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SURVEILLANCE REPORTS

Immunological surveys of

A. PERTUSSIS

B. POLIOMYELITIS

C. MEASLES

in Thailand, Pakistan, Nigeria (Eastern) and Togo.

General:

The collection, storage and investigation of blood samples from human and animal populations in various parts of the world, in addition to the research aspects such as ecology of diseases and posterity studies of diseases not yet recognized, play an extremely important role in the immediate analysis of the actual epidemiological situation in a country and in the assignment of priorities for control measures and later also for their evaluation.

Immunological surveys of a multipurpose nature, based on generally accepted methods of sampling and on standardized laboratory techniques, provide often better comparisons of the epidemiological situations among the populations living in different environmental conditions than do existing morbidity and mortality statistics collected under widely different criteria of diagnosis, accuracy and facilities for reporting.

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Material:

Large serum collections have been obtained in the last few years in epidemiological/serological surveillance surveys for yaws following mass penicillin campaigns in tropical countries. Surveys in Thailand (1), Philippines (1) and Eastern Nigeria (1) have been completed and a summary report recently issued (CD Surveillance Report 2 - Yaws). Other surveys in Northern and Western Nigeria, Togo and Western Samoa have not yet been completed.

The serum collections obtained in these epidemiological/serological evaluations of yaws are utilized also for multisubject exploitation in co-operation with one or more of the other WHO programmes (virus, malaria, human genetics, serum reference bank or global surveillance). So far aliquots of the serum collections from Thailand, the Philippines, Togo (2) and Eastern Nigeria have been deposited with the WHO Serum Reference Bank in Prague.

To the collections of sera from Thailand, Eastern Nigeria and Togo, a small sample of sera from three big cities in Pakistan (Karachi, Lahore and Dacca) (3) was added, and an immunological study with regard to the following is presented in this paper:

(a) Pertussis-parapertussis

Sera from four countries were investigated.

1. Thailand: from a total of about 4,000 sera specimens collected by the WHO Treponematoses Advisory Team in Thailand in 1962, 100 specimens were selected according to random numbers so that individual age groups would include the following predetermined numbers of specimens:

Age group (in years)	Number of sera
2-3	10
3-4	10
4-5	10
5-6	10
6-10	20
11-20	20
20+	20

2. Pakistan: In the spring of 1965, with the help of Dr K. Zacek, WHO short-term consultant, a small collection of sera was obtained from the populations of Karachi, Dacca and Lahore and was shipped to the Prague Serum Reference Bank. The main purpose of this collection was the investigation of arbovirus antibodies (mosquito-borne haemorrhagic and dengue-like fevers), and aliquots of sera were

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(1) WHO Treponematoses Epidemiological Team (TET): Teamleader - Dr G. Antal; Serologist - Mr J. D'Costa; Field Administrator - Mr J. Maxwell.

(2) WHO Medical Officer: Dr F. Vorst, Serologist: Mrs Heinze.

(3) STC Dr K. Zacek, Director, WHO Serum Reference Bank, Prague.

Plans and design of Philippines, Thailand, Eastern Nigeria and Togo collections of sera: Dr T. Guthe, Chief Medical Officer, Dr J. de Vries, Medical Officer, VDT Unit, Division of Communicable Diseases, Mr K. Uemura, Dr B. Grab, Health Statistical Methodology Unit, WHO Headquarters.

sent to Dr Wiseman of Maryland University, USA, who kindly offered his help. However, this sample was considered too small and the results obtained were used only for a crude orientation.

3. Eastern Nigeria: The Prague Serum Reference Bank received a total of 2,590 serum specimens collected by the WHO Treponematoses Advisory Team in 1964 from 50 sampling points in rural areas of the country. The collection has been divided into three subsamples:

Sub-sample	Area	No of specimens tested
I	North-east (thinly populated)	158
II	North-west (densely populated)	164
III	Southern coastal area	239
	Total	561

Owing to the small number of sera in the age groups up to 5 years and above 15 years, all the specimens available in these age groups were investigated.

4. Togo: From the collection of sera from south Togo a subsample was made according to random numbers so that the individual age groups would include approximately the following predetermined numbers of specimens:

Age group (in years)	Number of sera
2-3	20
3-4	20
4-5	20
5-6	20
6-10	40
11-20	40
20+	40

A. PERTUSSIS

B. pertussis and B. parapertussis antibodies were determined by the agglutination test in plastic panels with a suspension of 20,000 mil. of bacteria. The sera were diluted in twofold steps from 1:4 to 1:512 and titres equal to or above 1:8 have been designated as positive.

All investigations of pertussis and pertussis antibodies were made by the Pertussis Laboratory (Ass. Prof. Dr. B. Vysoka) and the Statistical Department (Mr J. Jelinek) of the Institute of Epidemiology and Microbiology, Prague.*

Results: Whooping cough is periodically reported to WHO only from Nigeria and Togo.

The number of reported cases of whooping cough in 1964 is shown in table 1. (From Monthly EVS, 1966, population mid-1964, calculation of rates by DSI).

Table 1

Country (population in thousands)	Number of reported cases	per 100,000
Nigeria[X] (56.400)	19.368	34
Togo (1.603)	3.695	230

[X] From 19.368 cases reported in Nigeria in 1964, 3.972 had appeared in the Eastern Nigeria Region.

Tables 2, 3, 4 and 5 provide information on agglutination antibodies against B. pertussis and B. parapertussis in sera from Thailand, Pakistan, Eastern Nigeria and Togo.

The results are interesting. They demonstrate that both etiological agents causing whooping cough (B. pertussis and B. parapertussis)are circulating in the population of all these countries. There is no cross immunity between the agents and agglutinins disappearing slowly during the years after disease or immunization.

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* Detailed results and analysis will be published later in extenso. This preliminary Surveillance Report should serve for immediate information of the WHO Regional Offices and the interested countries.

Table 2 THAILAND AGGLUTINATION ANTIBODIES

Age Groups	No. of Sera Tested	B. pertussis Titres neg.	1:8	16	32	64	128	256	512	Percent of Positives	B. parapertussis Titres neg.	1:8	16	32	64	128	256	512	Percent of Positives
2 - 3	10	10	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0
3 - 4	10	10	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0
4 - 5	10	10	0	0	0	0	0	0	0	0	9	0	1	0	0	0	0	0	10
5 - 6	10	9	1	0	0	0	0	0	0	10	10	0	0	0	0	0	0	0	0
6 - 10	20	18	0	0	1	1	0	0	0	10	18	0	0	1	0	0	1	0	10
11 - 20	20	15	1	0	2	1	1	0	0	25	16	1	0	2	1	0	0	0	20
20 +	20	16	1	0	1	1	1	0	0	20	15	0	0	1	1	3	0	0	25
TOTAL	100	88	3	0	4	3	2	0	0		88	1	1	4	2	3	1	0	

Table 3 PAKISTAN AGGLUTINATION ANTIBODIES

Age Groups	No. of Sera Tested	B. Pertussis Titres neg.	1:8	16	32	64	128	256	512	Percent of Positives	B. Parapertussis Titres neg.	1:8	16	32	64	128	256	512	Percent of Positives
2 - 3	8	8	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0
3 - 4	13	13	0	0	0	0	0	0	0	0	12	0	0	0	1	0	0	0	8
4 - 5	7	6	0	0	1	0	0	0	0	14	6	0	1	0	0	0	0	0	14
5 - 6	8	6	0	1	0	0	0	0	1	25	6	0	2	0	0	0	0	0	25
6 - 10	39	37	0	1	1	0	0	0	0	5	30	0	4	3	1	0	0	1	23
11 - 20	71	66	0	1	2	1	1	0	0	7	56	0	3	10	2	0	0	0	21
20 +	152	124	0	4	8	10	3	1	2	18	113	0	4	17	8	7	2	1	26
TOTAL	298	260	0	7	12	11	4	1	3		231	0	14	30	12	7	2	2	

Table 4 EASTERN NIGERIA

B. Pertussis antibodies

Age Groups	No. of Sera Tested	Titres								Percent of Positives
		neg.	1:8	16	32	64	128	256	512	
2 - 3	13	11	1	0	0	0	1	0	0	15
3 - 4	33	28	1	2	0	1	1	0	0	15
4 - 5	41	38	0	0	2	1	0	0	0	7
5 - 9	86	81	1	1	1	1	0	1	0	6
10 - 14	98	89	2	2	1	3	1	0	0	9
15 - 19	23	21	0	0	1	1	0	0	0	8
20 - 29	65	57	0	3	3	2	0	0	0	10
30 - 39	82	65	3	5	3	2	4	0	0	19
40 - 49	57	45	0	2	4	4	0	2	0	21
50 - 59	34	29	0	1	2	2	0	0	0	14
60 +	29	25	0	0	1	1	1	1	0	13
TOTAL	561	489	8	16	18	18	8	4	0	

