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The world's last endemic case of smallpox: surveillance and containment measures*

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On 31 October 1977, the world's last known case of endemic smallpox was discovered in Merca, Somalia. The source of infection was quickly identified; 19 days previously, the male patient had been in contact with two other cases for not more than 15 minutes, but the surveillance activities surrounding these cases did not identify him as a contact. The patient was isolated and containment and surveillance activities and a vaccination campaign were rapidly instituted; 161 contacts were identified, 41 of whom had not been vaccinated within the last three years. The patient recovered and fortunately no other cases occurred.

In 1967, when WHO commenced its intensified programme to eradicate smallpox throughout the world, 46 countries reported cases of the disease and it was considered endemic in 33 of these. Almost 132 000 cases were reported in that year, but these certainly represented only a fraction of those that actually occurred.

By 1977 the programme had succeeded in interrupting smallpox transmission in all countries except Somalia in north-east Africa. Endemic smallpox had become re-established there in 1976 following multiple importations of the disease from Ethiopia. No cases were detected in Ethiopia after August 1976, but the disease persisted in Somalia despite efforts by the government and WHO to interrupt transmission. By the end of the year it was thought that these efforts had succeeded. However, increased surveillance in mid-March 1977 revealed widespread outbreaks throughout southern Somalia and in May 1977 the government declared the situation to be an emergency. The

peak of the epidemic occurred in late June, at which time more than 3000 national staff and 24 international epidemiologists were involved in containment activities. In all, 3228 smallpox cases were detected in ten regions in the south of Somalia and one imported case occurred in the northern part of the country. These cases occurred in 947 localities. By October smallpox transmission persisted in only four southern regions of the country, the last to experience cases being Lower Shabelli Region. What proved to be the last outbreak, occurred at the end of October 1977.

On 31 October, an urgent telephone call from the WHO epidemiologist in Lower Shabelli Region informed the smallpox eradication headquarters in Mogadishu of a smallpox case in the town of Merca (Fig. 1).

Merca is a busy regional centre and international port with a population of about 30 000. It is only two hours drive by surfaced road from the capital, Mogadishu, and is connected by bus services with the six other towns in the region. Most of the inhabitants are employed in local light industry or at the port. Administratively, the town is divided into three wards, each having four branches with 200-400 houses. The case was detected in Horseed Ward which forms the south-western sector of the town.

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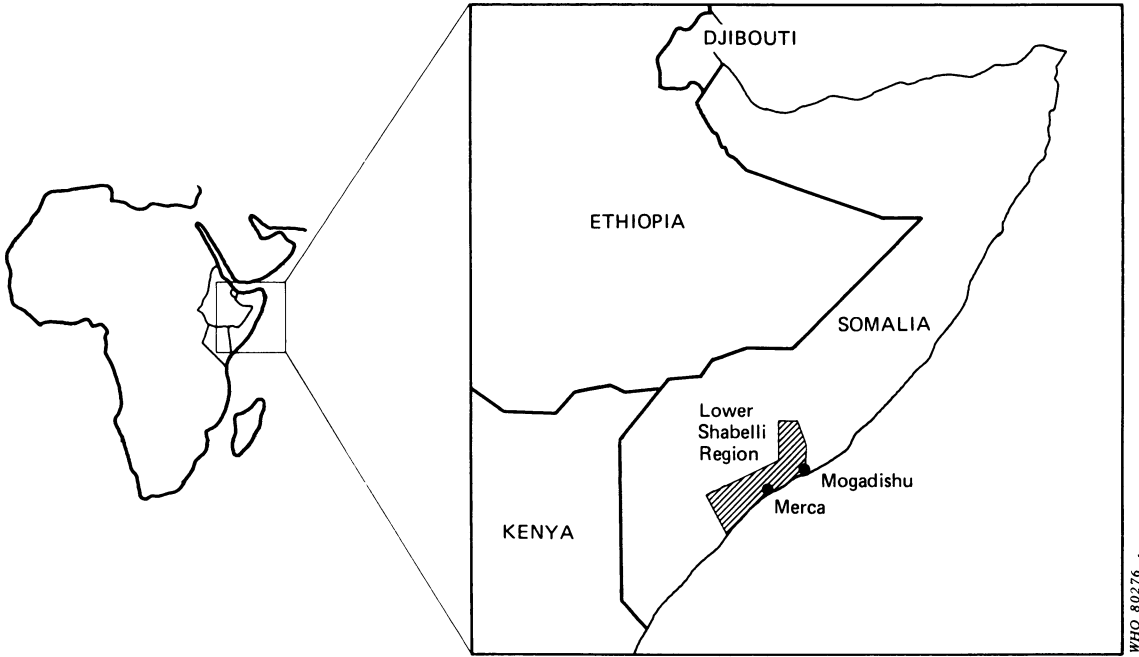


Fig. 1. Location of Merca.

