WORLD HEALTH ORGANIZATION
ORGANISATION MONDIALE DE LA SANTÉ

WHO/SE/71.27

ENGLISH ONLY

DEVELOPMENT OF THE SMALLPOX SURVEILLANCE PROGRAMME IN ANDHRA PRADESH

by

Dr M. C. Apparao[1]

1. Introduction

Andhra Pradesh is the largest of the southern States of India with a population of 42.7 million living in 20 districts (Table 1). The State is known to have been endemic for smallpox for centuries. Reported cases and deaths due to smallpox from 1956 to 1970 are shown in Table 2. The National Smallpox Eradication Programme was launched in the State during the last quarter of 1962 with the object of vaccinating at least 80 per cent. of the population by the end of 1966. During that period 6.44 million primary vaccinations and 38.58 million revaccinations were performed. The total number of vaccinations (44.02 million) was greater than the population. This is due to the fact that some revaccinations were repeated.

Even after the mass vaccination programme, the incidence of smallpox continued at a high level with 8679 and 7951 cases reported during 1967 and 1968 respectively. It appeared as though a high level of herd immunity alone could not effectively limit the transmission of smallpox. Persistence of infection for more than 24 months in some of the districts was a main problem that required immediate attention.

2. The problem

Intensive efforts were made to search for the reasons for persistent transmission. Investigations in the field and a critical analysis of epidemic reports for 1967 and 1968 revealed the following.

2.1 Reporting and containment

(a) The reporting of smallpox cases in almost all villages was nearly complete but abnormally delayed. The first case was never detected, and until at least one death occurred, the outbreak was not reported. There were no serious efforts at any level to improve reporting of cases.

(b) There was usually no delay on the part of health staff in reaching the infected village after receiving a report. Within 24 to 48 hours, they reached the spot for containment efforts. But by that time, the outbreak was usually already on the decline as the available susceptible persons, who were not many, had been infected. More important, however, was the fact that infection had already been disseminated to other villages and towns.

(c) Epidemic investigations were defective. The health staff did mass vaccinations in the village from which the report came. They would return to their headquarters, fully satisfied with the control measures taken. In a few days, however, another report would come from a nearby village and the pattern would be repeated.

---

[1] Assistant Director, Medical and Health Services, Hyderabad, Andhra Pradesh.

(d) The medical officers of the primary health centres were neither acquainted with proper epidemic containment measures nor were they interested. The containment operations were entirely left to junior paramedical staff and vaccinators who, in turn, had little knowledge about the epidemiology of smallpox and proper containment measures.

(e) At the State level, supervision left much to be improved. A staff of one medical officer with a few clerical assistants, was inadquate to cope with the problem.

2.2 Epidemiological features of smallpox

In general, the transmission of smallpox was rather slower than was previously thought. Normally, it took many months for an epidemic outbreak to build up to a large number of cases. However, explosive outbreaks occurred in a few communities who resisted vaccination. Nearly 80 per cent. of persons in these communities were unprotected. Fishing communities along the sea coast, away from the main population centres, were the best example. The smallpox virus found them an ideal host population who were not only susceptible but who helped the virus to find new susceptible hosts by continuously migrating along the sea coast. Smallpox infection could persist throughout the year in these communities by shifting from one settlement to another.

Nearly 66 per cent. of the total cases were less than 15 years of age.

2.3 Vaccination and vaccination technique

Through 1965, liquid calf lymph was used for vaccination but, thereafter, freeze-dried vaccine replaced the liquid vaccine. The success rate of revaccinations with rotary lancet technique using freeze-dried vaccine was never found to be more than 30 per cent.

Except for a few isolated communities, people generally realized the value of vaccination. This trend was especially noted among children of school age. Children no longer ran away from vaccinators but came forward to be vaccinated. In certain urban communities, there was not only an acceptance but also a demand for vaccination.

3. Actions taken

3.1 Measures to improve reporting

The village headman is statutarily responsible for reporting but seldom performs this duty. According to the Public Health Act every guardian or parent of a smallpox patient should report the infection. However, the people are accustomed to hiding cases inside the house. Even the neighbours may not know that there are smallpox cases next door. People are afraid to reveal the case for fear of forceable isolation of the patient in a hospital. Consequently, the village headman is not usually aware of the infection until a death occurs.