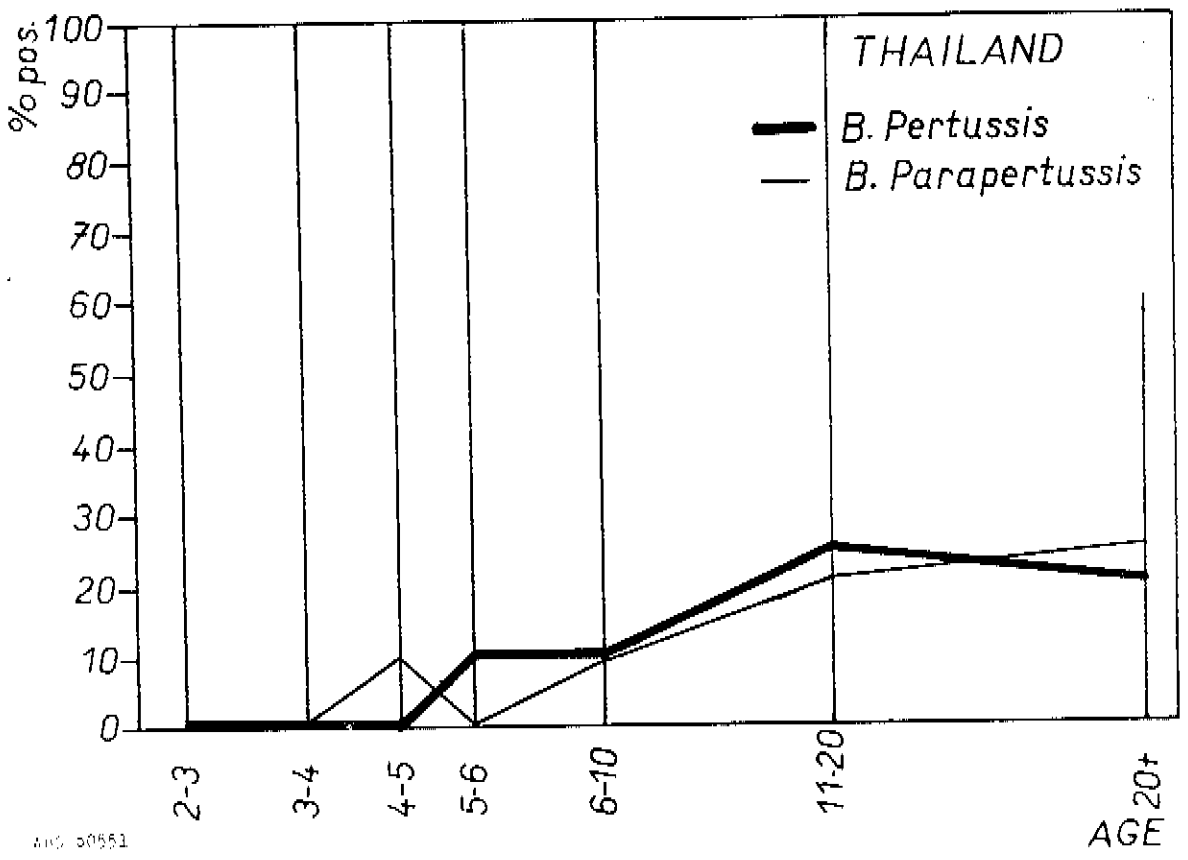
B. Parapertussis antibodies

Age Groups	Titres								Percent of Positives
	neg.	1:8	16	32	64	128	256	515	
2 - 3	12	0	0	0	1	0	0	0	7
3 - 4	32	0	0	0	1	0	0	0	3
4 - 5	33	0	2	3	1	1	1	0	22
5 - 9	76	2	6	1	1	0	0	0	12
10 - 14	80	6	5	4	1	1	0	1	18
15 - 19	21	0	0	1	1	0	0	0	8
20 - 29	52	1	8	3	1	0	0	0	20
30 - 39	64	6	4	6	0	0	2	0	22
40 - 49	45	4	4	4	0	0	0	0	21
50 - 59	28	1	4	1	0	0	0	0	17
60 +	25	1	2	1	0	0	0	0	13
TOTAL	468	21	35	24	7	2	3	1	

Table 5 TOGO AGGLUTINATION ANTIBODIES

Age Groups	No. of Sera Tested	B. Pertussis Titres neg.	1:8	16	32	64	128	256	512	Percent of Positives	B. Parapertussis Titres neg.	1:8	16	32	64	128	256	512	Percent of Positives
2 - 3	10	8	0	0	2	0	0	0	0	20	9	0	0	1	0	0	0	0	10
3 - 4	19	19	0	0	0	0	0	0	0	0	16	0	3	0	0	0	0	0	16
4 - 5	19	18	0	1	0	0	0	0	0	5	16	0	3	0	0	0	0	0	16
5 - 6	20	19	0	0	0	1	0	0	0	5	19	0	0	1	0	0	0	0	5
6 - 10	40	33	0	3	2	0	1	1	0	17	36	0	2	1	0	1	0	0	10
11 - 20	40	35	0	1	2	2	0	0	0	12	32	0	4	2	0	2	0	0	20
20 +	40	31	0	6	2	1	0	0	0	22	34	0	4	2	0	0	0	0	15
TOTAL	188	163	0	11	8	4	1	1	0		162	0	16	7	0	3	0	0	

FIG. 1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100
90
80
70
60
50
40
30
20
10
0
THAILAND
B. Pertussis
B. Parapertussis
2-3
3-4
4-5
5-6
6-10
11-20
20+
AGE

FIG. 2

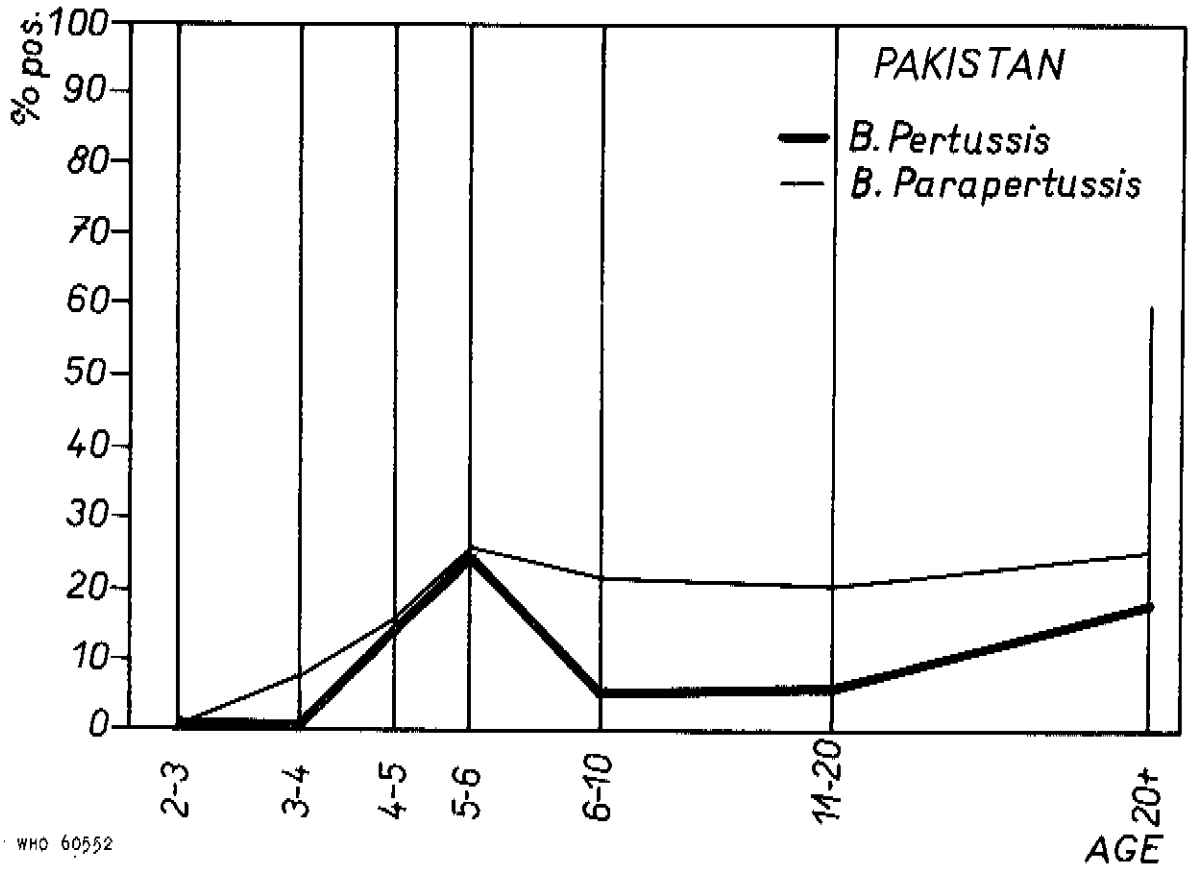

% pos.
100
90
80
70
60
50
40
30
20
10
0
PAKISTAN
B. Pertussis
B. Parapertussis
2-3
3-4
4-5
5-6
6-10
11-20
20+
AGE
WHO 60552

FIG. 3

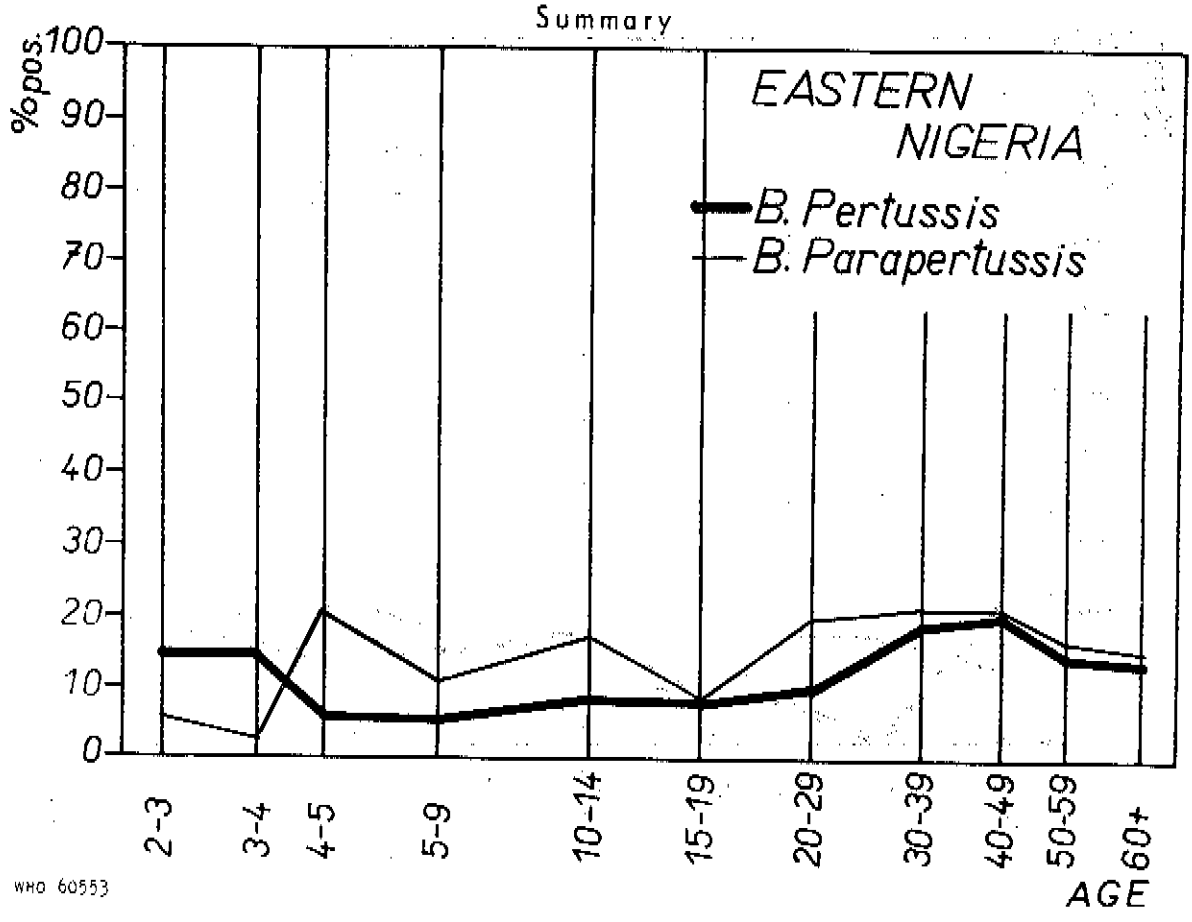

Summary
%pos.
100
90
80
70
60
50
40
30
20
10
0
EASTERN
NIGERIA
B. Pertussis
B. Parapertussis
2-3
3-4
4-5
5-9
10-14
15-19
20-29
30-39
40-49
50-59
60+
AGE
WHO 60553

