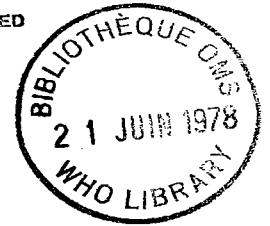




INDEXED



SMALLPOX POCK MARK SURVEY IN BANGLADESH,
WITH AN ASSESSMENT OF REPORTING EFFICIENCY

by

K. Hughes,^a S. O. Foster,^b D. Tarantola^c and A. K. Joarder^d

Through a pock mark survey on a one per cent. sample of houses in Bangladesh in 1976, the annual incidence of smallpox was calculated for the years from 1972 to 1975. From this the increasing completeness of reporting of smallpox, reflecting increasing surveillance efficiency, has been shown as the smallpox eradication programme developed from 1972 to 1975. The survey also showed that in the sample no person with pock marks was found with a history of smallpox dating since the last reported case.

INTRODUCTION

A pock mark survey involves examining a sample of the population for facial pock marks, defined as concentric depressed scars one or more millimetres in diameter. Five or more such marks is presumptive evidence of previous smallpox infection. Such a survey was carried out in Indonesia as part of an assessment of the smallpox eradication programme.¹

Pock mark surveys provide two types of information. Firstly, by correcting observed rates of persons with facial smallpox pock marks for mortality and pock mark disappearance, it is possible to estimate the smallpox incidence for a given period. Comparing this derived figure with the number of cases actually reported provides an estimate of the completeness of notification of smallpox. Secondly, it can be seen whether or not there is an absence of facial pock marks in children born since the last case, and of a history of smallpox dating since the last case in older persons.

Bangladesh was certified free of smallpox in December 1977 by an International Commission following two years of intensive surveillance since the last reported case on 16 October 1975. Between July and November 1976 a pock mark survey was carried out in Bangladesh to provide objective data on the surveillance system as the Smallpox Eradication Programme developed from 1972.

^a WHO epidemiologist, Smallpox Eradication Programme, Mohakhali, Dacca, Bangladesh.
Present address: WHO Smallpox Eradication Programme, Mogadishu, Somalia.

^b WHO epidemiologist, Smallpox Eradication Programme, Mohakhali, Dacca, Bangladesh.
Present address: Centre for Disease Control, Smallpox Eradication Programme, Atlanta, Georgia 30333, United States of America.

^c WHO epidemiologist, Smallpox Eradication Programme, Mohakhali, Dacca, Bangladesh.
Present address: World Health Organization, P.O. 302, Jakarta, Indonesia.

^d Assistant Director of Health Services, Smallpox Eradication Programme, Mohakhali, Dacca, Bangladesh.

Reprint requests should be addressed to Dr K. Hughes.

The issue of this document does not constitute formal publication. It should not be reviewed, abstracted or quoted without the agreement of the World Health Organization. Authors alone are responsible for views expressed in signed articles.

Ce document ne constitue pas une publication. Il ne doit faire l'objet d'aucun compte rendu ou résumé ni d'aucune citation sans l'autorisation de l'Organisation Mondiale de la Santé. Les opinions exprimées dans les articles signés n'engagent que leurs auteurs.

METHOD

Sample

A total sample size of 1550 sites of 100 houses each was chosen giving a total of 155 000 houses which is about one per cent. of the houses in Bangladesh. Of these sites, 1500 were in the rural areas, and 50 in the four major municipalities of Dacca (28 sites), Chittagong (nine sites), Khulna (nine sites), and Narayanganj (four sites), according to their population. These four municipalities account for about four per cent. of the population of the country.²

The whole of Bangladesh, except the Chittagong Hill Tracts, was used as the sampling frame. The Hill Tracts is a sparsely populated and relatively inaccessible part of the country, and has had only two reported outbreaks since 1972. For rural areas jurisdictional lists (JLs) corresponding roughly to villages and for municipalities blocks, were chosen by a random selection process weighted for their population. For each JL or block an index house was chosen randomly, and the site then consisted of this house and the nearest 99 houses, forming a cluster of 100 houses. Each house in the country had therefore an equal chance of being selected. Cluster sampling of a population may cause errors if the disease being studied itself clusters in the population, which smallpox does as an infectious disease. This possible error however has to be accepted, as cluster sampling was necessary for logistic reasons.

