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**Autor:** Singh, P. / Tomaszunas, S. / White, Elisabeth  
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Medical and Health Services (Communicable Diseases), Rajasthan, India,  
Smallpox Eradication, World Health Organization, South-East Asia Region, New Delhi, and  
Public Health Laboratory Services, Exeter, England

## Smallpox eradication in Rajasthan, India

P. SINGH<sup>1</sup>, S. TOMASZUNAS, ELISABETH WHITE<sup>2</sup>

### Summary

In 1962, when the smallpox eradication programme was launched in India, there were 3909 reported cases in Rajasthan. Mass vaccination was introduced but had little impact on the incidence of the disease; in 1970, 4074 cases were reported and in 1971, the reported incidence (4821 cases) was the highest in India. Changes in the vaccination technique, the use of a new and potent vaccine and the introduction of a new strategy based on surveillance and containment of outbreaks, rather than mass vaccination, brought good results. By 1972, only 1970 cases were reported and endemic smallpox was eliminated from Rajasthan before the launching of the intensified all-India campaign in July, 1973. In 1974, epidemics were occurring in the neighbouring states of Uttar Pradesh and Madhya Pradesh as well as in Bihar and West Bengal. But in that year, there were only 10 new smallpox outbreaks in Rajasthan, all originating from imported cases.

The organization and progress of the eradication campaign and the history of smallpox eradication in Rajasthan are described in this communication.

*Key words:* Smallpox eradication; Rajasthan (India).

### *Geographical features, population and health services*

Rajasthan is the second largest State in India with an area of 342 214 sq. km. It is bordered on the west by Pakistan, on the north by Punjab and Haryana; Uttar Pradesh and Madhya Pradesh are to the east and Gujarat to the

<sup>1</sup> Deputy Director, Medical and Health Services, Rajasthan

<sup>2</sup> Epidemiologist, Public Health Laboratory Services, Exeter

south. It is a State of geographical contrasts; the Aravalli mountains extend from north-east to south west with the Thaar desert to the west and north west and fertile plains, liable to flooding, to the east.

At the 1971 census, the population of Rajasthan was 25 724 142, the tenth largest of the States but the population density was only 75 per sq. km: low when compared with the all-India population density of 182 per sq. km [1].

The State of Rajasthan is divided into 26 administrative districts. In each district, there are from 3 to 18 Primary Health Centres (PHC) each of which provides curative and preventive health services for a population of around 100 000. Additionally, there are hospitals and dispensaries in the towns and cities and medical colleges in the cities of Jaipur, Udaipur, Jodhpur, Bikaner and Ajmer. Each PHC is staffed by 1–3 medical officers and 15–25 auxiliary medical staff, including nurses, midwives, sanitary inspectors and vaccinators. There are 10–12 malaria workers at each PHC. The public health services in each district are supervised by a deputy chief medical and health officer (Health). All PHC and district level staff are involved in the National Smallpox Eradication Programme (NSEP). At State level, the NSEP work is coordinated by the deputy director of health services (Communicable Disease) and the State programme officer. There are two mobile State surveillance teams, each led by a medical officer, to assist in the smallpox surveillance activities.

A WHO epidemiologist was assigned to Rajasthan from 1971 to 1974, and again from December 1975.

### *Smallpox eradication campaign in India*

The smallpox eradication campaign was launched in India in 1962. The strategy employed throughout the country was based on mass vaccination. At first, the aim was to vaccinate 85% of the population as it was considered that, if this goal were achieved, the chain of transmission of smallpox would be broken. Then, in 1964, instructions were issued to field staff that 100% of the population should be vaccinated. This proved to be an unrealistic target.

The Nineteenth World Health Assembly (1966) adopted a resolution on the eradication of smallpox from the world and requested the World Health Organization to coordinate the global campaign and to assist those countries where smallpox was endemic to conduct their operations. In 1967, smallpox was reported from 42 countries;

India was one of the 30 countries where it was endemic, with 80 174 cases reported, 68% of the global total [7].