FIG. 4

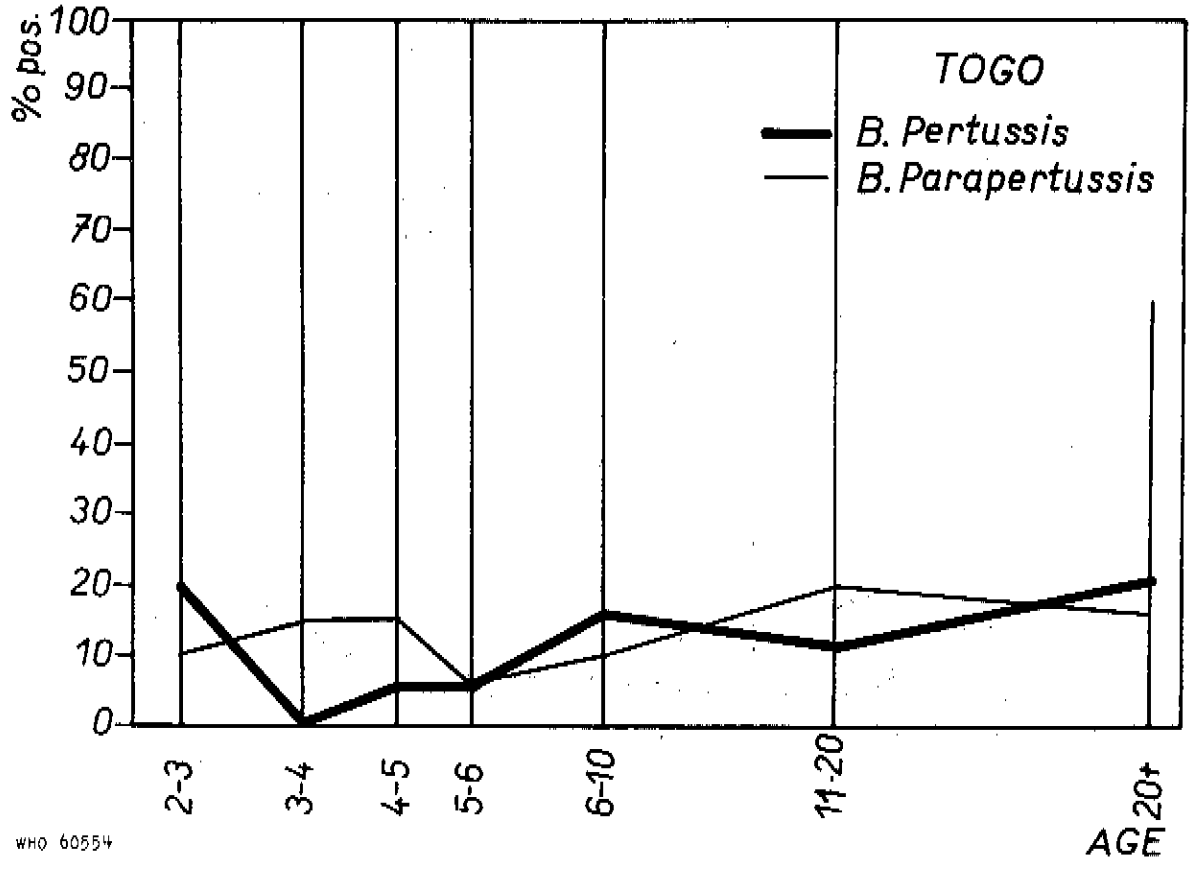

% pos.
100
90
80
70
60
50
40
30
20
10
0
TOGO
B. Pertussis
B. Parapertussis
2-3
3-4
4-5
5-6
6-10
11-20
20+
AGE
WHO 60554

FIG. 5

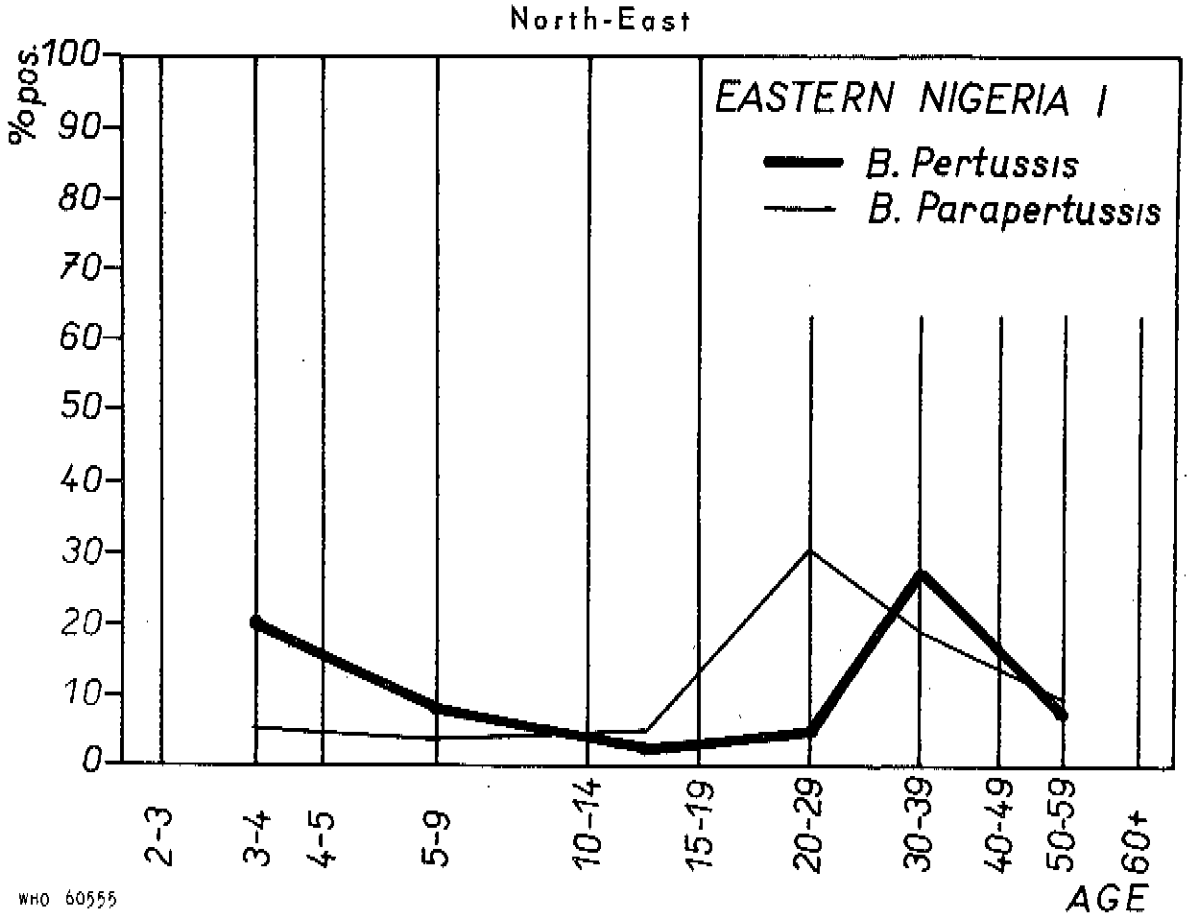

North-East
% pos.
100
90
80
70
60
50
40
30
20
10
0
EASTERN NIGERIA I
B. Pertussis
B. Parapertussis
2-3
3-4
4-5
5-9
10-14
15-19
20-29
30-39
40-49
50-59
60+
AGE
WHO 60555