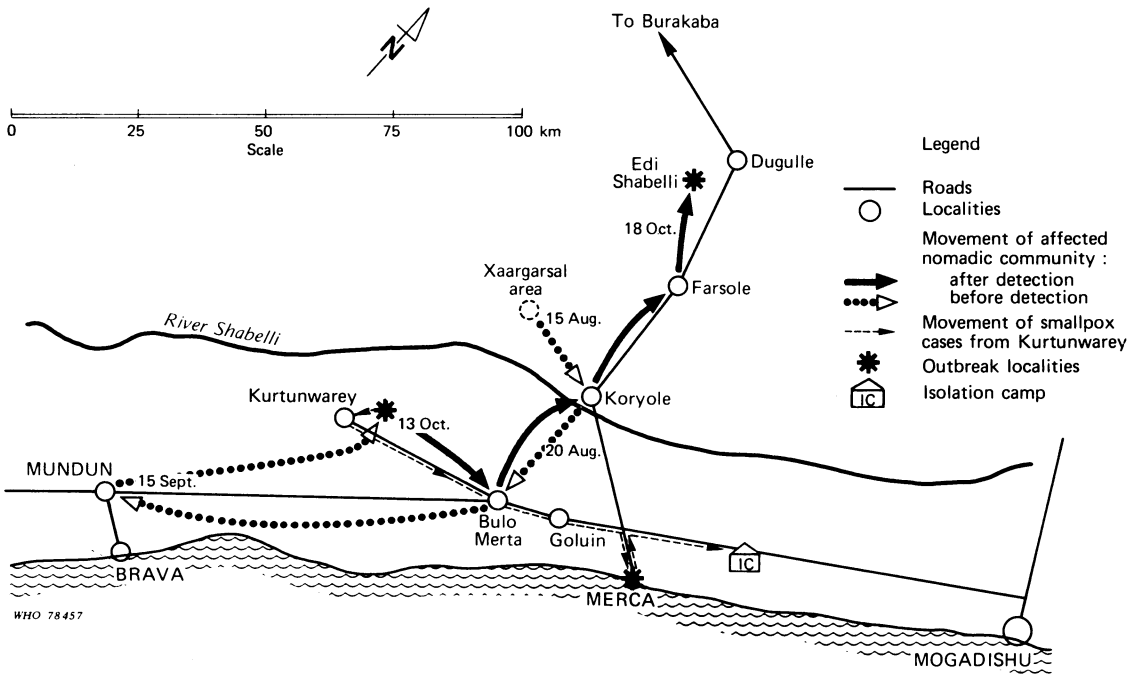


Fig. 2. Movements of the smallpox-affected nomadic community in Lower Shabelli region, 15 August – 18 October 1977.

Epidemiological investigations

The patient, Ali Maow Maalin, a 23-year-old cook at Merca Hospital, had not been previously vaccinated against smallpox and when discovered was suffering from moderately severe, clinically typical smallpox.

Investigation revealed the following sequence of events:

22 October: The patient developed a fever while at work and went home.

23–24 October: At home he was visited by many friends, including neighbours and hospital employees.

25 October: Admitted to the medical ward of Merca Hospital with a diagnosis of malaria, he was treated accordingly. He was visited by many friends and hospital employees and walked through the hospital and outside the compound to receive his salary and visit a friend.

26 October: A rash developed in the evening.

27 October: The patient was discharged after an attending physician had made a provisional diagnosis of chickenpox.

28 October: At home, very ill, he was visited by friends and relatives.

29 October: The patient himself suspected smallpox, but through fear of being sent to an isolation camp, did not inform the authorities.