Technique

The survey was carried out by surveillance team members (government health workers specially trained for full-time work on the Smallpox Eradication Programme), under the supervision of WHO national and international epidemiologists. Before the survey started all personnel were trained in the technique of reading facial pock marks. A pilot survey was carried out in eight sites to help in the design of the questionnaire.

The majority of cases of smallpox occur in younger persons (see Table IV). Persons aged 0-19 were included in the survey to ensure that all children up to 14 years of age at the time of infection from 1972 onwards would be identified.

The total number of sites was covered in four rounds lasting about two weeks each, between July and November 1976. Personnel (usually two or three) spent from three to five days at each site, visiting the cluster of 100 houses. All persons aged 0-19 resident in the houses were enumerated. Those available were examined for facial pock marks, the personnel staying overnight near the site to ensure as high a coverage as possible. If a person had five or more facial pock marks (concentric depressed scars one or more millimetres in diameter), then the year and place of attack and the age when attacked with smallpox were recorded.

RESULTS

A total of 465 892 persons aged 0-19 years were examined (91.0% of those enumerated), and the number found to have five or more facial pock marks by year of attack with smallpox analysed (Table I). The data was further broken down by age-group at time of attack with smallpox (Table II).

To calculate the number of smallpox cases it was decided to use only the 5-14 age-group. The 0-4 age-group has a highly variable general mortality rate by age within this group,³ which would make correction difficult. The number of persons aged 5-14 found with facial pock marks in 1976 has to be corrected for sample size, case fatality, loss of facial pock marking, general mortality since attack, and age distribution of cases.

The sample size was calculated using the 1974 Census.² In this year the population of the country minus that of the Chittagong Hill Tracts was 76.521 million, and with an annual growth rate of 2.5% the population in 1976 was estimated at 80.395 million. As the 0-19 age-group represents 56.4% of the population, the size of this age-group was calculated as

45.343 million, and with 465 892 persons aged 0-19 examined the sample size is 1.03%. The number of persons in the country, aged 5-14 at time of attack, with facial pock marks in 1976 can then be calculated (Table III).

To determine age distribution of cases, age-specific case fatality rates, and facial pock mark retention rates, surveillance team members and epidemiologists revisited the last 115 smallpox outbreaks (detected between 1 July and 14 November 1975) in June 1976, after obtaining a line-listing of recorded cases locally. Of the 517 recorded cases, 98 had died from the attack of smallpox. Of the remaining 419 cases, 80 had either died from other causes or were absent so that 339 (80.9%) were examined and it was determined whether or not five or more facial pock marks were present. For the 5-14 age-group the proportion surviving the attack of smallpox was 87.3% (Table IV), and the proportion of the survivors retaining five or more facial pock marks 74.8% (Table V). The 5-14 age-group has been found to experience an annual general mortality rate of 3.8 per 1000 giving a survival rate of 99.6%.³ Using this data the number of cases of smallpox in the 5-14 age-group has been derived for the different years (Table VI). It was found that the 5-14 age-group accounts for 39.5% of smallpox cases (Table IV), and using this the total number of smallpox cases for the different years was calculated (Table VI). Surveillance efficiency is then the ratio of cases reported to national headquarters for a particular year to cases found to have occurred from the study for the same year (Table VII).