In 1967, the smallpox eradication campaign in India was still based on mass vaccination. As a result of experience gained during the smallpox eradication programme in Africa, a new strategy, based on surveillance and containment of outbreaks, was formulated. This was introduced gradually during the years 1968–1971 and proved effective [3].

Table 1. Number of smallpox cases reported in Rajasthan and in India, 1962–1975\*

Year	Rajasthan cases	India cases	Percentage of Rajasthan cases to total cases in India
1967	4506	83 943	5.37
1968	1923	30 295	6.35
1969	1439	14 139	10.18
1970	4074	12 349	33.00
1971	4821	16 166	29.85
1972	1990	27 047	7.36
1973	877	88 110	0.99
1974	61	188 003	0.03
1975	nil	1 436	0

\* Figures of the Directorate General of Health Services, Government of India.

A major problem encountered by NSEP in India was the instability of the liquid vaccine used at the beginning of the campaign. Under field conditions in the heat, it quickly lost its potency. To counter this, freeze dried vaccine was provided by a number of countries and the existing vaccine production centres in India were helped to develop the production of this form of vaccine. By the end of 1972, India produced enough freeze dried vaccine for the campaign, and the use of the liquid vaccine was discontinued. The new vaccine was of high potency and could withstand exposure to temperatures of up to 37° C for a period of 4 weeks without loss of its immunogenic property [6].

Another important change in technique was the introduction of the bifurcated vaccination needle, in the place of the old rotary lancet. When the new vaccine was applied with the new needle, positive takes were almost 100%.

#### *Progress of the smallpox eradication campaign in Rajasthan*

In Rajasthan, as elsewhere in India, the method used in the smallpox eradication campaign from 1963 until 1970 was mass vaccination. Freeze dried vaccine, provided by the USSR, was available in this State from 1963 and the bifurcated needle was in use throughout the State by 1970.

The reported smallpox incidence in Rajasthan remained high during the period 1962–1967, fell during 1968–1969 but rose again in 1970–1971 (Table 1); in 1970–1971 the incidence was the highest in India.

As elsewhere [6] smallpox showed a seasonal incidence, the build up in cases beginning in November, reaching a peak in April and decreasing markedly during the monsoon period which normally begins in July. It has been postulated that the spread of the disease was interrupted during the monsoon period, when travel is limited by weather and road conditions. Then, during the winter (November to March), the disease is more easily spread as travel is once more possible. Winter is also the season of marriages and other festivities.

In Rajasthan, considerable population movement occurs in winter. If the rains have been poor, cattle-owners will drive their herds to areas which have had better rains, remain there over the winter months and return home only when the monsoon is due. Additionally, landless peasants will move during the winter period to obtain temporary work in harvesting crops. Many of these people travel to the district of Ganganagar in the north of Rajasthan, where they come into contact with similar workers from Haryana and the Punjab. Such workers return to their home districts in March, just before the peak month for smallpox incidence. Almost 20% of the population may migrate in this way, and, there are also nomads (particularly tinkers), pedlars and travelling entertainers who move all year round. So, there is, potentially, an increase in the likelihood of the spread of any infectious disease, including smallpox, during the winter months with a corresponding decrease in transmission when travel is restricted during the monsoon season.

There is a great devotion to Sitla Mata, the goddess of smallpox, in Rajasthan. It is the custom to take those suffering from the disease to worship at a temple of Sitla Mata to seek her help in the patient's recovery. During 1971, "Temple Searches" were introduced. These temples were visited twice a week by the NSEP staff from neighbouring PHCs and any cases of smallpox detected followed up. Not far from the city of Jaipur, there is a famous temple of Sitla Mata where each year there is a special festival around the end of March. Since 1971, it has been visited each year by a mobile team from the State NSEP staff who look for smallpox cases among those present and enquire about other cases known to those attending the festival. Similarly, teams from the State, and from the districts concerned, visit the other major festivals and fairs which take place in Rajasthan.

