



AN EVALUATION OF THE EFFECTIVENESS OF
SMALLPOX SURVEILLANCE AND CONTAINMENT IN SOMALIA

Z. Jezek¹ and Abdullahi Deria²



1. Introduction

During the intensified drive against smallpox in Somalia, simple indicators were used in the field and at the operational headquarters in Mogadishu to measure the effectiveness of surveillance and containment activities that were carried out in the country during the 1977 epidemic.

Clearly defined and realistic targets and appropriate indicators were established and their use to measure programme performance proved to have an important impact on the whole operation.

2. Methods

To measure the effectiveness of surveillance-containment activities the following indices were used.

2.1 Time interval between the onset of the first case and the discovery of the outbreak (surveillance index)

The time interval between the occurrence of the first case in a focus and the date of its discovery reflects the effectiveness of surveillance.

2.2 Time interval between the discovery of an outbreak and its being reported (reporting index)

The rapidity with which smallpox outbreaks were reported to the level providing the technical assistance for investigation and containment, played an important role in the subsequent containment progress.

2.3 Time interval between the discovery of an outbreak and the commencement of containment vaccination at that outbreak

The rapidity with which smallpox outbreaks could be effectively covered by containment vaccination depended greatly on the vigilance and organizational ability of the field staff.

2.4 Time interval between starting containment and the onset of the last case in an outbreak (containment index)

It was stated as an objective that no further case should occur in any outbreak more than 20 days after containment had started (i.e., three days containment and maximum 17 days incubation period). From July 1977, a new target was set, aimed at interrupting transmission within 15 days of detection of any outbreak.

¹Medical Officer, Smallpox Eradication Unit, WHO HQ, Geneva
²Medical Officer, Ministry of Health, Mogadishu, Somalia

2.5 Time interval between the onset of the first and the last cases in the same outbreak

This time interval is an index of the effectiveness of both surveillance and containment activities.

2.6 Size of a smallpox outbreak

Similarly, the size of a smallpox outbreak can be used as an index of the effectiveness of both surveillance and containment.

3. Results

3.1 Time interval between the onset of the first case and the discovery of the outbreak

Information on this time interval is available for 935 smallpox outbreaks that occurred in all 11 infected regions after January 1977 (Table 1).

TABLE 1

TIME INTERVAL BETWEEN THE ONSET OF THE FIRST CASE
IN AN OUTBREAK AND THE DATE OF DISCOVERY OF THE OUTBREAK (SURVEILLANCE INDEX)

Month of onset of outbreak	Total No. of outbreaks*	Time interval - outbreak detected in:									
		Week 1		Week 2		Weeks 3-4		Weeks 5-8		After 8 weeks	
		No.	%	No.	%	No.	%	No.	%	No.	%
March**	91	2	2.1	7	7.6	9	9.9	28	30.7	45	49.5
April	132	18	13.6	18	13.6	46	34.8	45	34.1	5	3.9
May	273	82	30.0	63	23.1	85	31.1	38	13.9	5	1.8
June	271	134	49.4	60	22.1	70	25.8	4	1.5	3	1.1
July	124	79	63.7	19	15.3	19	15.3	7	5.7	0	-
August	34	17	50.0	5	14.7	6	17.6	5	14.7	1	2.2
September	6	1	16.7	3	50.0	1	16.7	1	16.7	0	-
October	4	3	75.0	1	25.0	0	-	0	-	0	-

* On which data available

**And before

As shown in the table, at the beginning of the intensified drive in April 1977, only 13% of outbreaks were detected within the first week after the onset of the first case, about 62% were detected within the first month, 34% during the second month and about 4% in the third month, or later. A substantial improvement in surveillance, starting in the second half of May, reduced the delay in outbreak detection and in June about 50% of outbreaks were discovered in the first week and about 97% in the first month; only 2.6% remained undiscovered until the second month or later. A further substantial improvement in the speed of outbreak discovery was recorded in July, when about 64% of outbreaks were discovered within the first week. During the period August-October, when smallpox transmission had been substantially reduced by effective containment activities, the search activities, in spite of the rainy season, detected a further 44 outbreaks, mainly in remote areas, however, some of them had been continuing for more than five weeks.