DISCUSSION

Large numbers of smallpox cases were found to have occurred in 1972 and 1973 with a rapid decline in 1974 and a lesser one in 1975 (particularly as no cases occurred after October) to reach zero in 1976 (Table VII and Fig. 1). These findings correlate with known facts about smallpox in Bangladesh over this time. With the liberation of Bangladesh in December 1971 many persons returned to their homes from India and in many districts smallpox was detected in 1972. In this year administrative structures, including surveillance and containment systems, which had been disrupted by the war were not fully established, and so the disease continued to spread in 1973. The Smallpox Eradication Programme increased its activities from 1972 onwards and it was hoped that smallpox would be eradicated by the end of 1974. However, during the last months of 1974 the two remaining areas of infection in the north-west of the country (Jamalpur and Kurigram) were hit by the worst floods in 20 years. With the destruction of homes and crops people moved into temporary shelters in the major cities, especially Dacca. Smallpox spread rapidly in these densely populated camps. On contracting the disease some persons returned to their home villages travelling by train, bus, or boat, thus spreading the disease. Also in January 1975 the Government endeavoured to resettle this population in camps outside Dacca city, but many persons in fact returned to their villages, some incubating smallpox. The spread of the disease was accelerated throughout the country, requiring increased activity to achieve eradication before the end of the year.

The increasing completeness of the reporting system, reflecting increasing surveillance efficiency, as the Smallpox Eradication Programme developed from 1972 to 1975 is shown in Table VII and Fig. 1. In 1972 when the health services were not yet reorganized after the war and there was suppression of cases by health staff (for fear that a report of smallpox was an admission of incomplete vaccination) only 11.8% of cases were reported. This compares well with a sample survey of one heavily infected thana in May 1972, which showed that only 10% of smallpox cases were known to the health authorities, and also that 20-40% of cases reported to health workers were suppressed by them.

With the extension in 1973 and 1974 of active surveillance by surveillance teams searching villages, markets and schools for information about smallpox, surveillance efficiency increased to 39.9% and 49.4% respectively. This was helped in 1974 by the creation within the health services of a single line of authority and responsibility for smallpox surveillance and control; at each level a single individual was made responsible for reporting smallpox. Also in 1974 a reward for reporting smallpox cases was introduced for both the public and the health workers, so that there was incentive for 12 000 health workers and the public to search for and report smallpox cases.

In 1975 when publicity of the reward for reporting smallpox and house-to-house searches (involving 12 000 government health workers throughout the country over nine days every two months) had been perfected, 83.0% of cases are estimated to have been reported to national headquarters, and eradication was achieved by October 1975. Intensive surveillance activity was continued for a further two years up to December 1977, the time of the International Commission.

An important part of the survey was that no child younger than one year (that is born since the onset of the last case on 16 October 1975) was found with facial pock marks, and no older person with pock marks had a smallpox history dating since the last case. Of course no survey on a sample would necessarily detect a limited number of outbreaks and in particular a single chain of transmission. However, this survey on 0-19 year-olds in about one per cent of houses is some evidence in itself that major transmission of smallpox has been interrupted in Bangladesh.

ACKNOWLEDGEMENTS

We wish to thank the national and international epidemiologists, and the surveillance team members, who carried out the extensive field work needed to collect the data.

REFERENCES

1. Keja, J. (1968) Report on a visit to smallpox programme, Indonesia, WHO Regional Office for South-East Asia, SEA/Smallpox/21
2. Bangladesh Bureau of Statistics: Population Census of Bangladesh 1974, National Volume. Government of the People's Republic of Bangladesh, Dacca, 1977
3. Report on the 1974 Bangladesh Retrospective Survey of Fertility and Mortality. Ministry of Overseas Development, London, 1977

TABLE I. NUMBER OF PERSONS AGED 0-19 IN SAMPLE WITH FACIAL POCK MARKS^a
IN 1976 BY YEAR OF ATTACK WITH SMALLPOX

Year of attack	Before 1972	1972	1973	1974	1975	1976
Number with pock marks	3367	417	329	139	54	0
Number of persons examined = 465 892						

^a Five or more.