The maps show diagrammatically the occurrence of smallpox outbreaks in the districts of Rajasthan during the period 1971–1974 (Fig. 1). These maps demonstrate the rapidity with which the disease was controlled in this State. Effective surveillance and containment of outbreaks, rather than control by mass vaccination, began here in 1971. In 1971, only 2 districts, Jalore and Barmer, did not report smallpox. In 1972, 8 districts did not report cases and in 1973, no cases were reported from 10 districts. By the end of 1973, indigenous smallpox had been controlled in this State.

#### *Rajasthan at smallpox zero in 1974*

In 1974, when smallpox was no longer endemic in Rajasthan, the disease was epidemic in other states of India. 188 003 cases were reported in this country in 1974; this included 36 959 cases in Uttar Pradesh and 2251 cases in Madhya Pradesh, states bordering Rajasthan; in an epidemic in Bihar, there were 126 872 cases with 26 815 deaths [8]. In the same year, only 3 districts of Rajasthan, Jaipur, Tonk and Nagaur were affected. There were a total of 10 outbreaks with 61 cases and 11 deaths. All 10 outbreaks originated from imported cases.

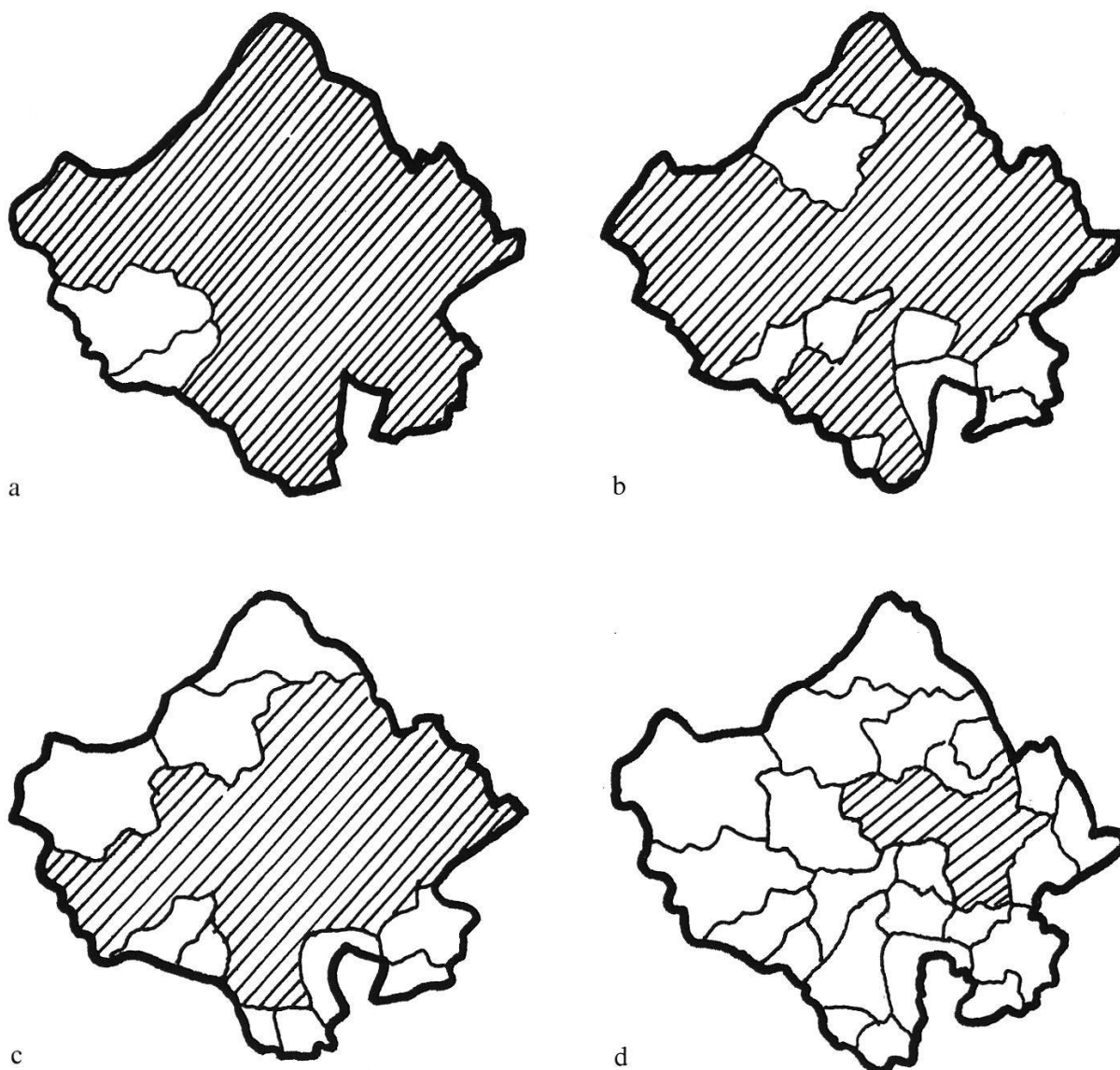


Fig. 1. Districts of Rajasthan reporting smallpox outbreaks (1971–1974). Number of districts reporting outbreaks and number of smallpox cases detected:

- a) year 1971: districts 24, smallpox cases 4827
- b) year 1972: districts 19, smallpox cases 1970
- c) year 1973: districts 16, smallpox cases 477
- d) year 1974: districts 3, smallpox cases 61

Eight of the outbreaks were in Jaipur district; in 4 instances they arose from cases infected in an outbreak which began in April 1973 with a case imported from New Delhi and in 2 others the source was not traced. The last 2 outbreaks in Jaipur district were single cases, both occurring in March, in two separate PHCs. The case in PHC Maid was in a child aged 7 who had a fever on arrival in the area from Calcutta on 22 March. He developed a rash on 23 March. The case was not notified to the PHC staff until 12 April when they investigated the case and took containment action. No other cases were detected

