

SURVEILLANCE ACTIVITIES OF THE SMALLPOX ERADICATION PROGRAMME  
IN WEST PAKISTAN

by

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Introduction

Smallpox vaccination was introduced to the Indo-Pakistan Sub-Continent in the early nineteenth century: in West Pakistan, vaccination began in 1875, in Punjab. In 1880, the Vaccination Act was enacted and, in 1888, local bodies were created and vaccination against smallpox was made their responsibility. In recent decades, vaccination has been performed by rotary lancet using liquid lymph vaccine but, in some areas, variolation was still practised.

In recent decades, 14 million vaccinations per year were performed in a population of 46 million persons. Although presumably enough to break the chain of infection, no corresponding decline in disease incidence has been evident.

During the past 7 years, 18 506 cases have been reported officially, an average of 2 644 cases per year. The number of deaths recorded during this same period was 3 650. The actual number of cases and deaths could probably be multiplied several times to arrive at reasonably correct figures. The major factor responsible for this failure was gross negligence of surveillance activity. Shortage of personnel, lack of supervision, duality of control over vaccination staff, poor assessment activities, improper registration of births and deaths, defective legislation, use of sub-standard vaccine, and public rejection due to inadequate motivation of the populace were other factors.

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## Situation of Smallpox in West Pakistan (1963-69)

Table 1 shows the incidence of smallpox during the last 7 years. Data for 1969 include cases detected on field investigation by the surveillance teams. The number of cases has varied from a minimum of 935 in 1964 to a maximum of 6 084 in 1967. The total number of deaths during this period was 3 650 with an average of 521 deaths per year and an average case-fatality rate of 19.7%. Periodic epidemic cycles, at intervals of a few years, are characteristic of the disease, as in other endemic areas.

There is also a seasonal variation in disease incidence as shown in Table 1. The highest incidence is in February and the lowest, in September. Low rainfall and low "absolute humidity" in winter (from December to February) correspond with the high incidence of the disease whereas the incidence is low after July and August when rains are heavy and the humidity is high.

## Present Programme of Smallpox Eradication

### Plan of operation

The Government of Pakistan was concerned about the situation and desired to embark on a programme which could not only lead to control of the disease but to its eradication. The Government, as a part of the WHO Global Smallpox Eradication Programme, signed a plan of operation with WHO for this purpose and the scheme was launched in the last quarter of 1968. The preparatory phase was completed in 9 months and the attack phase was started in June 1969, in Lahore and Multan Regions (now designated as project area), consisting of 16 districts with a population of 27 million. It was completed in May 1970 in all except three districts. This area together with three districts of Bahawalpur Division, namely Bahawalpur, Bahawalnagar, and Rahim yar Khan, constitute the newly formed Province of the Punjab. Mass vaccination was carried out from house to house and from village to village. This was followed by daily concurrent assessment. The project was supported by intensive surveillance activities.

### Development of surveillance activities

Surveillance activities were practically non-existent prior to the Programme. A medical officer, designated as Assistant Provincial Smallpox Eradication Officer, was assigned responsibility for surveillance activities at the Provincial level. Two "fire-fighting" teams, each consisting of 5 vaccinators were constituted and placed at his disposal. Each team was headed by an Assistant Superintendent of Vaccination and was provided with transport and jet injectors. These teams were primarily assigned to the Lahore Region but could be commissioned to any part of the Province where required.

A fire-fighting team, consisting of 10 vaccinators, was organized at each Regional Headquarters under the supervision of an Assistant Director, Public Health Services. These teams were also provided with transport. The performance of fire-fighting teams at the Regional level, however, was poor, ostensibly due to the lack of proper supervision by an independent medical officer. District fire-fighting teams were established in the 16 districts under the attack phase. Each team had

3 to 4 vaccinators and worked directly under the supervision of the District Smallpox Eradication Officer concerned. Surveillance teams were also established in Lahore and Karachi under the supervision of the Municipal Medical Officers of Health.

In addition to enforcing containment measures, the teams were engaged in case detection and investigation activities. This aspect was further fortified by personal participation of the Provincial Smallpox Eradication Officer and WHO Senior Adviser.