TABLE II. NUMBER OF PERSONS IN SAMPLE WITH FACIAL POCK MARKS
BY YEAR OF ATTACK AND AGE AT ATTACK

Age-group	Year of attack				
	1972	1973	1974	1975	1976
0- 4	169	107	41	5	0
5- 9	165	147	61	24	0
10-14	74	68	27	20	0
15-19	9	7	10	5	0
Total	417	329	139	54	0

TABLE III. NUMBER OF PERSONS WITH FACIAL POCK MARKS
AGED 5-14 AT TIME OF ATTACK, BY YEAR OF ATTACK

Year	In sample	In Bangladesh
1972	239	23 204
1973	215	20 874
1974	88	8 544
1975	44	4 272

TABLE IV. AGE DISTRIBUTION AND AGE-SPECIFIC CASE FATALITY RATES FOR SMALLPOX

Age-group	Cases		Deaths	
	No.	%	No.	%
0- 4	137	26.5	42	30.7
5-14	204	39.5	26	12.7
15+	176	34.1	30	17.0
Total	517	100.1	98	19.0

TABLE V. AGE-SPECIFIC FACIAL POCK MARK^a RETENTION RATES FOR SMALLPOX

Age-group	No. examined	With pock marks	
		No.	%
0- 4	71	36	50.7
5-14	159	119	74.8
15 and over	109	81	74.3
Total	339	236	69.6

^a Five or more.

TABLE VI. NUMBER OF SMALLPOX CASES IN BANGLADESH 1972 TO 1975

Year	Persons aged 5-14 with facial pock marks in 1976	Cases aged 5-14 at time of attack ^a	Cases all persons
1972	23 204	36 109	91 415
1973	20 874	32 353	81 906
1974	8 544	13 189	33 390
1975	4 277	6 568	16 628

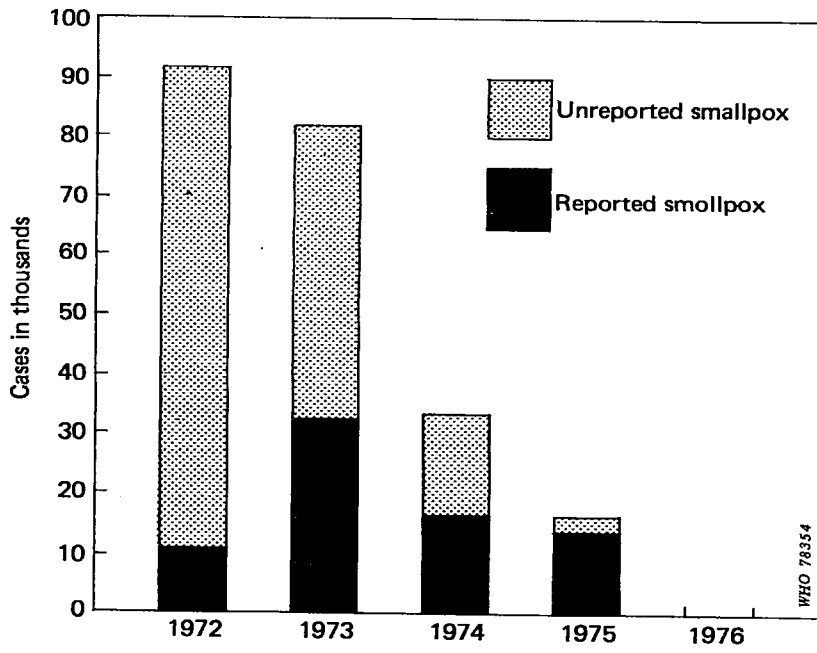
^a Calculated from formula $N = \frac{n}{a \cdot b \cdot (c) \cdot d}$, where n is number with pock marks in 1976, a is proportion surviving attack, b is proportion retaining pock marks, c is general annual survival rate, and d is number of years between attack of smallpox and survey in 1976.

TABLE VII. SURVEILLANCE EFFICIENCY FOR 1972 TO 1975

Year	Reported number of cases ^a	Estimated number of cases	Reporting efficiency per cent.
1972	10 754	91 415	11.8
1973	32 711	81 906	39.9
1974	16 485	33 390	49.4
1975	13 798	16 628	83.0
Total	73 748	223 339	33.0

^a From WHO Weekly Epidemiology Record.

Fig.1
Reported and estimated cases of
smallpox in Bangladesh for 1972 to 1976



* * *