



INTER-REGIONAL SEMINAR ON SURVEILLANCE  
AND ASSESSMENT IN SMALLPOX ERADICATION

New Delhi, 30 November - 5 December 1970

SCAR SURVEY IN SMALLPOX ERADICATION PROGRAMME  
OF WEST PAKISTAN

by

M. B. Khawaja, MBBS<sup>1</sup>  
and  
F. Adibzadeh, MD<sup>2</sup>



1.0 Introduction

The WHO-assisted Smallpox Eradication Programme was started in West Pakistan in the last quarter of 1968. The preparatory phase was completed in June 1969 and the attack phase was begun in Lahore and Multan Regions (Project Area) consisting of 16 districts, with a population of 27 million. It was completed in May 1970. These areas have now, by and large, entered the maintenance phase.

The Programme essentially consists of three major components - mass vaccination, assessment, and surveillance. As assessment activities serve to guide the vaccination programme activities, periodic assessment of vaccination status should be undertaken as a regular part of the programme. First, this serves as a valuable stimulus to more effective work by the vaccination teams. Second, examination of vaccination scars and pock marks provides data with respect to vaccination and disease activity in the recent past.

2.0 Planning and development of assessment activities

Before the Programme started, assessment activities were carried out in a primitive manner by the vaccinators themselves with very occasional spot-checks by the supervisory

---

<sup>1</sup> Provincial Smallpox Eradication Officer, Punjab, Pakistan

<sup>2</sup> WHO Senior Advisor, Smallpox Eradication Programme, West Pakistan

staff. Clearly, a regular and independent assessment system was needed.

A medical officer, designated as Assistant Provincial Smallpox Eradication Officer (assessment) was assigned responsibility for these activities at the provincial level. In the field, it was considered desirable to have one assessor for each team. Because of financial limitations, however, this number was reduced to 80 assessors for the attack phase area at the rate of 5 assessors per district. Finally, due to a paucity of funds, only 34 assessors were provided. Two were attached to the Provincial Headquarters under the supervision of the medical officer and two were posted to each of the sixteen districts of the project area. The district assessors worked under direct supervisory control of District Smallpox Eradication Officers and were independent of the vaccination teams to assure unbiased and independent results. All assessors carried out assessment one week after the vaccination teams had been in the area. This programme was continued until the middle of February 1970.

Due to financial and operational difficulties, the programme of concurrent assessment did not run satisfactorily. It was discontinued and replaced by a scar survey programme which could be conducted easily with the same staff, with much better coverage. This programme was carried out from early March 1970 to the end of May, when the attack phase in the project area was completed.

The work of the assessors was actively supervised by the District Smallpox Eradication Officers and by the Assistant Provincial Smallpox Eradication Officer. Spot-checks were also made by the Provincial Smallpox Eradication Officer and WHO Senior Adviser.

This paper is based on the study of scar surveys carried out from March to May 1970. For comparison, a pre-operation scar survey in Bahawalpur Division of the Punjab was conducted as this area is similar in all respects to the project area. A terminal scar survey was also carried out in six selected districts of the project area in order to assess the post-operation immunity level of the population.

### 3.0 Discussion and findings

#### 3.1 Scar survey following mass vaccination

Table 1 shows the details of the areas surveyed in Lahore and Multan Regions. Mass vaccination was in progress when the survey was started. The survey was carried out during the months of March, April and May 1970, in those areas where mass vaccination had been completed a few weeks to a few months before. It could not be continued because of the disintegration of the Province of West Pakistan, reorganization of the Programme, and a shortage of funds. The duration of work in the sixteen districts varied from 11 to 88 days. Similarly, the number of surveyed villages/localities and the proportion of the population examined varied from district to district. The proportion of the population examined ranges from 12% to 75%.

Surveys were carried out in 546 villages, and in parts of 71 union councils, four municipal and two town committees. The estimated population of the surveyed areas was 1 330 000, i.e. about 5% of the total population of the two regions. The population examined was 313 000, or 24% of the population sample. Thus, although the population in the survey area was small, the proportion examined was high.

Table 2 gives the results of the above survey indicating the percentage of those with and without a scar of vaccination and those with pock marks in all ages. It shows that only 3.7% of all persons were unprotected and only 1.6% had pock marks. The percentage of unprotected persons differs from district to district, with the lowest in Campbellpur (0.3%) and the highest in Lyallpur (13%). The proportion of persons with pock marks ranged from 0.8% in Sialkot to 5.3% in Mianwali. Vaccination scars were present in 90% in all Districts except Lyallpur.