The existing primitive case reporting system was improved, revised and regularized. A new "Weekly Report of Smallpox Cases" form was introduced for the notification of cases. "Case Investigation Record" forms were also introduced to obtain full epidemiological information about all cases.

Intensive training courses on surveillance activities were arranged separately for the District Smallpox Eradication Officers, Superintendents, Assistant Superintendents of vaccination and other supervisory staff.

These efforts gradually improved case notification and surveillance, particularly in the Project area.

The epidemiological findings, the results of field investigations and analysis of the reports received in the provincial office are presented in this paper.

#### Incidence of Smallpox in West Pakistan and Epidemiological Findings - 1970

With the improvement of case notification and establishment of a regular reporting system, cases reported or detected, were notified with details. From January to June 1970, 2 188 cases were recorded; full details were available for 2 036 cases, or 93%. Cases by Region are shown in Table 2 along with the figures for the corresponding period of last year.

#### Age distribution

Table 3 shows the number of cases by age group for West Pakistan excluding Karachi. The highest number of cases, 665 (43%), belong to the age group 1 to 4 years and 480 cases (31%) to the age group 5 to 14 years. Among children under 1 year of age, 199 cases occurred, constituting 13% of the total. Thus, 87% of all cases occurred among children less than 15 years of age.

Table 4 presents data relating to the 496 cases treated in the Epidemic Disease Hospital, Karachi, during this same period. The age distribution is different from that for West Pakistan as a whole. Only 66% of all cases are under 15 years. This difference in age incidence may reflect a lower immunity among adults in Karachi or that cases among older persons are more frequently admitted to the hospital.

### Sex distribution

For West Pakistan excluding Karachi, approximately equal numbers of cases occurred among males and females but among adults admitted to the hospital in Karachi males accounted for 78% of all adult cases. The data suggest that in Karachi, either female cases are not notified or they are not hospitalized.

### Vaccination status before exposure

Of 1 506 cases of known vaccination status in West Pakistan (excluding Karachi), 87% were either not vaccinated at all or were vaccinated unsuccessfully (Table 5). The percentage of vaccinated persons rises with an increase in age. Seven per cent of children under 1 year with smallpox had a scar of primary vaccination and 29% of adults.

Among hospitalized cases in Karachi (Table 6), a higher proportion of previously vaccinated cases is reported, ranging from 17% for those under 1 year to 26% among adults.

### Case-fatality rates

In West Pakistan excluding Karachi, the overall case-fatality rate was 17% with similar rates in all age groups except those under 1 year where the rate was 31%. Among hospitalized patients in Karachi, case fatality rates were considerably higher. The overall rate was 39%. By age group, the case-fatality rates were 40% in those under 1 year, 31% in 1 to 4 year olds, 40% in the 5 to 14 year age group and 45% among adults.

### Situation of Disease in Project Area - 1970

The Project area consists of 16 districts of Lahore and Multan Regions of the Province of the Punjab. Since the scheme was launched in these two regions and a revised reporting system was introduced, case notifications have considerably improved. The notified cases were investigated in the field and were traced as far as possible. Many other cases were detected following official and non-official notifications. Although the number of cases was, in fact, gradually decreasing due to the satisfactory mass vaccination campaign, more and more unreported cases were detected. Thus, no decline in smallpox incidence was observed in the project area during the first half of this year when mass vaccination was still in progress. In the third quarter of 1970, however, a sharp decline in cases occurred in the 13 districts of the project area where the attack phase was completed in May. Seasonal factors, however, undoubtedly contributed to this sharp decline.

During the first quarter of 1970 an increase of 85% occurred in the operational areas over the number of cases reported in 1969. In the second quarter, the number of cases compared to 1969 decreased by 22%. Finally, in the third quarter, a sharp decline of 68% occurred in operational areas while there was an increase of 5% in non-operational areas.

Table 7 shows that of 90 cases reported from the operational areas during the third quarter, 60 occurred in 3 districts where the attack phase had not been completed. Thus, only 30 cases were reported from the completely covered areas of 13 districts, as compared with 277 cases reported from the same districts in the corresponding period of 1969 - a decline of almost 90%.