30 October: A male nurse from the hospital reported the case to the Regional Health Superintendent.

31 October: The smallpox eradication programme epidemiologist was informed, investigated the case and diagnosed his illness as smallpox.

On 31 October, when first examined, the lesions were pustular and discrete, with many more lesions on the extremities, including the palms and soles, than on the trunk. The patient subsequently recovered and was discharged from the isolation centre at the end of November.

Specimens for laboratory diagnosis were collected on 31 October and the diagnosis confirmed by isolation of variola virus at the WHO Collaborating Centre at the Center for Disease Control, Atlanta, USA.

The source of infection was quickly identified. On the evening of 12 October, two smallpox cases, detected about 17 km north of Kurtunwarey settlement (Fig. 2), had been sent in a vehicle to an isolation camp near Merca. The vehicle had stopped at Merca Hospital to seek directions. Ali Maalin had travelled in the vehicle to direct it to the home of the local smallpox surveillance team leader. His contact with the patients, a 6-year-old girl, Habiba Nur Ali who had severe smallpox, and her 1½-year-old brother then in the papular stage of the rash, lasted for not more than 15 minutes. The patients from Kurtunwarey were

isolated but follow-up investigation at that time failed to identify Ali Maalin as a contact.

The chain of transmission, resulting in this last smallpox outbreak was traced back to mid-August, when the first smallpox case had occurred among a nomadic community of 20 families with a total of 109 persons, staying in Xaargarsal area in Koryole District. In all, eight smallpox cases, including the two mentioned above, had occurred among these nomads during their two months' movement through Koryole, Brava, and Kurtunwarey districts (Fig. 2). The last case occurred on 18 October at Edi Shabelli.

Containment measures

Additional national and WHO epidemiologists were immediately transferred to Merca from other posts and a detailed plan of action was formulated.

Isolation of the patient. Initially, the patient was isolated at his home, a room that he rented approximately 200 m from Merca Hospital, and day and night guards were posted. However, since his home was located in a densely populated urban area, it was decided to transfer the patient to an isolation camp at El Warego about 10 km from Merca on 2 November. One police guard and one militia guard lived permanently at the isolation centre until the patient was discharged four weeks later.

Contact tracing. Possible contacts included all hospital staff, medical and surgical ward patients from 21–27 October, visitors to the medical ward on the days of the patient's hospitalization, and his family, neighbours, and friends who had visited him in the hospital or at home. Also to be considered were others in the town who might have been exposed during the prodromal period. A total of 161 possible contacts were identified, located, and interviewed. Some were from localities more than 120 km away. Contacts were classified according to the intensity of their exposure and the presence or absence of vaccination scar resulting from vaccination within the previous three years (Table 1). Possible contacts without evidence of successful vaccination within the preceding three years were considered "unprotected". Individuals who had been in the same place with the patient at some time since the day before the onset of fever, but who had not had close exposure, were considered as "incidental contacts". Of 33 face-to-face contacts who had no evidence of successful vaccination within the previous three years, 12 had no vaccination scar from earlier vaccination either and were considered to be at maximum risk.

All known and possible contacts and members of their families were vaccinated. Incidental contacts were visited at least twice, "protected" face-to-face contacts were visited an average of four times each,

and those classified as unprotected, six times each during the 18 days following contact. During the surveillance period, two hospital employees and three neighbourhood contacts developed fever and were placed in isolation in their homes; none developed a rash. No secondary cases occurred among the 161 contacts.

Table 1. Classification of possible contacts by degree of exposure and vaccination status

Vaccination status prior to exposure	Degree of exposure		Total
	Face-to-face	Incidental	
vaccinated within past 3 years	58	62	120
vaccinated more than 3 years previously	21	8	29
unvaccinated/without vaccination scar	12	0	12
total	91	70	161

Measures at Merca Hospital. Owing to the numerous contacts with the patient while at the hospital, the following measures were taken:

- (a) all patients were vaccinated and quarantined and admissions were restricted to emergencies only;
- (b) all outpatients were referred to other health facilities;
- (c) all health staff in the town of Merca, as well as household members, were vaccinated;
- (d) all hospital staff and patients were checked daily for fever;
- (e) warning signs were posted and a 24-hour police guard was posted at the hospital entrance.