Appreciable progress in reporting is difficult unless the people themselves realize the importance of early reporting. Although health education is the long-range answer, practical demonstrations of successful and effective containment measures in the field after a chance early detection of cases was found to be a most effective way of educating and motivating the people.

In addition, the following immediate measures were taken:

(a) basic health workers, malaria surveillance workers, auxiliary nurses, midwives and health visitors were instructed to detect smallpox and to report cases immediately;

(b) the grampanchayats and school teachers were also requested to report;

(c) printed and addressed red cards were distributed for the purpose of reporting. Only the name and address of the patient and the name of the village had to be filled in.

3.2 Training of district officers and field staff

This measure is considered as most important. The field staff must know specifically what they are to do and why they have to do it. Therefore, from 1968, training programmes were begun.

(a) All district and deputy district medical and health officers were trained for two days in surveillance, assessment by scar surveys, methods of supervision and the use of the bifurcated needle.

(b) All paramedical assistants in each district were trained for four days. They were trained more intensively as they are the most important persons responsible for field work. Elementary knowledge about the epidemiology of smallpox, techniques of investigation and containment, scar surveys, and the multipuncture technique of vaccination were explained. Seminars were conducted in which paramedical assistants presented and discussed their field experiences. With the aid of their suggestions, detailed job analyses and job descriptions were worked out.

(c) Since 1968, groups of 30 medical officers from primary health centres have been trained by the programme officers in a series of seminars.

(d) The Health Education Bureau has been conducting training programmes for health inspectors and health visitors and the programme officer used this opportunity to orient this staff in smallpox surveillance methods and objectives.

(e) Besides the above, the programme officer, whenever he visits a district, has been demonstrating the methodology of investigation and containment in actual epidemic outbreaks in the field.

3.3 Vaccination of vulnerable populations

As mentioned, vulnerable communities were identified along the coastal areas and intensive health education was undertaken in these areas. Appreciable progress was achieved in motivating these people.

3.4 Priorities for vaccination

For the remaining population the following priorities were fixed:

(a) systematic primary vaccination of all infants delivered in maternity and child care institutions before discharging the mother;

(b) primary vaccination of all children of the age-group 0-14 years;

(c) revaccination of children at the age of school entry (four to five years) and of migrant populations. This priority for revaccination was given because the highest number of smallpox cases belonged to the age-group five to 14 years (Table 3). It was also observed that the first case introduced into a village was usually a labourer, beggar or vagrant.

3.5 Technique of vaccination

The multipuncture technique of vaccination was introduced in 1969 and completely replaced the old rotary lancet technique. The success rate with the bifurcated needle in revaccination is found to be as high as 60-80 per cent.

3.6 Standardization of forms for reporting

The following forms were introduced in 1968.

(a) Primary report

This is sent by the health inspector directly from the village to the primary health centre and to the district within 48 hours after his visit. This indicates the confirmation of diagnosis, magnitude and extent of infection and field requirements.

(b) Daily report

The health worker sends a daily report indicating the daily incidence and work done. The above reporting is insisted upon with the main object of ensuring that no items of investigation are overlooked and also to make the medical officer aware of the progress in containment measures.

(c) Final report

This is prepared after four weeks from the date of the last case reported and is sent by the medical officer to the district and to the Director and includes the full particulars of each outbreak.

(d) An epidemiological case sheet for each case, similar to that in the WHO Manual, was introduced.

3.7 Job specification and job description

Concerning the surveillance and containment operations, the following specific duties were given to the containment team:

(a) proceed to the infected village within 24 hours after receipt of report;

(b) identify all cases and prepare contacts lists for each case;

(c) commence immediate contact vaccination on the same day and send primary report;

(d) next day commence investigation for detection of other possible cases and suspected contacts and send daily reports;

(e) list all the villages within five miles and begin searching for cases and carrying out mass immunization;

(f) every day the infected village must be visited during the first week for detection of fresh cases and later once or twice each week until four weeks after the last case. Prepare case sheets for all cases;

(g) prepare a final report giving details of cases, sources of infection, lists of contacts and total vaccinations done in each village.

3.8 Concurrent assessment

A plan was developed for the programme to be assessed concurrently by conducting scar surveys every month in each district in a random sample of the population. Immediate remedial action is taken wherever defective work is noticed.