The last column of Table 7 shows the overall percentage of coverage in each district as of the end of May. These figures are based on the number of vaccinations performed in each district. The three districts with lowest coverage had not completed the attack phase and mass vaccination was still being conducted there through September.

The results of surveillance activities in the project areas during the first 6 months of 1970 are presented in Table 8. Of 687 cases recorded, 62% were officially reported to the District Smallpox Eradication Units, 27% were detected through field investigations and 11% were reported by other sources. In all, 98% of all cases were investigated in the field and the source of infection traced. In other words, only 2% of all known cases that occurred in the project areas could not be examined and investigated.

#### Summary and Conclusions

West Pakistan has been known as an endemic area of smallpox for decades. The number of cases and deaths reported in past years was far short of the actual figures. Available data show that the disease attains epidemic proportions after every few years. Despite millions of vaccinations performed in the past, there was no decline in disease incidence. Many factors were responsible for this failure, the major one being the lack of effective surveillance activities.

To eradicate the disease from West Pakistan, the WHO-assisted programme of smallpox eradication was started in 2 regions (project area) in the last quarter of 1968. Side by side with mass vaccination and concurrent assessment, a well-knit surveillance system was established. Case reporting and investigation systems were revised, improved and regularized. Surveillance teams contributed substantially to the notification and field investigation of cases.

A total of 2 188 cases and 452 deaths were reported from West Pakistan during the first half of the current year, with a case-fatality rate of 22%. There was an over-all decline of only 4% in smallpox incidence during this nine-month period as compared with last year. However, during the third quarter of this year, the number of cases reported was 38% less than during this period last year. Of 90 cases reported from the project area, only 30 occurred in completely covered areas. The disease has shown a sharp decline of 68% in the operational area as a whole and 89% in the completely covered areas.

The study leads to the conclusion that 100% vaccination coverage, despite best efforts is practically not possible. Mass vaccination programmes alone cannot achieve the goal of eradication. Effective surveillance activity is therefore the back-bone of an eradication programme. Early notification of cases leads to timely case detection and prompt institution of containment measures.

TABLE 1

CASES OF SMALLPOX BY MONTH, WEST PAKISTAN, 1963-69

Year	1963	1964	1965	1966	1967	1968	1969
Jan.	280	34	191	221	1 136	219	251
Feb.	210	59	209	353	966	338	230
Mar.	336	101	184	302	883	183	281
Apr.	186	83	109	188	409	193	317
May	106	151	112	219	313	204	411
June	51	116	105	126	354	120	785
July	101	59	136	74	488	63	249
Aug.	77	25	31	152	422	48	137
Sep.	212	15	3	54	279	77	75
Oct.	197	10	65	127	241	124	72
Nov.	50	112	47	335	265	78	252
Dec.	123	170	93	785	328	189	441
Total	1 929	935	1 285	2 936	6 084	1 836	3 501

Source: Health Department, Civil Secretariat, Lahore (1963-1968)  
Health Department, Provincial SE Office (1969)

TABLE 2

SMALLPOX CASES BY MONTH AND BY REGION - WEST PAKISTAN  
JANUARY - JUNE, 1970

Region	J	F	M	A	M	J	Total for 6 Months	Total Same Period of 1969
Lahore	112	37	56	97	82	49	433	321
Multan	62	12	65	76	38	1	254	306
Bahawalpur	354	34	57	99	52	41	637	908
Hyderabad	102	140	145	105	32	3	527	608
Quetta	1	2	8	5	31	13	60	77
Peshawar	113	40	28	5	27	64	277	55
West Pakistan	744	265	359	387	262	171	2 188	2 275

TABLE 3

SMALLPOX CASES BY AGE AND SEX - WEST PAKISTAN EXCLUDING KARACHI  
JANUARY - JUNE, 1970

Age Groups	Male		Female		Both Sexes	
	C	D	C	D	C	D
0 - 1	102	21	97	40	199	61
1 - 4	339	53	326	56	665	109
5 - 14	228	38	252	24	480	62
15 +	100	9	98	18	198	27
Unknown	2	-	-	-	150	-
Total	771	121	773	138	1 692	259