Coverage was universally high in the age group of 15 years and over; among those 1-14 years, it was reasonably high in most areas; but among those under one year of age, coverage varied widely. For brevity, the tables by age and locality are not appended.

### 3.2 Pre-operation scar survey

Table 3 shows the details of the selected areas of Bahawalpur Division where pre-operation scar surveys were conducted to find out the immunity level before mass vaccination. A village from each union council of one tehsil of each district was selected at random. In all, 63 villages were selected but the survey could only be carried out in 57 villages with a total population of 52 305. A total of 15 811 persons (30.2%) was examined. Of those sampled, 9% were under one year, 16% between 1 and 4 years, 27% from 5 to 14 years and the remaining 49% were adults. The population examined was 2.7% of the total population of the three tehsils.

Table 4 shows the results of this pre-operation scar survey. Only 10.5% of the population as a whole was unprotected. By age group, however, it is seen that 48.3% of those under one were unprotected; 21% of those 1-4 years; 7.6% of those 5-14 years, and 2.1% of adults. Children under one year, almost half of whom are unprotected, constitute the most vulnerable group, while children 1-4 years of age are next. Clearly, the overall percentage of unprotected persons does not give a correct idea about the immunity status of any society.

### 3.3 Terminal assessment through scar survey

Table 5 shows the details of populations in 18 villages of six districts where terminal scar surveys were carried out, 5 to 16 months after the completion of mass vaccination. Three districts with high vaccination coverage and three with low coverage were selected. Three tehsils from each district were then picked up and, finally, one village from each tehsil was selected at random.

The sample was small compared to the vast areas vaccinated but it was desired to get some idea about the immunity level in the population for comparison purposes. The survey was conducted from the last week of September to the first week of October 1970. In all, 18 villages with a total population of 13 893 were selected and 7 717 persons (55.6%) were examined.

Table 6 shows the result of the terminal scar survey in the above areas. Overall, 89% had vaccination scars; 3% had pock marks and 8% were still unprotected. However, 37% of those 0-1 year were unprotected; 19% of those 1-4 years; 3% of those 5-14 years, and only 0.4% of adults.

This high percentage of non-protection among children was due to several factors:

1. The entire vaccination staff in all the districts of the project area were engaged in mass vaccination and none were left for routine vaccination in the covered area.

2. No regular "maintenance programme" was carried out in the vaccinated areas.

3. The sample for the terminal scar survey included three districts with low coverage where the attack phase of the programme was not completed.

Table 7 shows the change in the immunity level of the population in the above six districts by intervals of time after the mass vaccination programme. The percentage of unprotected persons in the age group 0-14 years rises with the increase in the interval between mass vaccination and the survey. Among those less than one year, the rise is from 28% to 51% after an interval of ten months. This is due mainly to new births. The age group of 1-4 years shows a similar but less marked rise. This can be ascribed to the crossing over of unprotected children from the lower age group to this group. The insignificant rise in the age group 5-14 years may be due to immigrants.

#### 4.0 Difficulties and problems

1. At a number of places, people refused to cooperate in the survey because they thought that it was in no way beneficial to them. Unless the masses fully understand the usefulness of such public welfare programmes, no substantial cooperation can be expected from them.

2. The high rate of absenteeism at the time of the survey was another problem faced by the field workers.

Because of these difficulties, the workers could not examine more than one-third of the sampled population.

3. Differentiation between a smallpox vaccination scar, and a scar of BCG vaccination, a boil or an ulcer, etc., was sometimes difficult.

4. Another technical difficulty experienced by the workers was the differentiation of pock marks on the face from those of chickenpox, acne, etc.

Proper orientation of the workers, coupled with field experience, enabled them to overcome the preceding two difficulties to a great extent.

#### 5.0 Role of scar survey in the management of the programme

In the pre-operation phase, the scar survey provides data regarding the vaccination status and the activity of the disease in the population in recent years. During the operation phase, it depicts the extent and effectiveness of mass vaccination as well as the prevalence of the disease. In the post-operation phase it is a practicable method for assessing the level of immunity and in guiding the maintenance vaccination programme.