3.9 Health education

Intensive efforts to educate and motivate the people were launched. The media of education preferred are radio, press and health bulletins.

4. Achievements during 1969-1970

4.1 Number of vaccinations performed

Although the same number of vaccinators were working, the total number of vaccinations done in the State during 1968 and 1969 declined when compared to 1966 and 1967, but the number of primary vaccinations increased (Table 4) due to the emphasis given to primary vaccinations in the age-group 0-15 years. In 58 maternity institutions 22 176 neonatal vaccinations were done during the year 1969. Neonatal vaccinations are now well accepted in urban communities.

4.2 Incidence of smallpox

In 1969 the State reported the lowest number of smallpox cases ever recorded. Only 1893 cases were reported as compared to 7951 cases during 1968 - a reduction of 75 per cent. Further progress was achieved during 1970 as only 359 cases were reported, a further reduction of 80 per cent.

During 1969, out of the 20 districts of the State, five were free from smallpox and during 1970, 12 districts were free.

While nearly one-third of all cases were reported from urban areas during 1968, not a single case was reported from urban areas during 1970. Hyderabad city, with a population of over 1.5 million, which was never free from smallpox during any year in the past, has recorded no cases for over 21 months.

Eight districts reported smallpox in 1970. Outbreaks were due to imported cases in two districts, Medak and Mahaboobnagar. In Guntur, East Godavari, Nellore and Visakhapatnam the infection was indigenous in fishing communities. In Srikakulam district transmission continued for a longer time due to operational failure. Even there, no reports of smallpox were received after August.

4.3 Investigation and containment action

Considerable improvement has been noticed in investigation and containment activities. Investigation teams have thoroughly searched for all reservoirs and hence the number of cases detected has been double the number of cases routinely notified. The effectiveness of the containment action has been demonstrated by the rapidity with which transmission has been arrested in all districts except in Srikakulam. In Medak district a single imported case was successfully contained without secondary transmission. In Mahaboobnagar district, one imported case gave rise to four secondary cases before the health staff detected the outbreak but they were able to successfully contain the infection after the occurrence of only one additional case which was in the incubation period when visited.

Even though prompt detection of the first case and reporting have not been improved to the extent desired, the periods of delay have been reduced considerably. Efforts are being intensified to achieve even more prompt reporting.

4.4 Assessment

Monthly reviews of the programme are being done at the State level and necessary remedial measures are being undertaken. Rapid scar surveys are being carried out in all districts to assess the immunity status amongst children under 15 years of age. In these surveys, the

number of unprotected children has been found to vary from seven to 23 per cent. (Table 6). These surveys have proved to be very useful to assess the vaccination work so that immediate corrective action can be taken.

4.5 Vulnerable population

With the identification of vulnerable populations, the task of surveillance and immunization has become easier. We now know where the infection is likely to appear. All efforts have been concentrated on these populations and transmission at this moment appears to have been interrupted.

SUMMARY

A mass vaccination programme performed during the period 1963-1966 in the State appeared to have no appreciable impact in reducing the incidence of smallpox. A critical study to identify the defects in the programme was made in 1968 and corrective action was taken. Rapid progress occurred.

The important measures responsible for this improvement were:

(a) identification of vulnerable areas and populations for intensified efforts;

(b) training of medical and paramedical personnel in surveillance and containment measures;

(c) job specification and job analysis of each category of worker and standardization of forms for reporting;

(d) concurrent and periodic assessment of the programme;

(e) improved health education measures.

TABLE 1. ANDHRA PRADESH DEMOGRAPHIC DATA

District	Estimated population 1969-1970 (in thousands)	Population density (per mile)
1. Adilabad	1 197	160
2. Ananthapur	2 095	239
3. Chittoor	2 269	327
4. Cuddapah	1 591	227
5. E. Godavari	3 091	624
6. Guntur	3 567	519
7. Hyderabad	963	690
8. Karimnagar	1 922	354
9. Khammam	1 254	172
10. Krishna	2 462	615
11. Kurnool	2 262	206
12. Mahaboobnagar	1 885	223
13. Medak	1 455	331
14. Nalgonda	1 867	287
15. Nellore	2 410	255
16. Nizamabad	1 212	329
17. Srikakulam	2 774	600
18. Visakhapatnam	2 715	441
19. Warangal	1 832	310
20. W. Godavari	2 345	657
21. Twin Cities	1 482	-
Total	42 650	