TABLE 4

SMALLPOX CASES BY AGE AND SEX - KARACHI  
JANUARY - JUNE, 1970

Age Groups	Male		Female		Both Sexes	
	C	D	C	D	C	D
0 - 4	50	21	35	13	85	34
1 - 4	71	27	68	16	139	43
5 - 14	54	15	46	25	100	40
15 +	132	61	38	15	170	76
Unknown	1	-	1	-	2	-
Total	308	124	188	69	496	193

TABLE 5

VACCINATION STATUS OF SMALLPOX CASES BEFORE EXPOSURE, BY AGE  
WEST PAKISTAN EXCLUDING KARACHI, JANUARY - JUNE, 1970

Age Groups	Total No. of Cases	Vaccination Status Before Exposure			
		Vaccinated		Not Vaccinated	
		No.	%	No.	%
0 - 1	197	13	6.6	184	93.4
1 - 4	656	61	9.3	595	90.7
5 - 14	467	73	15.6	394	84.4
15 +	186	54	29.0	132	71.0
* Total	1 506	201	13.3	1 305	86.7

\* 186 cases of unknown age or vaccination status are not included



TABLE 6

VACCINATION STATUS OF SMALLPOX CASES BEFORE EXPOSURE, BY AGE  
KARACHI, JANUARY - JUNE, 1970

Age Groups	Total No. of Cases	Vaccination Status Before Exposure			
		Vaccinated		Not Vaccinated	
		No.	%	No.	%
0 - 1	84	14	16.7	70	83.3
1 - 4	138	25	18.1	113	81.9
5 - 14	99	20	20.2	79	79.8
15 +	165	43	26.1	122	73.9
Unknown	2	-	-	2	100.0
* Total	488	102	20.9	386	79.1

\* 8 cases of unknown vaccination status are not included

TABLE 7

SMALLPOX CASES BY DISTRICT (JANUARY - SEPTEMBER 1970)  
AND VACCINATION COVERAGE (AT 31 MAY 1970) IN THE PROJECT AREA

District	J	F	M	A	M	J	J	A	S	Coverage at 31 May (%)
Multan	27	-	49	51	21	-	-	-	-	97.9
M. Garh	8	4	7	-	-	-	-	-	-	93.0
Gujrat	3	-	-	13	2	1	-	-	-	89.1
Lahore	58	26	44	39	20	-	5	-	3	86.4
Gujranwala	-	4	-	1	-	-	-	-	-	85.6
Jhelum	1	-	-	-	2	1	-	-	-	83.1
Sialkot	-	6	7	1	-	1	1	-	-	82.5
Jhang	-	-	-	-	-	-	-	-	-	82.1
Sahiwal	14	4	-	20	16	-	19**	-	-	79.1
D.G. Khan	-	1	4	-	-	-	-	-	-	78.3
Sargodha	4	-	5	2	1	1	-	-	-	77.4
Sheikhpura	1	-	2	3	2	-	1	1	-	77.2
Lyallpur	-	-	-	-	-	-	-	-	-	72.0
*Rawalpindi	26	1	3	39	44	41	26	11	9	70.3
*Campbellpur	23	-	-	1	12	5	1	13	-	63.2
*Mianwali	9	3	-	3	-	-	-	-	-	60.9
Total	174	49	121	173	120	50	53	25	12	83.0

■ systematic mass vaccination concluded

\* mass vaccination in progress

\*\* occurred in previous months, detected and reported in July

TABLE 8

SMALLPOX CASES IN THE PROJECT AREA BY SOURCE OF INFORMATION  
 AND PERCENT INVESTIGATED, JANUARY - JUNE, 1970

Month	Total No. of Cases Re- ported	Source of Information						Cases Investigated and Traced	
		Official		On Investigation		Other		No.	%
		No.	%	No.	%	No.	%		
Jan.	174	103	59	35	20	36	21	160	92
Feb.	49	37	76	11	22	1	2	48	98
Mar.	121	58	48	61	50	2	2	114	94
Apr.	173	119	69	33	19	21	12	149	86
May	120	87	72	24	20	9	8	118	98
June	50	23	46	19	38	8	16	49	98
Total	687	427	62	183	27	77	11	638	98