The scar survey was utilized in the management of the eradication programme in West Pakistan as follows:-

1. The pre-operation scar survey was utilized for planning the programme in the areas under attack phase during the current year.
2. The post-operation scar survey is being utilized for repetition of vaccination in unsuccessfully covered areas.
3. The post-operation survey is also being used for "mopping up" operations in places which were detected to have been left during mass vaccination.
4. The terminal scar survey has indicated that efforts should be concentrated on the vaccination of children under 5 years, particularly on those under one year, during the maintenance phase.

In some of the studies, it was observed that nearly 15% of smallpox cases had a vaccination scar. Thus, the importance of revaccination should not be ignored.

#### 6.0 Summary and conclusions

1. The attack phase of the WHO-assisted Smallpox Eradication Programme was started in Lahore and Multan Regions in June 1969 and was completed in May 1970. Concurrent assessment was carried out regularly up to the middle of February 1970, when it was replaced by scar surveys for various reasons.
2. The scar survey was carried out on three different occasions: pre-operation survey in Bahawalpur Division, post-mass vaccination survey in the project area, and terminal survey in the selected districts of the covered area.
3. These surveys showed:
  - (a) In the pre-operation areas, 11% of the people had no scar of vaccination, 87% had a scar of previous vaccination, while 2% had pock marks. Among those less than 1 year, 50% were unprotected.
  - (b) After mass vaccination, the number of unprotected persons declined to 37% among those less than one year of age and to 8% for all ages.
  - (c) With the passage of time, the percentage of unprotected persons rose again. This rise was very significant in the age group of 0-1 year, because of new births. Some increase was also observed in the age group 1-4 years.
4. The overall immunity level measured in these surveys was as follows:

	<u>O</u>	<u>X</u>	<u>P</u>
Pre-operation area	10.5	87.5	2.0
Project area, following mass vaccination	3.7	94.7	1.6
Terminal survey in the project area	7.8	89.0	3.2
5. Assessment activities are an essential component of Smallpox Eradication Programmes and scar surveys are an effective tool in the management of the programme in all its phases.

TABLE 1. SCAR SURVEY IN PROJECT AREA OF WEST PAKISTAN, MARCH-MAY 1970  
(Details of Selected Areas and Population Sampled)

S.No.	Districts	No. of selected villages/localities	Population of villages/localities	Percent
1.	Lahore	85	314 435	11.9
2.	Sheikhupura	49	136 170	24.7
3.	Gujranwala	4	2 900	49.0
4.	Sialkot	36	32 055	46.9
5.	Gujrat	43	39 216	55.3
6.	Rawalpindi	22	18 517	13.5
7.	Campbellpur	52	57 411	18.5
8.	Jhelum	57	114 641	30.0
9.	Sargodha	14	48 283	13.0
10.	Mianwali	24	83 900	14.2
11.	Jhang	78	160 154	26.1
12.	Lyalpur	7	64 671	14.5
13.	Sahiwal	29	37 750	42.8
14.	Multan	41	93 785	20.4
15.	Muzaffargarh	66	106 183	34.4
16.	D. G. Khan	16	20 000	74.6
Total		623	1 330 071	23.7

TABLE 2. RESULTS OF SCAR SURVEYS BY DISTRICT  
IN PROJECT AREA OF WEST PAKISTAN, MARCH-MAY 1970

Districts	O : Unprotected (%)	X : Vaccination scar present (%)	P : Pockmarks observed (%)
Lahore	4.1	94.7	1.2
Sheikhupura	2.9	95.8	1.3
Gujranwala	5.6	93.2	1.2
Sialkot	1.2	98.0	0.8
Gujrat	4.0	95.0	1.0
Rawalpindi	5.4	93.2	1.4
Campbellpur	0.3	97.2	2.5
Jhelum	3.1	95.0	1.9
Sargodha	4.7	94.4	0.9
Mianwali	4.0	90.7	5.3
Jhang	0.6	97.6	1.8
Lyalpur	13.1	84.9	2.0
Sahiwal	4.6	94.1	1.4
Multan	3.6	94.9	1.4
Muzaffargarh	0.7	98.3	1.0
D.G. Khan	1.1	97.5	1.4
Total	3.7	94.7	1.6

TABLE 3. BAHAWALPUR DIVISION, PUNJAB - PRE-OPERATION SCAR SURVEY, OCTOBER 1970  
(Details of the Areas and Population Sampled)