FIG. 6

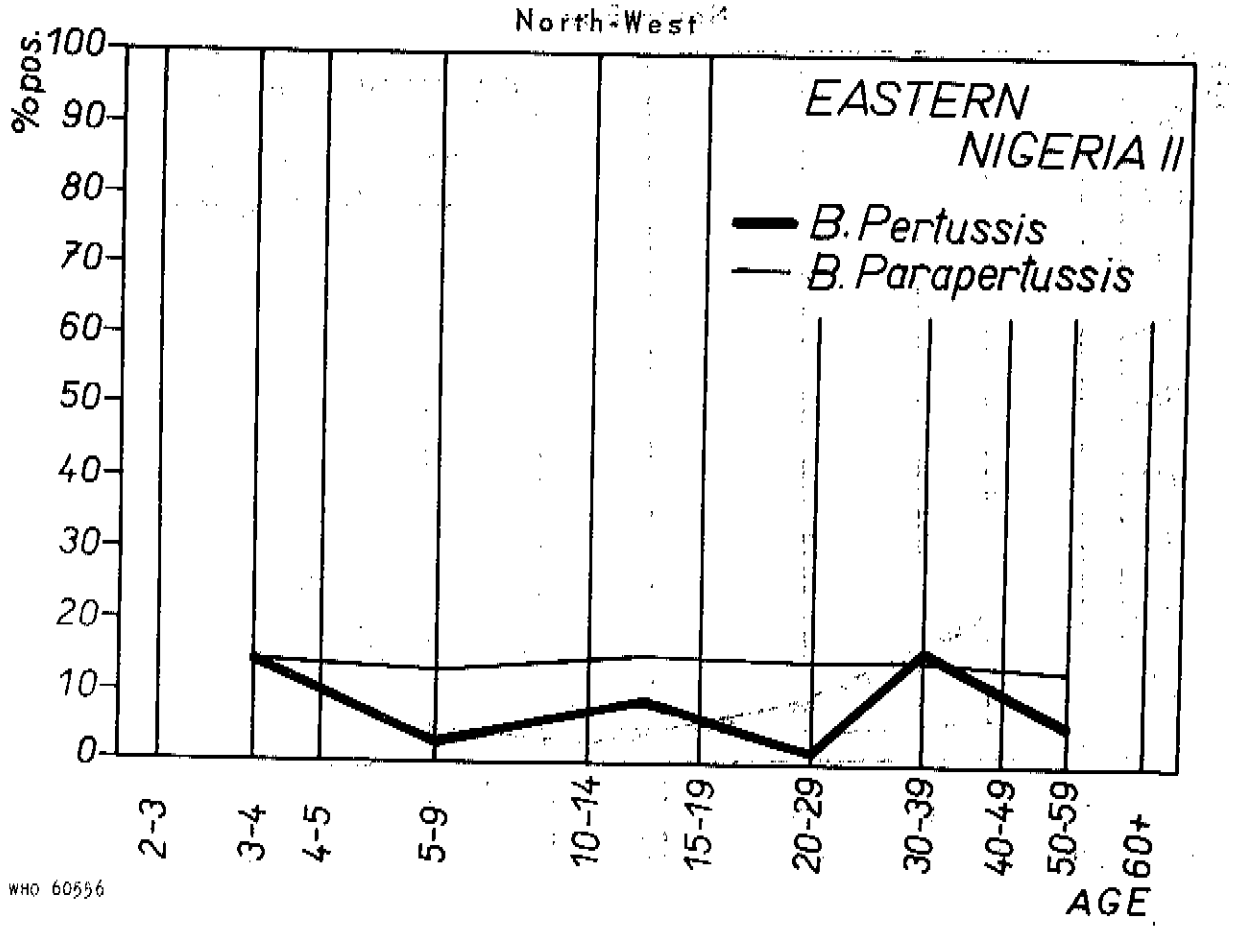
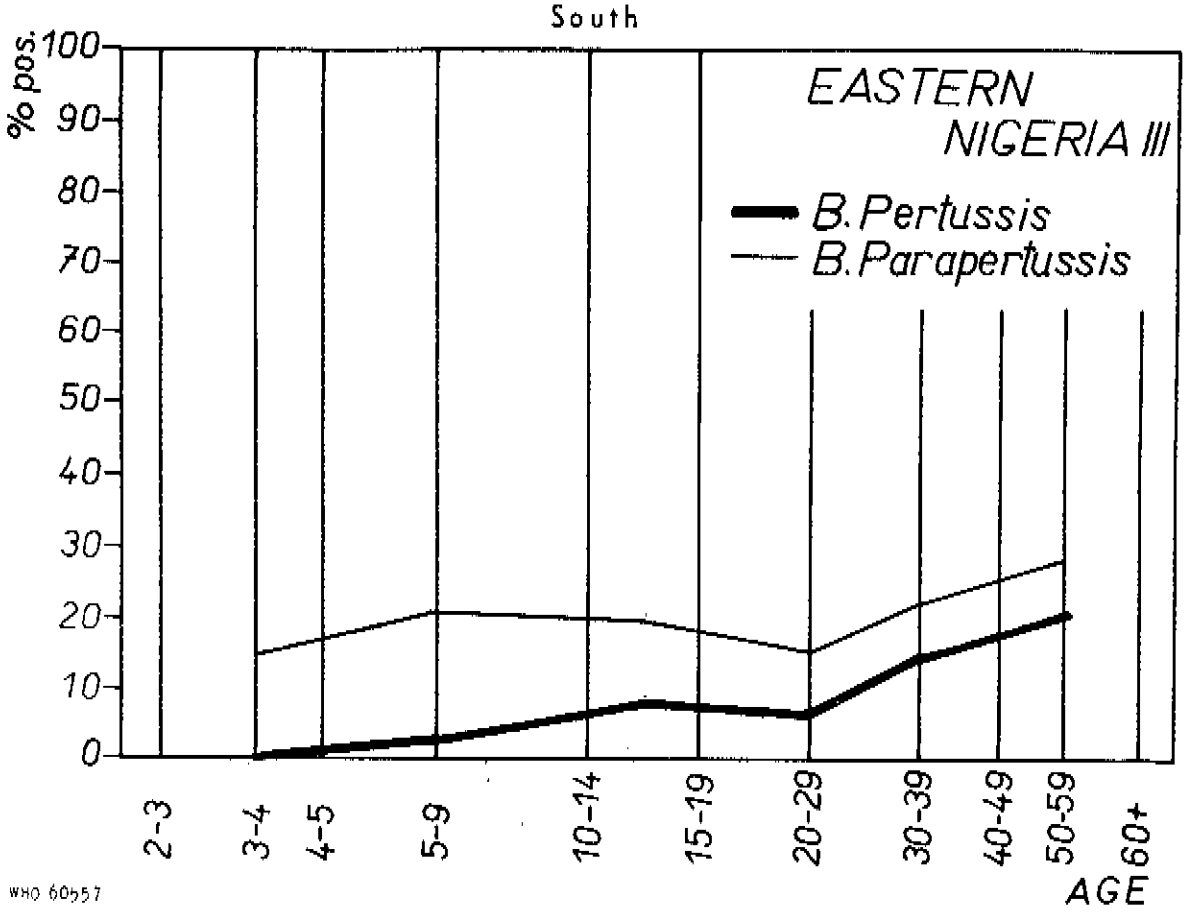
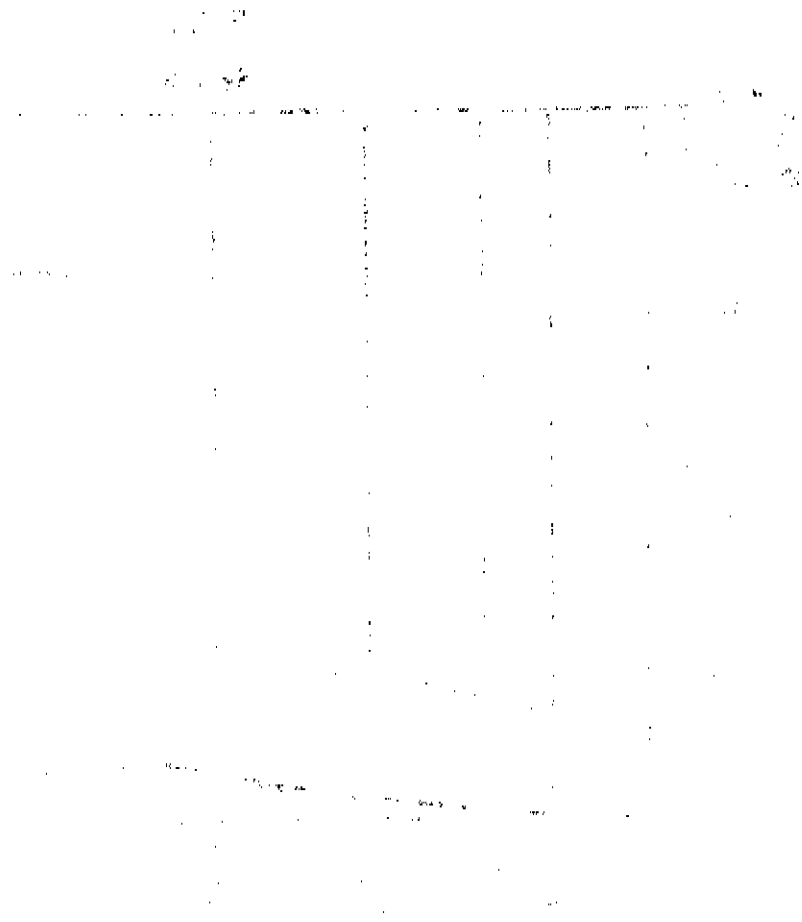

North-West
%pos.
100
90
80
70
60
50
40
30
20
10
0
EASTERN
NIGERIA II
B. Pertussis
B. Parapertussis
2-3
3-4
4-5
5-9
10-14
15-19
20-29
30-39
40-49
50-59
60+
AGE
WHO 60556

FIG. 7


South
% pos.
100
90
80
70
60
50
40
30
20
10
0
EASTERN
NIGERIA III
B. Pertussis
B. Parapertussis
2-3
3-4
4-5
5-9
10-14
15-19
20-29
30-39
40-49
50-59
60+
AGE
WHO 60557



Figures 1, 2, 3 and 4 shew the antibody levels in different age-groups. Figures 5, 6 and 7 demonstrate different antibody patterns in different parts of Eastern Nigeria.

No systematic vaccination against whooping cough is carried out in all these countries. Population samples investigated in Thailand, Eastern Nigeria and Togo are from rural areas. But reported incidence (Table 1) is coming mostly from the cities, where the antibody level in population samples is probably higher.

Results of immunological surveys in Thailand, Pakistan, Eastern Nigeria and Togo prove the presence of both etiological agents in the population of all these countries. Reported morbidity from Nigeria and especially from Togo demonstrates that the public health problems of whooping cough in these countries should not be underestimated. These findings also justify the further study of the relative importance of clinical manifestations of B. parapertussis infections in all these countries. If the situation is similar as for example in Central Europe, then the inclusion of a B. parapertussis component in whooping cough vaccine should be considered.

B. POLIOMYELITIS

Method: Serum-neutralizing antibodies were determined by the colorimetric (pH) test in plastic panels as outlined in the 1958 Report of the WHO Expert Committee on Poliomyelitis.

In measuring age specific curve levels of antibody of 1:4 or above have been designated as positive.*

Results: Poliomyelitis is not yet reported from Pakistan. Table 6 shows the number of reported cases in the other three countries in 1964.

Table 6

Country (population in thousands)	Number of reported cases	per 100.000
Thailand (29.700)	104	0.35
Nigeria* (56.400)	465*	0.824*
Togo (1.603)	33 (incomplete)	2.05

(Number of cases from Monthly EVS-1966, Population in 1964 and calculation of rates by DSI).

