of the whole population). The reason why people do not return for the reading of the test may be that they interpret their own reactions as positive and do not take the trouble to return to have the result confirmed by the team. If this hypothesis is correct, those completing the test include relatively few positive reactors. As mentioned earlier, a particularly large proportion failed to return for the reading in the Karachi area, the Punjab and Bahawalpur State.

Percentages of positive reactors have been calculated for males and females in the age-groups 7-14 and 15-19 years in the provincial capitals, other urban areas (population 20 000 or more) and rural areas of the districts visited during the campaign; in a few cases percentages have not been calculated because the number of persons tested was too small. The age-groups 0-6 years and 20 years and over have not been included in the analysis as the age distribution of the tested individuals within these groups often varies from district to district, and the percentages are thus not comparable.

The results have been summarized by Province or State in Table III. To indicate the magnitude of the material on which the percentages are based, the total number of persons whose test was read has been given for each area. The sensitivity level was highest in the capitals (48% and 65% for the age-groups 7-14 and 15-19 years, respectively, both sexes taken together), a little lower in the other urban areas (45% and 62%) and lowest in the rural areas (41% and 56%). Young adult males (15-19 years old) usually showed slightly higher percentages than young adult females. Among children (7-14 years old) boys showed higher percentages than girls in the capitals, little difference was found in other urban areas, and in the rural areas girls often had higher percentages than boys. That in Khairpur the percentages in both age-groups were considerably lower for females than for males may be due to the low attendance-rate for females in this area; those who did attend may have been a selected group with

**TABLE III. PERCENTAGES OF TUBERCULIN-POSITIVES AT AGES 7-14 AND 15-19 YEARS, BY SEX, IN URBAN AND RURAL AREAS IN DIFFERENT PROVINCES AND STATES OF WEST PAKISTAN**

Province or State	Provincial capitals						Other urban areas <sup>a</sup>						Rural areas					
	persons with test read <sup>b</sup>			positives (%)			persons with test read <sup>b</sup>			positives (%)			persons with test read <sup>b</sup>			positives (%)		
	7-14		15-19		M	F	7-14		15-19		M	F	7-14		15-19			
Baluchistan Districts	39	30	55	51			—	—	—	—			—	—	—	—	33	33
Federal Capital Area (Karachi)	107	53	48	72	65	—	—	—	—	—	—	—	—	—	—	—		
North-West Frontier Province	32	56	46	67	64	99	43	43	59	61	—	—	39	41	57	58		
Frontier Regions	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
Punjab	79	51	48	68	64	522	46	45	63	60	3 458	40	42	59	55			
Bahawalpur State	15	41	42	60	58	7	40	39	55	54	243	26	28	41	37			
Sind	29	62	52	66	79	23	43	40	70	63	547	53	52	67	61			
Khairpur State	4	—	—	—	—	—	—	—	—	—	44	35	27	46	36			
Azad Kashmir	—	—	—	—	—	—	—	—	—	—	283	34	36	44	44			
Total . . . . .	325	50	45	66	63	651	45	44	63	60	5 848	40	42	57	54			

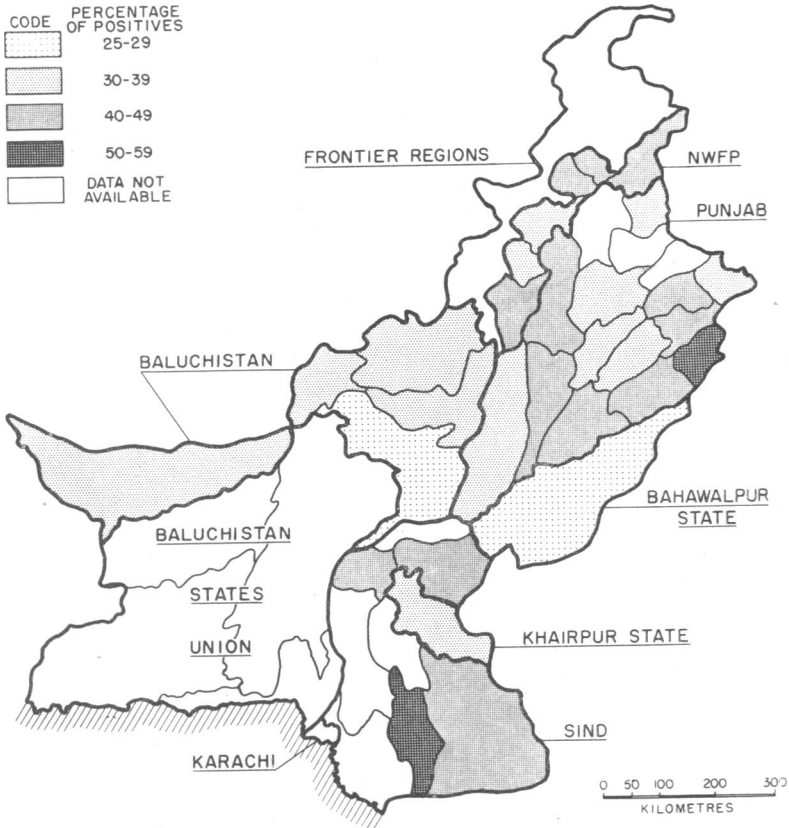
<sup>a</sup> With more than 20 000 inhabitants

<sup>b</sup> All ages, both sexes (in thousands)

<sup>c</sup> Percentage not given because of the insufficient number of observations

a specially low proportion of positive reactors. A similar selection, possibly in connexion with a low attendance, may have been the cause of the lower percentages for girls aged 7-14 years in the capitals.