Districts	Tehsil sampled	Population	No. of villages selected	No. surveyed	Population	Population examined					Percentage
						Under 1 year	1-4 years	5-14 years	15 yrs & above	Total	
Bahawalpur	Hasilpur	168 172	22	17	20 734	378	597	1 402	2 635	5 012	24.2
Bahawalnagar	Christian	197 437	22	22	15 996	754	1 459	2 068	3 265	7 546	47.2
Rahimyar Khan	Liaquatpur	227 940	19	18	15 575	218	432	800	1 803	3 253	20.9
Total		593 549	63	57	52 305	1 350	2 488	4 270	7 703	15 811	30.2



TABLE 4. BAHAWALPUR DIVISION, PUNJAB - RESULTS OF PRE-OPERATION  
SCAR SURVEY, OCTOBER 1970

Age Group	Total number examined	O : Unprotected		X : Vaccination scar present		P : Pockmarks observed	
		Number examined	Percentage	Number examined	Percentage	Number examined	Percentage
Under 1 year	1 350	652	48.3	698	51.7	-	-
1-4 years	2 488	525	21.1	1 952	78.5	11	0.4
5-14 years	4 270	325	7.6	3 860	90.4	85	2.0
15 years & over	7 703	161	2.1	7 320	95.0	222	2.9
All ages	15 811	1 663	10.5	13 830	87.5	318	2.0

TABLE 5. TERMINAL SCAR SURVEY IN SIX DISTRICTS OF PROJECT AREA, SEPTEMBER-OCTOBER 1970  
(Details of the Areas and Population Sampled)

Districts	No. of tehsils	No. of villages surveyed	Population	Population Examined					Percent
				Under 1 year	1-4 years	5-14 years	15 years & above	Total	
Lahore	3	3	1 808	76	251	216	343	886	49.0
Gujrat	3	3	2 500	100	237	620	1 111	2 068	82.7
Multan	3	3	3 250	196	380	582	1 127	2 285	70.3
Mianwali	3	3	3 222	82	168	231	392	873	27.1
Rawalpindi	3	3	1 523	93	143	207	323	766	50.3
Campbellpur	3	3	1 590	127	188	205	319	839	52.8
<b>Total</b>	<b>18</b>	<b>18</b>	<b>13 893</b>	<b>674</b>	<b>1 367</b>	<b>2 061</b>	<b>3 615</b>	<b>7 717</b>	<b>55.6</b>

TABLE 6. RESULTS OF TERMINAL SCAR SURVEY IN SIX DISTRICTS OF  
PROJECT AREA, SEPTEMBER-OCTOBER 1970

Age Group	Total number examined	O : Unprotected		X : Vaccination scar present		P : Pockmarks observed	
		Number examined	Percentage	Number examined	Percentage	Number examined	Percentage
Under 1 year	674	252	37.4	421	62.5	1	0.2
1-4 years	1 367	263	19.2	1 094	80.0	10	0.7
5-14 years	2 061	71	3.4	1 935	93.9	55	2.7
15 years & over	3 615	14	0.4	3 420	94.6	181	5.0
All ages	7 717	600	7.8	6 870	89.0	247	3.2

TABLE 7. TERMINAL SCAR SURVEY, SEPTEMBER-OCTOBER 1970  
(Immunity Level of Population at different intervals after vaccination - in percent)

Intervals (months)	Age Groups											
	0-1 year			1-4 years			5-14 years			15 years and over		
	O	X	P	O	X	P	O	X	P	O	X	P
5-6	28.4	71.6	-	17.1	82.9	-	2.7	95.8	1.5	-	96.9	3.1
7-8	29.7	70.3	-	18.6	81.4	-	3.8	93.6	2.6	-	95.2	4.8
9-10	34.1	65.9	-	18.2	80.7	1.1	2.8	94.9	2.3	1.1	93.0	5.9
11-12	38.5	61.5	-	19.7	80.3	-	3.1	94.0	2.9	-	93.7	6.3
13-14	43.1	56.0	0.9	20.6	78.4	1.0	4.6	92.4	3.0	0.3	95.2	4.5
15-16	50.6	49.4	-	21.1	76.7	2.2	4.2	92.5	3.3	0.9	93.9	5.2

O : Vaccination scar not present  
X : Vaccination scar present  
P : Pock marks observed