*292 cases out of the total of 465 are from Ibadan province in the Western Nigeria Region. Corrected morbidity per 100.000 therefore should be 0.31 for Nigeria (excluding Ibadan) and 48.7 for Ibadan only.

Tables 7, 8, 9 and 10 show the findings of antibodies against all three polio viruses. Again it should be borne in mind that the sera from Pakistan are from the population of three big cities but that the sera from the three other countries are from rural areas.

Figures 8, 9, 10 and 11 illustrate the immunological patterns of antibodies against three types of polio virus. The results are not surprising. We can only say that Type 2 in rural areas of Thailand, in the few years preceding 1962/63, and Type 3 in Togo, for a few years before 1965 were less common

Table 7 THAILAND

Poliovirus Antibodies by pH Test

Age Groups	No. of Sera Tested	Type I neg.	I 4	I 16	I 64	I 256+	Percent of Positives	Type II neg.	II 4	II 16	II 64	II 256+	Percent of Positives	Type III neg.	III 4	III 16	III 64	III 256+	Percent of Positives
2 - 3	10	2	0	0	2	6	80	7	1	1	1	0	30	4	0	1	1	4	60
3 - 4	10	0	1	2	2	5	100	4	0	1	1	4	60	1	1	3	4	1	90
4 - 5	10	3	0	0	1	6	70	1	0	2	0	7	90	2	0	0	6	2	80
5 - 6	10	1	0	2	2	5	90	2	1	0	4	3	80	2	0	3	2	3	80
6 - 10	20	2	0	2	4	12	90	0	1	3	7	9	100	2	1	2	9	6	90
11 - 20	20	0	0	3	9	8	100	1	2	2	7	8	95	1	1	5	7	6	95
20 +	20	0	0	4	8	8	100	3	2	6	7	2	85	0	0	5	13	2	100
TOTAL	100	8	1	13	28	50		18	7	15	27	33		12	3	19	42	24	

Table 8 PAKISTAN

Poliovirus Antibodies by pH Test

Age Groups	No. of Sera Tested	Type I					Percent of Positives	Type II					Percent of Positives	Type III					Percent of Positives
		neg.	4	16	64	256+		neg.	4	16	64	256+		neg.	4	16	64	256+	
2 - 3	9	1	1	2	2	3	89	0	2	2	1	4	100	1	4	1	2	1	89
3 - 4	13	1	1	3	5	3	92	0	0	3	7	3	100	1	5	3	3	3	92
4 - 5	7	0	0	0	4	3	100	0	0	3	3	1	100	0	0	1	4	2	100
5 - 6	9	0	0	2	2	5	100	0	1	3	3	2	100	0	0	5	3	1	100
6 - 10	38	0	1	9	22	6	100	0	3	9	21	5	100	0	7	14	15	2	100
11 - 20	73	1	5	30	25	12	99	1	6	35	22	9	99	7	18	35	6	7	90
20 +	152	4	15	78	49	6	98	8	17	73	49	5	96	14	36	76	26	0	91
TOTAL	301	7	23	124	109	38		9	29	128	106	29		23	68	135	59	16	

Table 9 EASTERN NIGERIA

Poliovirus Antibodies by pH Test

Age Groups	No. of Sera Tested	Type I					Percent of Positives	Type II					Percent of Positives	Type III					Percent of Positives
		neg.	4	16	64	256+		neg.	4	16	64	256+		neg.	4	16	64	256+	
2 - 3	13	7	1	2	3	0	46	5	2	2	2	2	62	6	4	2	0	1	54
3 - 4	31	4	3	15	5	4	87	9	3	5	9	5	71	9	5	12	5	0	71
4 - 5	37	5	3	13	11	5	86	5	5	10	9	8	86	5	10	11	8	3	86
5 - 9	81	8	8	26	26	13	90	3	16	22	29	11	96	4	26	32	15	4	95
10 - 14	92	6	21	41	21	3	93	3	13	34	39	3	97	8	27	43	12	2	91
15 - 19	21	0	4	13	4	0	100	1	5	8	5	2	95	7	4	1	1	0	66
20 - 29	64	0	16	34	11	3	100	3	15	26	17	3	95	5	27	21	10	1	92
30 - 39	79	3	22	36	14	4	96	2	30	29	16	2	97	8	25	36	6	4	90
40 - 49	56	5	19	23	8	1	91	6	18	25	7	0	84	7	22	19	8	0	88
50 - 59	34	5	9	16	4	0	85	9	15	8	2	0	97	8	14	9	3	0	76
60 +	26	4	8	8	6	0	85	1	10	9	6	0	96	0	15	8	3	0	100
TOTAL	534	47	114	227	113	33		47	132	178	141	36		67	179	194	71	15	

Table 10 TOGO

Policvirus Antibodies by pH Test

Age Groups	No. of Sera Tested	Type I neg.	I 4	I 16	I 64	I 256+	Percent of Positives	Type II neg.	II 4	II 16	II 64	II 256+	Percent of Positives	Type III neg.	III 4	III 16	III 64	III 256+	Percent of Positives
2 - 3	9	2	1	3	1	2	78	2	1	4	1	1	78	4	3	2	0	0	56
3 - 4	19	1	2	5	6	5	95	0	2	6	7	4	100	5	5	8	0	1	74
4 - 5	20	1	2	9	7	1	95	1	3	6	8	2	95	1	4	11	1	3	95
5 - 6	20	1	2	9	6	2	95	3	3	4	8	2	85	1	5	10	3	1	95
6 - 10	40	2	7	16	12	3	95	1	15	16	5	3	98	2	16	16	6	0	95
11 - 20	39	0	10	16	11	2	100	3	6	22	5	3	92	2	12	21	2	2	95
20 +	40	2	9	19	7	3	95	0	7	19	10	4	100	2	22	13	3	0	95
TOTAL	187	9	33	77	50	18		10	37	77	44	19		17	67	81	15	7	

than the other two types of polio virus.

No systematic vaccination against poliomyelitis was until now carried out in Pakistan or in the rural areas of the three other countries.

With some reservation (because of the number of investigated sera in Pakistan, Thailand and Togo larger representative samples of sera from Thailand and Togo will be investigated in the near future), the sample from Eastern Nigeria (no difference in the findings of polio antibodies in three subsamples) indicates that at the present time the population over about 5 years of age is well immunized against poliomyelitis by natural infection.

It should however be mentioned that our conclusion may have been different if we had had blood samples of the population of Ibadan in the Western Nigeria Region where a large outbreak of poliomyelitis was reported in 1964.

Therefore the results of the immunological surveys (polio antibodies pattern) presented here will be also useful in the near future because of changes and further developments in the ecological and epidemiological situation of poliomyelitis in tropical countries.

C. MEASLES

Method: Measles antibodies were determined by the haemagglutination-inhibition test using Takatsy's micromethod. After preliminary absorption of sera to concentrated monkey erythrocytes, four units of antigen (prepared from the "Boston" strain according to Rosen, 1961) were added per dilution of serum (from 1:2 or 1:4 to 1:256) and the mixture was held one hour at room temperature. Then 0,05 ml of Cereopithecus aethiops erythrocytes was added per well and the reaction was incubated one hour in a moist chamber at 37°C.

In calculating age, specific curve levels of antibody of 1:2 or above have been designated as positive.

Measles antibodies were investigated in the Measles National Reference Laboratory at the Institute of Epidemiology and Microbiology, Prague, (Dr J. Strauss) and the statistical work was carried out by Mr. J. Jelinek of the Statistical Department of the same Institute.

Results: Measles is not reported in Thailand and Pakistan. Table 11 shows the number of reported cases of measles in Eastern Nigeria and Togo in 1964.

Table 11*

Country (population in thousands)	Number of reported cases	Incidence per 100.000
Nigeria (56.400)	82,300	145,9
Togo (1.603)	14.955	932,9

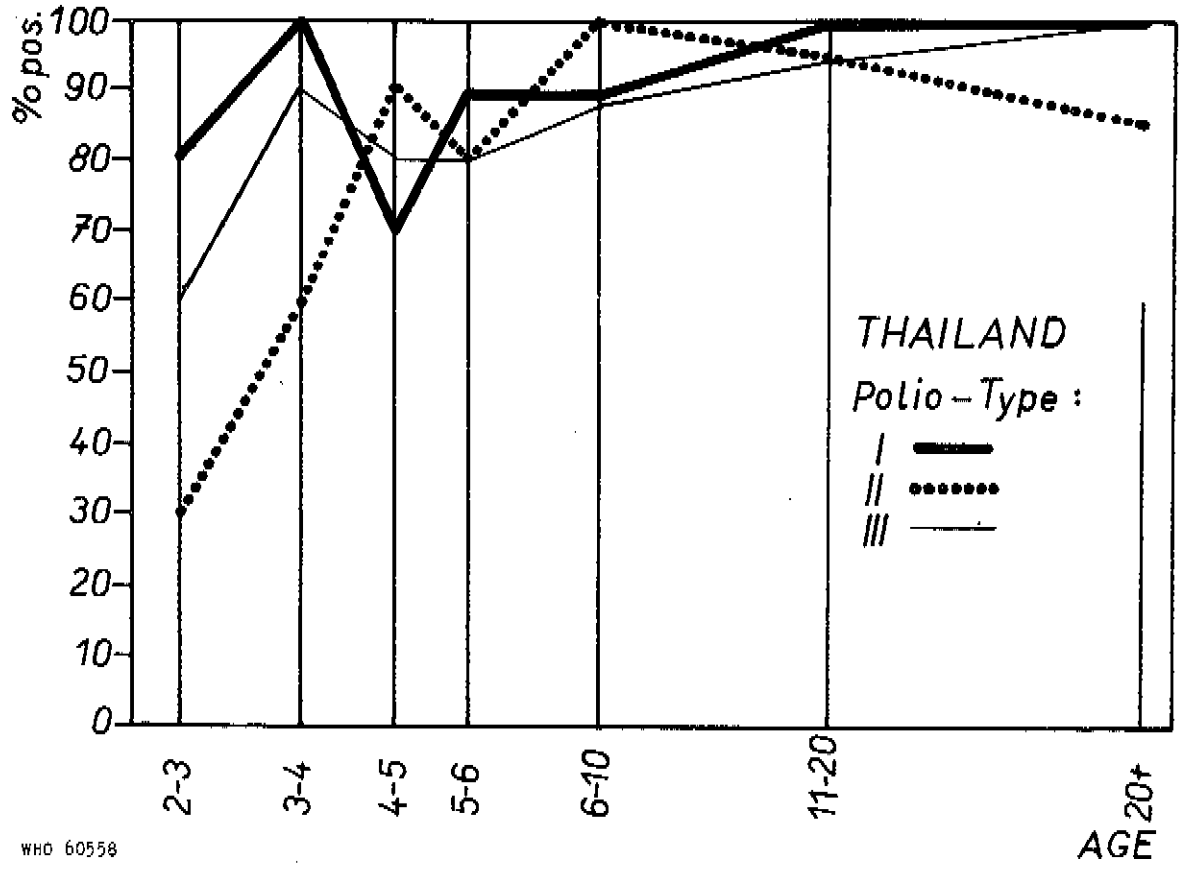
*Number of cases from Monthly EVS-1966. Population mid-1964 and calculation of rates by DSI.