In May about 10%, and in June, 21% of outbreaks were detected during the first three days after the onset of the first case in the outbreak. This percentage rose to 37% in July and finally reached 47% in August. Of the total 935 outbreaks analysed, 16% were detected during the first three days after the onset of the first case in the outbreak, 36% within the first week. Approximately 80% were detected within the first month, about 14% during the second month and, finally, 6.3% in the third month and later. Of these 6.3%, 4.8% were outbreaks which developed in March 1977 or earlier, and were clearly a setback to the operation.

The target for surveillance activities, to detect at least 70% of all outbreaks within 14 days after onset of the first case, was reached in June and was maintained thereafter. From field observations, it is clear that if outbreaks are detected within 14 days and contained, further transmission and development of "satellite" outbreaks is minimal.

3.2 Time interval between the discovery of an outbreak and its being reported

This reflects the rapidity with which an outbreak is reported to the level that provides technical assistance for containment activities and epidemiological investigation. In Somalia, this assistance, provided by national and international epidemiologists and their special containment teams, was available at regional level in low-incidence areas and at district level in highly affected ones. In the majority of cases, the date of outbreak detection and the date of its being reported was the same.

Pertinent data about this interval is available for 416 outbreaks that occurred from April to July 1977. This data indicates that 71% of outbreaks were reported to the epidemiologist or smallpox control room on the day of detection, another 23.4% were reported within the first three days and the remaining 5.6%, mainly those discovered in the bush areas among nomads, were reported with a delay of three days and more. Delays of one week or more in reporting occurred only exceptionally and usually as a result of misdiagnosis.

3.3 Time interval between discovery of an outbreak and the commencement of containment vaccination at that outbreak

Throughout the affected regions of Somalia, there was a relatively rapid response following the detection of a new smallpox outbreak. In the majority of outbreaks containment activities were initiated by local staff without substantial delay.

The delay in commencement of containment was analysed for 694 outbreaks that were discovered from April to October 1977 and for which exact dates were reported (Table 2).

TABLE 2
TIME INTERVAL BETWEEN OUTBREAK DISCOVERY
AND COMMENCEMENT OF CONTAINMENT VACCINATION

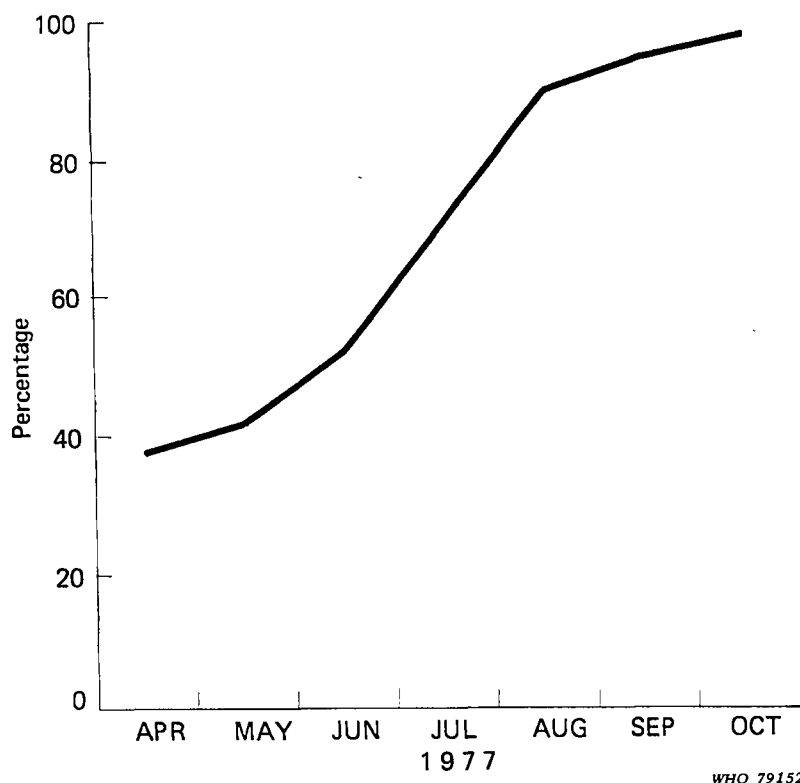
Month of outbreak discovery	Total No. of outbreaks*	Time interval - containment started							
		Same day		2-3 days		After 3 days		Before discovery	
		No.	%	No.	%	No.	%	No.	%
April	44	17	38.6	17	38.6	8	18.2	2	4.5
May	206	85	41.3	87	42.3	18	8.7	16	7.8
June	235	122	51.9	85	36.2	10	4.3	18	7.7
July	147	105	71.4	33	22.4	6	4.0	3	2.0
August	39	35	89.7	3	7.7	0	-	1	2.6
September	16	15	93.7	0	-	0	-	1	6.3
October	7	7	-	0	-	0	-	0	-