and the child recovered and returned to Calcutta on 3 May 1974. The other case occurred in Jaipur city. The 4-year-old child of a beggar arrived in Jaipur from Allahabad on 9 April, suffering from smallpox. The rash had developed on 26 March. He was seen by a sanitary inspector on 12 April and admitted to the isolation hospital. No other cases were detected.

The outbreak in Nagaur district began on 31 May and the last case occurred on 2 August. Information on the outbreak was not received at the district headquarters until 15 July 1974, 6 weeks after the beginning of the outbreak. There were 9 cases with one death. All the cases were in unvaccinated children of the Bawari community. Their ages ranged from 1 to 11 years. Most of the Bawari families left the village in mid March for the district of Ganganagar or the areas bordering Madhya Pradesh and returned to the village towards the end of May. The first case left Ganganagar district, by rail, on 18 May, arrived in the village on 21 May and developed the rash on 31 May. No cases were detected in Ganganagar district and although the source was not traced, it is possible that the child contracted the disease while travelling.

In Tonk, the outbreak began on 18 April 1974; a child of 8 years, who had arrived with his parents from Delhi on 10 April, was the first case. Unfortunately, the outbreak was not detected until 3 September, when it was reported by a malaria worker. Search and containment was then begun and the last case occurred on 9 September. During the course of the outbreak, there were 26 cases and 5 deaths. The source was never satisfactorily traced.

Since this last recorded case of smallpox in Rajasthan, in district Tonk on 9 September 1974, no further cases of smallpox had occurred or been introduced by the date of writing this report (April 1976).

#### *Active surveillance in India*

Active searches for smallpox began in India in 1973. The aim of an active search is the detection of all smallpox cases and outbreaks in the area searched. If any cases are found, the transmission of the disease must be interrupted immediately by containment procedures. Each search is prepared and planned by the State, district and PHC medical officers and their staff. All the paramedical staff of the PHCs, including malaria workers, family planning workers and all other available personnel, in addition to the NSEP staff of vaccinators and vaccinator supervisors, are employed in the search.