Since 1961, the number of reported cases and deaths from measles in Nigeria has continuously increased. (Table 12).

Table 12. Measles morbidity and mortality in Nigeria since 1961

1961		1962	1963	1964	1965
Cases	26.093	36.894	56.522	82.300	80.132
Deaths	402	624	896	1.335	...

FIG. 8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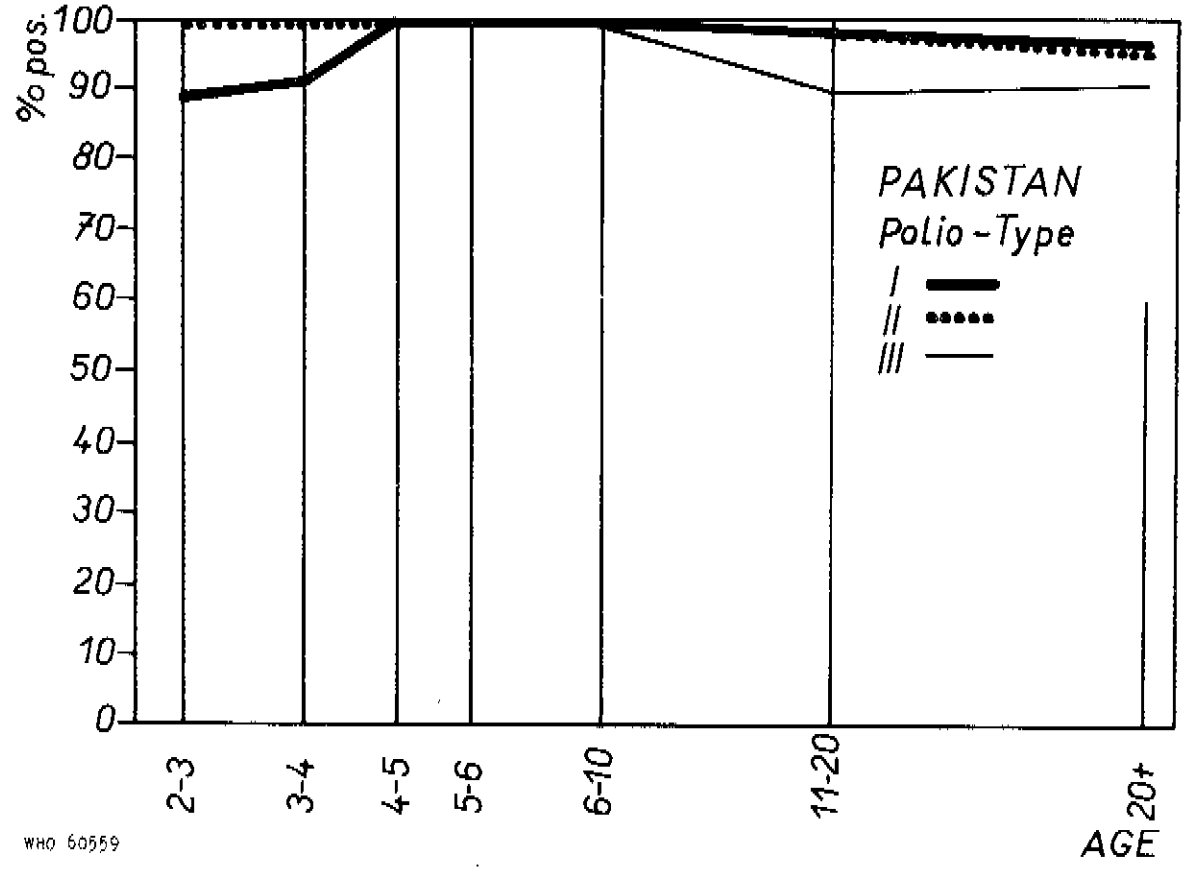
90
80
70
60
50
40
30
20
10
0
2-3
3-4
4-5
5-6
6-10
11-20
20+
AGE
THAILAND
Polio – Type :
I
II
III
WHO 60558

FIG. 9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70
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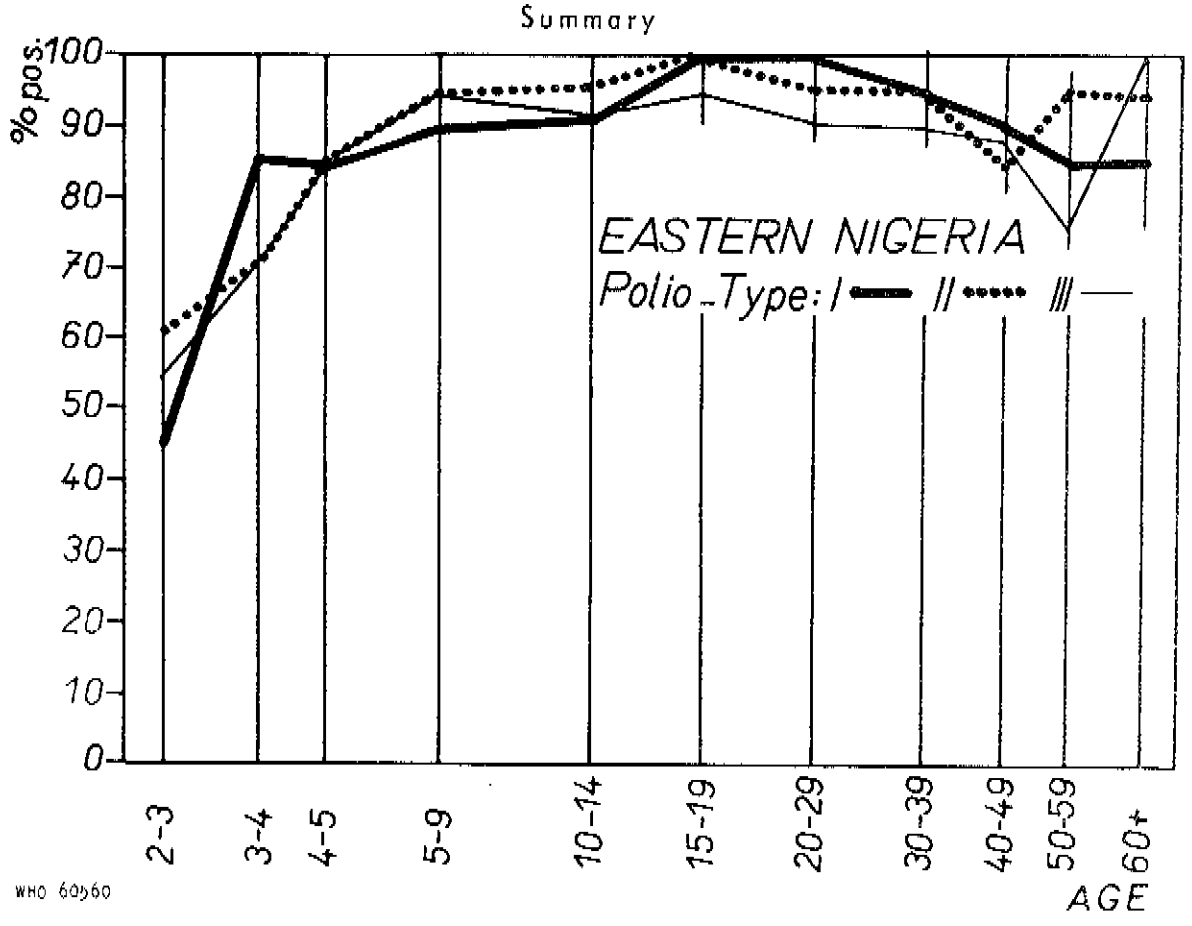
40
30
20
10
0
2-3
3-4
4-5
5-6
6-10
11-20
20+
AGE
PAKISTAN
Polio - Type
I
II
III
WHO 60559