* On which data available

From Table 2 it is apparent that containment activities started in the majority of the outbreaks (88%) within the first three days after detection. Figure 1 shows a gradually increasing percentage of outbreaks in which containment started on the same day as detection. On average, commencement of containment was delayed more than three days after detection in only about 6% of outbreaks.

According to operational guidelines, all surrounding villages and nomadic camps within a 10 km radius of an affected locality were searched and their populations vaccinated. In fact, about 6% of new foci developed in localities where vaccination had been completed just before the discovery of a new case. In most cases, this was an already infected contact vaccinated during the incubation period.

FIG. 1
PERCENTAGE OF OUTBREAKS WHERE CONTAINMENT STARTED
ON THE SAME DAY AS DISCOVERY
(BY MONTH, APRIL-OCTOBER 1977)



3.4 Time interval between starting containment and onset of the last case in an outbreak

At the beginning of intensified activities, each outbreak in which cases occurred after 20 days was notified to the Mogadishu headquarters and an experienced epidemiologist visited the outbreak to determine why the containment had not been effective. Usually the newly occurring cases were unprotected children, hidden at the time of vaccination, or unvaccinated newcomers. From July 1977 a new target was set: to interrupt transmission within 15 days of outbreak detection.

The time interval between starting containment activities and the date of onset of the last case for 945 of the outbreaks which occurred in Somalia during 1977 is shown in Table 3.

TABLE 3
TIME INTERVAL BETWEEN STARTING CONTAINMENT VACCINATION
AND DATE OF ONSET OF LAST CASE IN AN OUTBREAK

Month when containment started	Total No. of out-breaks*	Time interval					
		14 days or less		15-20 days		21 days or more	
		No.	%	No.	%	No.	%
April or before	92	75	81.5	6	6.5	11	11.9
May	240	209	87.1	13	5.4	18	7.5
June	357	340	95.2	5	1.4	12	3.4
July	191	186	97.4	2	1.0	3	1.6
August	41	39	95.1	2	4.8	0	-
September	17	17	100.0	0	-	0	-
October	7	7	100.0	0	-	0	-

*On which data available

In 92% of outbreaks no additional smallpox case occurred more than 14 days after containment had been initiated. In 3% of outbreaks cases still occurred within three weeks of initiating containment and, finally, in about 5% of outbreaks cases occurred three weeks and more after starting containment activities. Occurrence of cases after three weeks was considered evidence of inefficient containment.

As expected, surveillance effectiveness varied with time and place. Earlier in the year, smallpox cases occurred three weeks or more after containment activities started in about 12% of outbreaks. As containment team members gained further field experience, this percentage decreased to 7.5 in May and further to about 3.4 in June and, finally, to 1.6 in July. No smallpox cases occurred three weeks or more after starting containment in outbreaks which were detected from August onwards, indicating a high level of performance of containment.

3.5 Time interval between onset of the first and the last cases in the same outbreak

Data regarding this time interval is available for 931 outbreaks that occurred after January 1977 (Table 4).

In many instances, especially in rural and nomadic areas, smallpox outbreaks developed comparatively slowly. Infected individuals usually transmitted the disease to no more than two or three other persons and between each generation of cases there was a period of about two weeks.