Patients were permitted to leave the surgical ward on 13 November and the medical ward on 17 November.

Vaccination and search for further cases

Of greatest concern was Horseed Ward, where the patient's house and Merca Hospital were located. Immediately, the patient's house and the 50 closest neighbouring houses were visited by a two-man team of local residents who listed and vaccinated all inhabitants and visitors. Teams, each comprising two smallpox programme staff, one local party leader, and one policeman, visited the remaining houses of Horseed Ward. The teams worked at night to achieve the maximum possible vaccination coverage of the population. A first round of vaccination was completed by 2 November.

Thereafter, a team of ten persons was assigned to revisit all households in Horseed Ward searching for smallpox cases, vaccinating newly-returned residents or visitors and revaccinating those whose first vaccination was unsuccessful. In the remaining two wards, Wadajir and Hawl Wadag, the team visited all houses, listing and vaccinating all residents during the following seven days. By 10 November, the entire town of Merca had been covered by one round of search and vaccination. This intense activity was followed by repeated three-day searches of the entire town during each of the six weeks of the observation period (Table 2).

With police assistance, a checkpost was established on the road into Merca to stop all traffic entering or leaving and to vaccinate all passengers. Three additional checkposts covered the three footpaths into Merca. These fixed vaccination/surveillance posts were maintained for six weeks. Public meetings were held in the orientation centres of all wards to inform the public about the smallpox emergency, the actions being taken, and the need to report illnesses with rash to health authorities. A reward of 200 shillings (approx. US\$ 30) for reporting a smallpox case was widely publicized as was the location of vaccination centres.

Table 2. Results of containment, vaccination, and search operations in Merca, November 1977

Area	Period	No. of houses	Population	No. of persons vaccinated	No. of rash cases detected		
					Smallpox	Chickenpox	Others
Horseed	31.10 - 2.11	792	5 000	3 558	0	1	4
Wadajir	3.11 - 6.11	738	4 300	2 873	0	1	1
Hawl Wadag	7.11 - 13.11	1 007	10 500	8 092	0	1	6
checkposts	31.10 - 14.11	—	—	40 254	0	0	0

Follow-up surveillance

No further smallpox cases were found in the town of Merca or in Somalia during the six weeks following the last case. During the four subsequent months (November 1977–March 1978), five house-to-house searches were conducted in the affected district and throughout Lower Shabelli Region (Table 3). Again no cases were discovered. Continuing searches throughout 1978 and 1979 detected no evidence of smallpox. The case described remains the world's last known occurrence of endemic smallpox. In retrospect, it can be seen to have occurred as the result of a combination of errors and omissions. However, prompt and comprehensive containment and an element of good fortune confined the outbreak to a single case. Ali Maow Maalin was thus the world's last case of endemic smallpox.

Table 3. Summary of search activities in Lower Shabelli Region, November 1977 – March 1978

Month	No. visited and searched				No. of rash cases detected		
	Villages	Nomad camps	Houses	Schools	Small-pox	Chicken-pox	Others
November 1977	786	239	62 676	598	0	9	362
December 1977	1 328	341	102 898	900	0	16	454
January 1978	1 576	550	104 818	1 000	0	11	204
February 1978	1 064	240	79 843	1 053	0	11	70
March 1978	1 230	586	77 287	948	0	13	27

ACKNOWLEDGEMENTS

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RÉSUMÉ

LE DERNIER CAS DE VARIOLE ENDÉMIQUE QUE LE MONDE AIT CONNU:
MESURES DE SURVEILLANCE ET D'ENDIGUEMENT

Le 31 octobre 1977, le dernier cas de variole endémique que le monde ait connu a été découvert à Merca, en Somalie. L'origine de l'infection fut très vite identifiée; 19 jours auparavant, le patient avait été en contact avec deux varioleux pendant une quinzaine de minutes tout au plus, et le dispositif de surveillance mis en place n'avait pas permis de

repérer ce contact. Le patient fut isolé, tandis que des mesures d'endiguement et de surveillance ainsi qu'une campagne de vaccination étaient rapidement instituées; on identifia 161 contacts, dont 41 n'avaient pas été vaccinés depuis trois ans. Le patient se rétablit et on n'eut heureusement à enregistrer aucun autre cas.