FIG. 10


Summary
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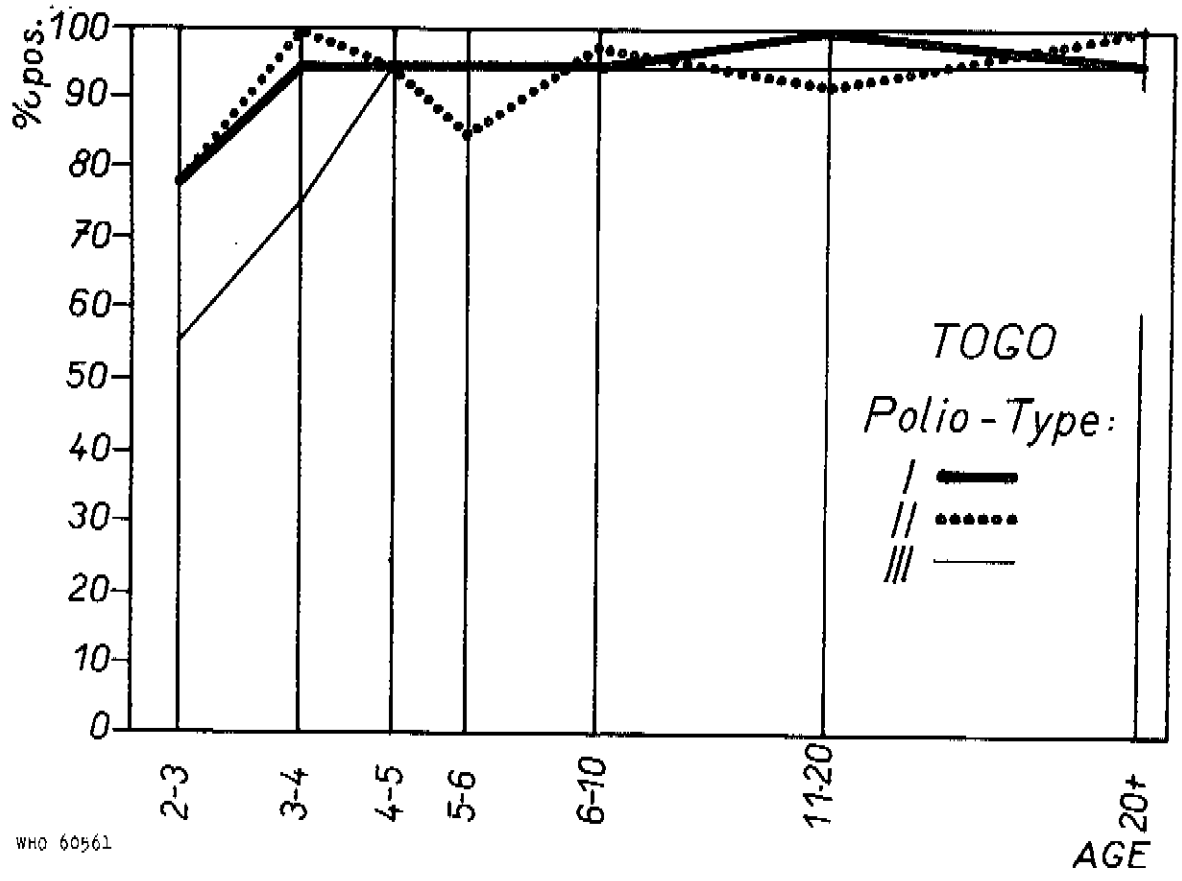
90
80
70
60
50
40
30
20
10
0
EASTERN NIGERIA
Polio Type: I II III
2-3
3-4
4-5
5-9
10-14
15-19
20-29
30-39
40-49
50-59
60+
AGE
WHO 60560

FIG. 11


%pos.
100
90
80
70
60
50
40
30
20
10
0
2-3
3-4
4-5
5-6
6-10
11-20
20+
AGE
TOGO
Polio - Type:
I
II
III
WHO 60561

Blood samples were collected in the areas where vaccination against measles had not yet started.

Tables 13, 14, 15 and 16 show the findings of measles antibodies of different levels in different age groups. Figures 12, 13, 14 and 15 illustrate the immunological patterns of measles antibodies in individual countries. Because of the small number of investigated sera in Pakistan, Togo and Thailand, no detailed analysis and conclusions can be made.*

Larger samples of sera from Thailand and Togo will be investigated in the near future. The serum sample from rural areas of Western Nigeria is representative. It is evident that in the rural areas of Eastern Nigeria vaccination against measles of children above the age of 4 will not be necessary.

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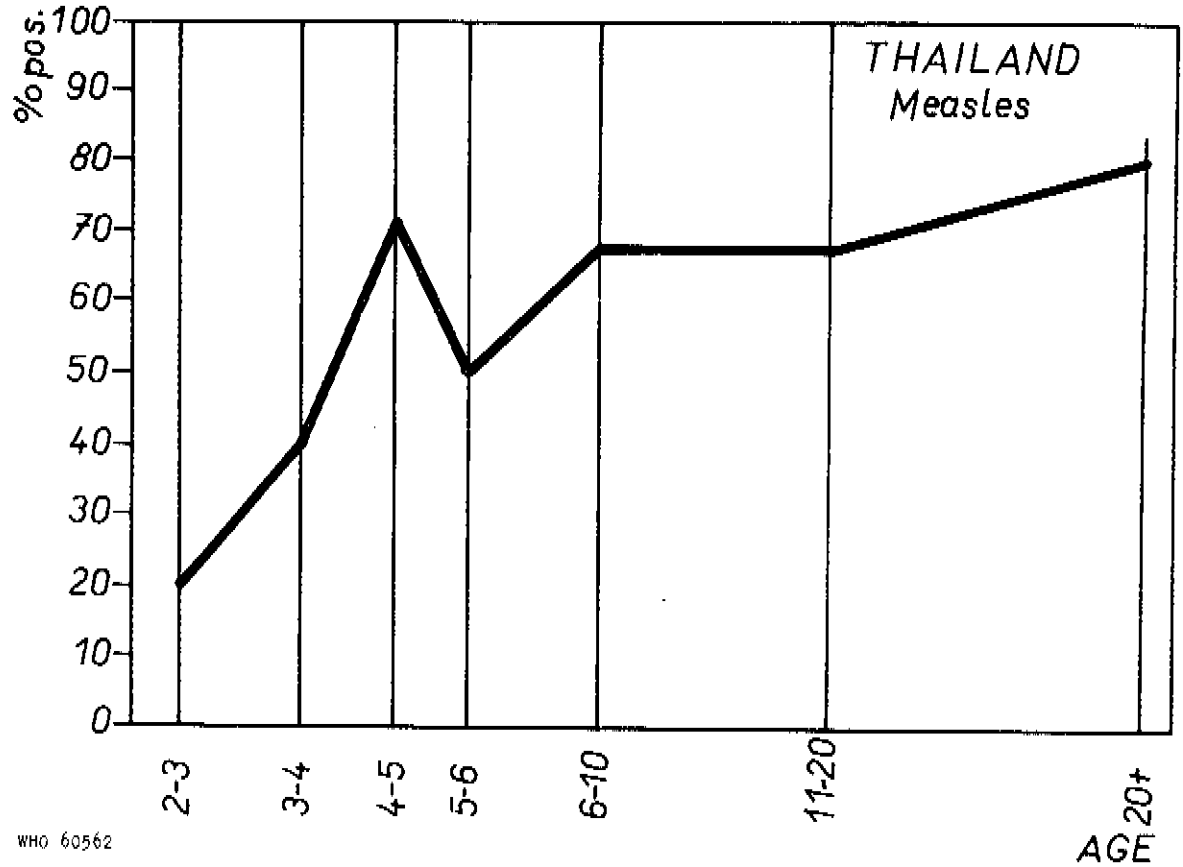
*Detailed results and analysis will be published later in extenso. This preliminary Surveillance Report should serve for immediate information of the WHO Regional Offices and the interested countries.

Table 13 THAILAND

HI ANTIBODIES TO MEASLES

Age Groups	No. of Sera Tested	Titres								Percent of Positives
		neg.	4	8	16	32	64	128	256	
2 - 3	10	8	0	0	1	0	1	0	0	20
3 - 4	10	6	0	0	2	1	1	0	0	40
4 - 5	10	3	0	1	2	1	1	1	1	70
5 6	10	5	0	1	4	0	0	0	0	50
6 - 10	19	6	0	3	4	4	2	0	0	68
11 - 20	19	6	1	2	3	6	1	0	0	68
20 +	20	4	2	5	0	4	4	1	0	80
TOTAL	98	38	3	12	16	16	10	2	1	

FIG. 12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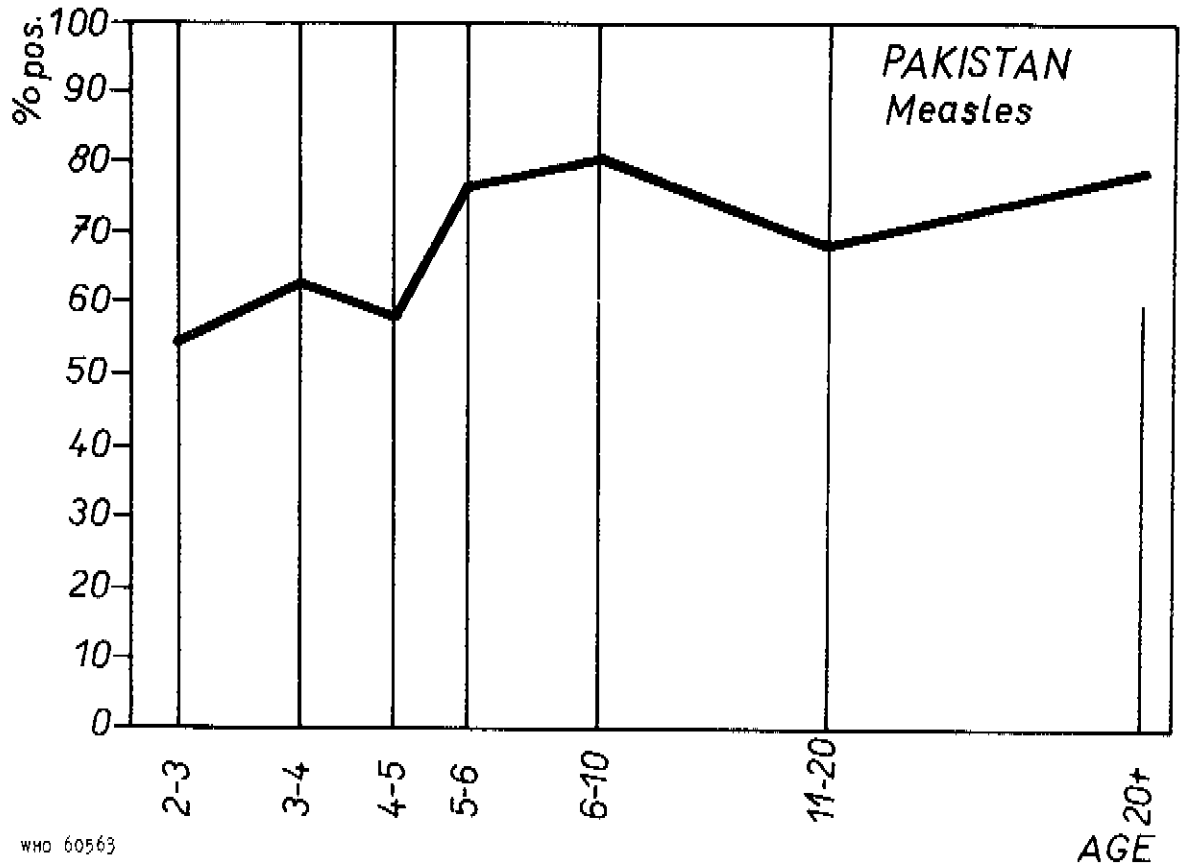
80
70
60
50
40
30
20
10
0
THAILAND
Measles
2-3
3-4
4-5
5-6
6-10
11-20
20+
AGE
WHO 60562