An interval of 14 days between onset of the first and last cases in an outbreak suggests only one generation subsequent to the index case; a month, two generations; two months, three or four generations; and three months or more, at least five generations.

The collected data suggests that overall, about 61% of outbreaks ended after one generation, about 19% endured two generations and about 15% ended with three or four generations. Less than 6% had five, six or more generations, before being contained.

In May, about 54% of outbreaks ended after one generation. Less than 3% had five generations or more before being contained. In July, about 81% of outbreaks ended after one generation and less than 1% had five generations or more. From August onwards, outbreaks with five generations did not occur.

TABLE 4
TIME INTERVAL BETWEEN ONSET OF THE FIRST CASE
AND THE LAST CASE IN THE SAME OUTBREAK

Month of onset of outbreak	Total No. of outbreaks*	Time interval between the onset of the first and last cases							
		Within 14 days		15-30 days		2nd month		3rd month and more	
		No.	%	No.	%	No.	%	No.	%
March & before	90	17	18.9	8	8.9	30	33.3	35	38.9
April	130	62	47.7	29	22.3	31	23.8	8	6.2
May	267	145	54.3	60	22.5	55	20.6	7	2.6
June	272	208	76.4	52	19.1	10	3.7	2	0.7
July	128	104	81.2	15	11.7	8	6.2	1	0.7
August	34	26	76.5	6	17.6	2	5.8	0	-
September	6	2	33.3	4	66.6	0	-	0	-
October	4	4	100.0	0	-	0	-	0	-

*On which data available

3.6 Size of smallpox outbreaks

The number of smallpox cases which occurs in an outbreak is another index of the effectiveness of surveillance-containment activities. Rapid detection and effective containment should result in small outbreaks.

From the analysis of 946 smallpox outbreaks which occurred from the beginning of 1977, it was found that about 40% were "single case" outbreaks and only about 6% resulted in 10 cases or more. As expected these proportions varied in both time and place (Table 5),

TABLE 5
DISTRIBUTION OF SMALLPOX OUTBREAKS BY SIZE AND MONTH

Month of onset of outbreaks	Total No. of outbreaks	No. of cases in the outbreak				Percentage	
		1	2-4	5-9	10+	Single case outbreaks	5 cases or more
March & before	93	9	39	25	20	9.7	48.4
April	132	44	54	28	6	33.3	25.7
May	277	89	107	62	19	32.1	29.2
June	272	124	109	32	7	45.6	14.3
July	128	77	45	1	5	60.1	4.3
August	34	19	10	2	3	55.8	14.7
September	6	2	2	1	1	-	-
October	4	4	0	0	0	-	-

In April and May 1977, about 30% of outbreaks were "single case" outbreaks, but nearly the same percentage had five cases or more. As a result of intensified search operations and improved containment activities in the second half of May, the percentage of single case outbreaks rose in June to about 46%, in July to about 60% and, finally, remained at 56% during the August-October period. Simultaneously, the proportion of outbreaks having five and more cases decreased to 14% in June, further dropped to 4.3% in July, but increased to 15% during the August-October period, when surveillance activities identified the last outbreaks in remote and difficult access areas.

4. Conclusion

As described, during the intensified drive against smallpox in Somalia simple indicators were used in the field and at Mogadishu headquarters to measure the effectiveness of programme performance. This evaluation played a substantial role in the success of the whole operation. By employing these specific indicators, the "weak spots" in programme performance were quickly detected and corrective measures could be implemented.

These objective indices show the gradual but steady improvement that took place in both surveillance and containment activities. The results demonstrate that in Somalia an effective level of programme performance was achieved within two months of beginning intensified smallpox eradication activities. Furthermore, they indicate that the Somali programme achieved a level of performance that can be favourably compared with the smallpox eradication programmes developed in India and Bangladesh.

= = =

REFERENCES

1. Jezek, Z., Ward, N.A. & Basu, R.N. Smallpox Eradication in India, SEA/Smallpox/77, New Delhi.
2. Smallpox Eradication in Bangladesh SEA/Smallpox/82, Dacca, 1977.