TABLE 2. ANNUAL INCIDENCE OF SMALLPOX IN ANDHRA PRADESH (1956-1970)

Year	Cases	Cases per 100 000	Deaths	Case fatality rate (%)
1956	7 231	23.5	1 409	19.4
1957	13 669	43.8	2 788	20.4
1958	20 580	61.4	4 917	23.8
1959	6 679	19.5	1 248	18.6
1960	7 210	20.6	1 467	20.3
1961	4 569	12.6	1 022	22.3
1962	5 272	14.3	1 251	23.7
1963	12 454	33.5	2 987	23.9
1964	10 550	28.0	2 107	19.9
1965	11 229	29.4	2 031	17.9
1966	4 570	11.8	850	18.6
1967	8 679	22.2	1 800	20.7
1968	7 951	21.0	1 436	18.0
1969	1 893	4.7	538	17.8
1970	358	0.9	79	22.1

TABLE 3. AGE DISTRIBUTION OF SMALLPOX CASES COMPARATIVE STATEMENT FOR 1968, 1969 AND 1970

Age-group	No. of cases			% to total No. of cases		
	1968	1969	1970	1968	1969	1970
0-1	884	99	21	14.6	6.2	7.4
1-4	1 459	341	48	24.1	21.2	16.9
5-14	1 653	575	98	27.2	35.8	34.6
15-29	1 296	274	48	21.4	17.0	16.9
30 and above	767	319	68	12.6	19.8	24.0
Total	6 059	1 608	283			

TABLE 4. VACCINATIONS - ANDHRA PRADESH STATE - 1962-1966

Year	Primary vaccinations (in thousands)	Revaccinations (in thousands)	Total (in thousands)
1962	593.5	2 250.8	2 844.3
1963	1 652.6	8 637.2	10 289.8
1964	1 597.1	10 654.0	12 251.1
1965	1 543.7	11 068.6	12 612.3
1966	1 056.7	5 972.7	7 029.4
1967	1 452.6	4 785.4	6 238.0
1968	1 718.9	3 510.3	5 229.2
1969	1 628.7	1 993.6	3 622.3

TABLE 5. INCIDENCE OF SMALLPOX IN ANDHRA PRADESH DURING 1970

District	January	February	March	April	May	June	July	August	September	October	November	Total
E. Godavari	24 (1)	12 (1)	1	1	-	-	-	-	-	-	-	38 (2)
Guntur	-	2	4 (1)	-	-	-	-	-	-	-	-	6 (1)
Krishna	-	-	-	-	-	-	1	-	-	-	-	1
Mahaboobnagar	-	-	-	1	3	2 (1)	-	-	-	-	-	6 (1)
Medak	1	-	-	-	-	-	-	-	-	-	-	1
Nellore	6 (1)	5 (2)	1	-	-	-	-	-	-	-	-	12 (3)
Srikakulam	44 (4)	45 (21)	20 (7)	37 (2)	62 (16)	37 (5)	16 (9)	8 (2)	-	-	-	269 (66)
Visakhpatnam	13 (4)	1	-	6 (1)	1	2	3 (1)	-	-	-	-	26 (6)
Total	88 (10)	65 (24)	26 (8)	45 (3)	66 (16)	41 (6)	20 (10)	8 (2)	-	-	-	359 (79)

Deaths shown in parentheses.

TABLE 6. RESULTS OF SCAR SURVEYS AMONGST CHILDREN UNDER 15 YEARS OF AGE - 1969

Name of the district	No. of villages surveyed	No. of children contacted	No. unprotected	Percentage unprotected
1. Adilabad	4	265	51	19.2
2. Chittoor	12	3 903	313	8.0
3. E. Godavari	Municipality	1 062	75	7.0
4. Anathapur	4	607	74	12.1
5. Cuddapah	12	1 653	220	13.3
6. Guntur	9	11 070	1 545	13.9
7. Krishna	3	926	150	16.2
8. Kurnool	3	751	178	23.7
9. Nellore	3	347	68	19.5
10. Nizamabad	9	3 503	630	17.9
11. Srikakulam	2	2 525	432	17.1
12. Visakhapatnam	2	1 256	124	9.7
13. W. Godavari	2	476	57	11.9