FIG. 13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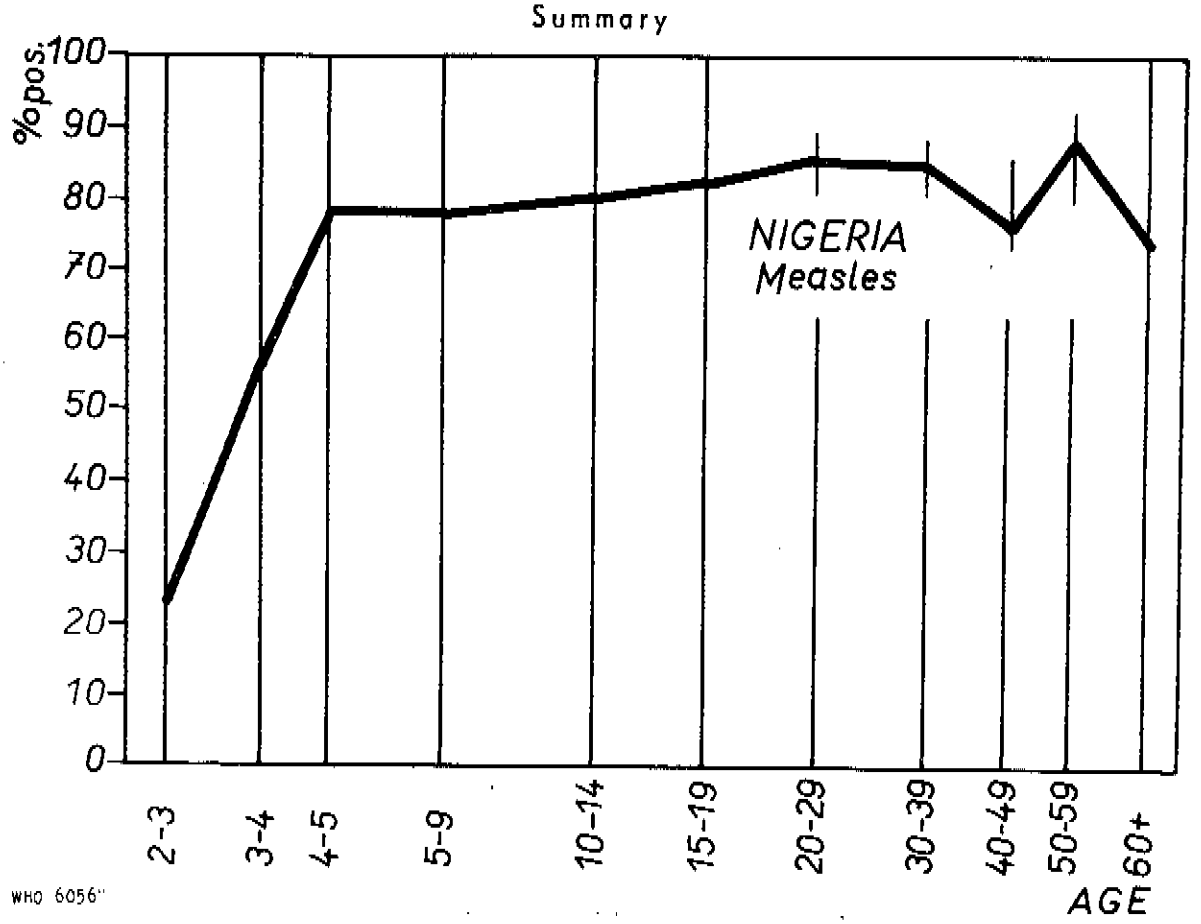
90
80
70
60
50
40
30
20
10
0
PAKISTAN
Measles
2-3
3-4
4-5
5-6
6-10
11-20
20+
AGE
WHO 60563

FIG. 14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90
80
70
60
50
40
30
20
10
0
NIGERIA
Measles
2-3
3-4
4-5
5-9
10-14
15-19
20-29
30-39
40-49
50-59
60+
AGE
WHO 6056"

FIG. 15

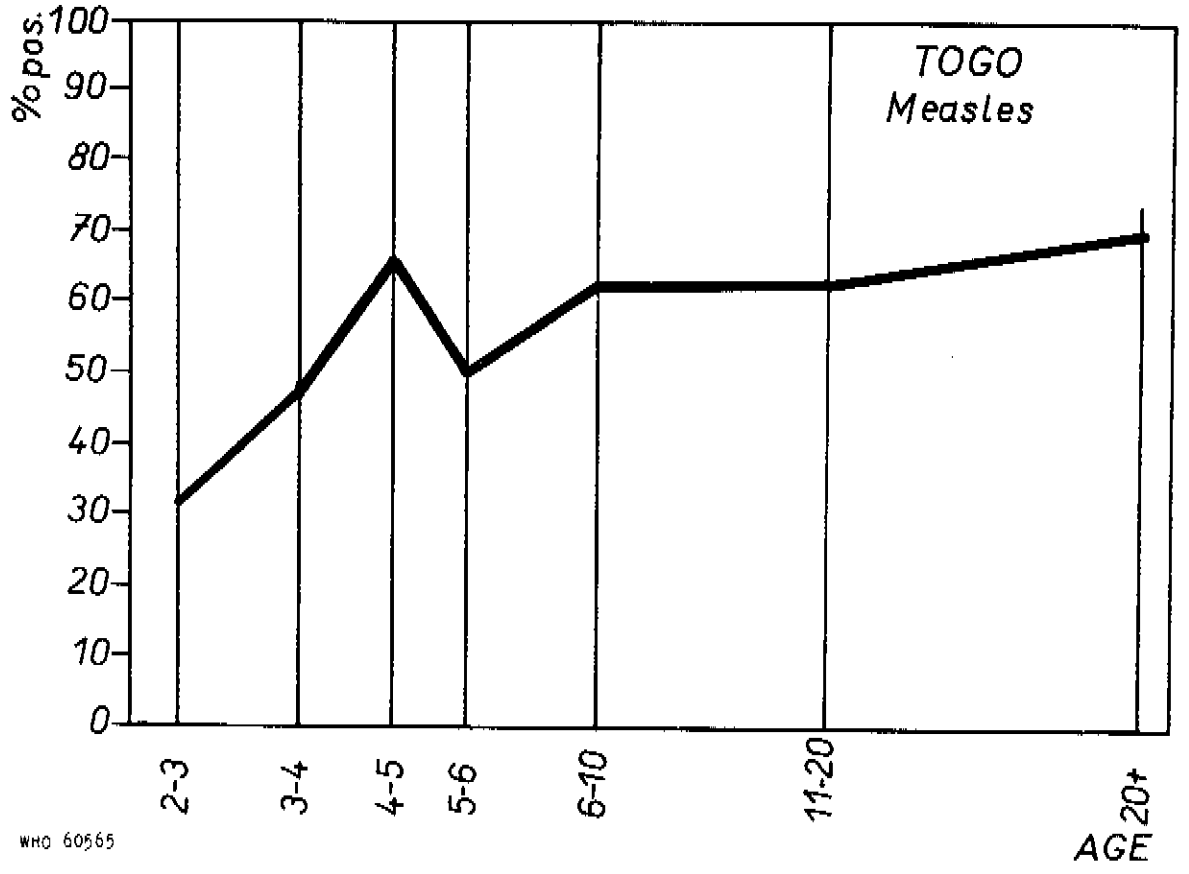
% pos.
100
90
80
70
60
50
40
30
20
10
0
TOGO
Measles
2-3
3-4
4-5
5-6
6-10
11-20
20+
AGE
WHO 60565

Table 14 PAKISTAN

HI-ANTIBODIES TO MEASLES

Age Groups	No. of Sera Tested	Titres neg.	4	8	16	32	64	128	256	Percent of Positives
2 - 3	13	6	0	0	0	2	2	3	0	54
3 - 4	21	8	2	0	4	3	3	1	0	63
4 - 5	12	5	0	1	1	3	1	1	0	58
5 - 6	17	4	2	1	4	3	0	2	1	77
6 - 10	60	12	1	12	12	7	7	6	3	80
11 - 20	87	17	6	15	28	15	3	2	1	69
20 +	174	36	27	29	42	26	10	4	0	79
TOTAL	384	88	38	58	91	59	26	19	5	

Table 15 EASTERN NIGERIA

HI ANTIBODIES TO MEASLES

Age Groups	No. of Sera Tested	Titres neg.	2	4	8	16	32	64	128	256	512	Percent of Positives
2 - 3	13	10	0	0	0	1	1	1	0	0	0	23
3 - 4	33	15	1	0	3	2	4	1	2	5	0	55
4 - 5	40	9	2	3	7	10	4	1	3	1	0	78
5 - 9	88	19	9	4	12	10	12	11	8	3	0	78
10 - 14	89	18	9	11	12	18	9	7	2	2	1	80
15 - 19	23	4	1	4	5	4	3	0	1	1	0	82
20 - 29	66	9	5	9	16	7	11	5	3	1	0	86
30 - 39	82	12	8	16	15	13	8	7	1	2	0	85
40 - 49	56	15	6	9	7	9	6	3	1	0	0	73
50 - 59	34	4	3	6	8	2	3	6	0	2	0	88
60 +	29	8	4	1	4	5	3	3	0	1	0	72
TOTAL	553	123	48	63	89	81	64	45	21	18	1	

Table 16 TOGO

HI ANTIBODIES TO MEASLES

Age Groups	No. of Sera Tested	Titres								Percent of Positives
		neg.	4	8	16	32	64	128	256	
2 - 3	12	8	0	1	1	2	0	0	0	33
3 - 4	19	10	1	3	1	3	0	0	1	48
4 - 5	21	7	1	2	5	4	2	0	0	67
5 - 6	20	10	0	2	2	3	2	0	1	50
6 - 10	40	15	4	3	6	8	1	1	2	63
11 - 20	40	15	5	9	3	3	3	1	1	63
20 +	39	12	7	9	5	6	0	0	0	70
TOTAL	191	77	18	29	23	29	8	2	5	