State level, district and PHC pre-search meetings are held; the staff are briefed on their duties and the necessary forms distributed. Advance tour programmes for the searchers are laid down and supervisory work planned. In a search, over a period of 15 days, all villages and towns in a State are visited by the searchers who contact people in their homes and enquire about cases of "fever with rash". Such cases are reported and the diagnosis made by a medical officer or senior paramedical worker. If the case is thought to be smallpox, containment activity is begun immediately and specimens obtained for virolog-

ical examination. The case is isolated, preferably at home and not in hospital. Special watchguards are posted at the door of the house and they are there day and night. They note the movements of all family members of the patient and warn newcomers of the danger of infection. Watchguards leave the house only after the last scabs have fallen off the patient's body, and the locality has been declared smallpox free. Immediately after the diagnosis has been made, even before confirmatory laboratory evidence has been received, all the people in the affected house, in neighbouring houses, in the village and in nearby villages are vaccinated. A thorough search is conducted in a 10-mile radius of the affected house and the search of this area repeated after a lapse of 2 to 3 weeks. The active searches have proved effective as a means of detecting and controlling smallpox throughout the country.

### *Active surveillance in Rajasthan*

Active smallpox surveillance in Rajasthan date back to 1971 [5]. The first full active search in the State was in November 1973; since then there have been a total of 9 searches, the most recent one in April 1976. The active searches in Rajasthan have not revealed many unknown outbreaks as endemic smallpox had been eliminated before this special drive began. However, the searches are of value in detecting suspect cases and ensuring that there is no recurrence of smallpox. At the time of a search, all cases of fever and skin eruption are reported, and the diagnosis of each case made by a medical officer or an experienced paramedical worker. The number of such cases (chickenpox, measles, furunculosis, etc.) reported by each PHC and district provides a useful index of the coverage of the area and the quality of the search.

In addition to the regular active searches, efforts are being made to get the cooperation of the public in the detection and reporting of suspected smallpox cases. A reward of Rs 100/- for the first person reporting a case of smallpox was introduced in India in October 1974; the reward was increased to Rs 1000/- from 1 July 1975. A wide publicity campaign has been launched in Rajasthan with radio announcements, press advertisements and news items. In common with the rest of India, slogans have been posted on the walls of houses, telling of the reward and of the necessity of reporting possible smallpox cases to the health authorities.

India will be declared smallpox free, only if she can satisfy an International Commission that there have been no cases of smallpox in the country for a period of two years. Before the International Commission can grant a certificate of eradication, it will require evidence that if a case of smallpox had occurred anywhere in the country, it would have been detected. To convince the Commission of this, active searches must be carried out efficiently and full records kept. Additionally, there must be adequate information, at all levels, of the

work done between searches. An adequate number of rumours of possible smallpox cases received from the general public will indicate that they are aware of the necessity of reporting suspicious cases and that a case of smallpox is unlikely to go undetected, or unreported through lack of interest. It is important that a reasonable number of such 'rumours' are investigated by a medical officer and that specimens for laboratory examination are taken in doubtful cases.

At present, it is planned that there will be a search of urban areas during the monsoon seasons and one further all-India search in October 1976. If no further cases are detected, it is hoped that India will receive her certificate of eradication by mid 1977, as the last case occurred in the State of Bihar on 17 May 1975.

In Bangladesh, the last known case of smallpox occurred on 16 October 1975. If no further cases are detected, this may have been the last case of variola major in the world. Variola minor is still endemic in Ethiopia. In mid June 1976, 787 cases were reported [9].

Today, India appears to be free from an endemic scourge which brought death and misery to thousands. But it is too soon to be complacent. Vaccination against smallpox is still essential part of the programme. Until the world has been declared smallpox free, all children in India should be protected by primary vaccination during the first few months of life. Vaccination and surveillance together should ensure that Asia now remains smallpox free.

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