**FIG. 3. GEOGRAPHICAL DISTRIBUTION OF TUBERCULIN SENSITIVITY AT AGES 7-14 YEARS IN WEST PAKISTAN (RURAL AREAS ONLY)**



The geographical variations in the sensitivity level are best studied on the basis of the data for the rural areas. The percentage of positive reactors in each district visited during the campaign (age-group 7-14 years, both sexes) is shown on the map in Fig. 3, classified in the broad groups 25-29%, 30-39%, 40-49% and 50-59%. The levels were relatively low in Bahawalpur and Khairpur States and in Baluchistan Province, averaging 29% for the

age-group 7-14 years and 41 % for the age-group 15-19 years. The corresponding rates for the NWFP and the Punjab were 41 % and 57 %, and for Sind 53 % and 64 %.

## RÉSUMÉ

En 1949, le Gouvernement du Pakistan, avec l'assistance de la Campagne internationale contre la Tuberculose, entreprenait l'exécution d'un programme de formation professionnelle et de démonstrations, afin d'initier des médecins et des infirmières du pays à la vaccination par le BCG. Ce projet, qui devait durer un an, s'est transformé en une campagne de vaccination s'étendant à tout le pays, avec l'aide de l'OMS et du FISE. D'août 1949 à décembre 1954, 12 millions de personnes ont été soumises au test tuberculinique et 4 millions vaccinées — dont la moitié en 1954.

L'administration centrale, aidée de l'équipe internationale, coordonnait les opérations, organisées à l'échelon provincial et exécutées par des équipes de 3-8 vaccinateurs qui parcouraient le pays. Lorsque le programme fut mis en œuvre, on ne connaissait presque rien de la sensibilité à la tuberculine des populations de l'Asie. On adopta la même technique que pour la vaccination en Europe, et depuis 1950, l'injection intradermique de 5 UT. Seules les personnes ayant réagi négativement étaient vaccinées au BCG. Le Moro patch-test, appliqué aux enfants, n'ayant pas été satisfaisant, a été abandonné dès juin 1950. Les solutions de PPD venant du Statens Seruminstitut de Copenhague étaient diluées dans le laboratoire établi depuis 1949 à Karachi pour la production du BCG. Le vaccin lui-même contenait 0,75 mg (poids humide) de BCG par ml et était injecté à raison de 0,1 ml.

Sur les 76 millions d'habitants recensés en 1951 au Pakistan, 12 millions ont été soumis au test tuberculinique d'août 1949 à décembre 1954. Toutefois, 9 millions d'entre eux seulement se sont présentés à la lecture. Quatre millions ont été reconnus négatifs et vaccinés dans la proportion de 99 %.

La dimension de l'induration tuberculinique permet-elle de se faire une idée de la fréquence de la tuberculose dans une collectivité en distinguant les sujets infectés des sujets indemnes ? Il est impossible de dire en toute certitude si une personne présentant une réaction de 4 ou de 5 mm appartient à l'un ou à l'autre groupe. Au Pakistan occidental, on a constaté cependant que ces réactions « douteuses » ne représentaient que 4 % du total. Dans le Bengale oriental en revanche, les réactions moyennes sont beaucoup plus fréquentes qu'au Pakistan occidental, et la répartition des réactions d'après leur diamètre semble indiquer la présence de deux sortes de sensibilité à la tuberculine: une sensibilité forte due à l'infection tuberculeuse et une sensibilité faible, non spécifique. La présence de cette dernière, observée également dans d'autres régions du monde, semble limiter sérieusement l'emploi du test tuberculinique. Au Bengale oriental, ce sont les personnes présentant des indurations de 4-10 mm après administration d'une dose de 5 UT qu'il est difficile de classer, c'est-à-dire 40 % de la population testée.

Après élimination de nombreuses sources d'erreur provenant de la sensibilité non spécifique, des groupes d'âge de 0-6 ans et de 20 ans ou plus, de composition très variable selon les districts, du nombre partiellement conjectural de personnes positives — probablement fortement inférieur à la réalité — l'analyse des résultats indique que les sujets allergiques à la tuberculine appartenant respectivement aux groupes d'âge de 7-14 ans et de 15-19 ans se répartissent comme suit: 48 % et 65 % dans les capitales des provinces; 45 % et 62 % dans les zones urbaines; 41 % et 56 % dans les régions rurales. L'allergie est généralement plus fréquente chez les jeunes gens de 15-19 ans que chez les jeunes filles du même âge.

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