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Poliomyelitis in the World

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The incidence of poliomyelitis in different parts of the world is reviewed, mainly from publications of the World Health Organization. In countries of Europe and North America, and in several countries in other regions, the disease has fallen to insignificant proportions. However, in many countries in Africa, Asia, and Central and South America the incidence is rising and large outbreaks are being reported from those areas with increasing frequency. Such outbreaks are not yet as extensive as those previously common in Europe and North America before vaccines came into use but they are growing, and the countries concerned may be faced with widespread epidemics in the future. Where regular programmes of vaccination are not possible (as in many of the countries at risk) plans should be made now to control, by the application of appropriate epidemic control measures, the upsurges of poliomyelitis as soon as they are recognized.

An analysis of the world state of poliomyelitis from data available for 1951–55 and 1961–64 (i.e., before and after the use of vaccines) showed that a steep fall in incidence had occurred in Europe, North America and in several countries in other regions, but that in much of the tropics and subtropics the incidence was static or increasing (Drozdov & Cockburn, 1967). In this article, the situation is again reviewed and information for 1968, as far as it is available, is included.

The data come mainly, but not entirely, from publications of the World Health Organization, including *World Health Statistics Annual*, *Epidemiological and Vital Statistics Reports* and *Reports on the World Health Situation*, and are based on notifications from individual countries, some of which report only paralytic cases and others, both paralytic and non-paralytic cases. Values for incidence in most countries are inaccurate and the limitations imposed by the deficiencies must be borne in mind. Chastel (1969) reported that the real incidence in two tropical countries known to him was at least 50% greater than that given by Drozdov & Cockburn (1967). Similar, or greater, errors no doubt apply to the data from many other countries. However, the problem is one of under-reporting, not over-reporting, and the use of the data as sources of information on general trends of the disease is justifiable.

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As in the previous report, the countries of the world have been divided into three groups, namely: (1) Europe; (2) the USA, Canada, Australia and New Zealand; (3) Africa, Asia, and Central and South America.

EUROPE

In Table 1, data are given on the average annual number of cases of poliomyelitis registered in each of 23 European countries in 1951–55 and in 1961–65. Separate annual numbers are also given, when available, for the years 1966–68. In all the countries taken together, the annual incidence for the years 1966 and 1967 is about 3% of the annual average for the years 1951–55. In 1968, a further decrease would probably have been recorded but for a large outbreak in Poland.

The number of cases in many of the countries has progressively declined and has now reached a very low level but there are still a few countries in which the numbers fluctuate widely, or in which the fall has not been consistent over the years. These few countries account for most of the cases now being reported. Data for the USSR (Table 2) show that the incidence there was as low as in other well-vaccinated European countries.

In most countries in Europe, therefore, poliomyelitis is being well controlled by the systematic use of poliovirus vaccines. In the majority, live vaccine is used but in Scandinavia killed vaccine has given results as good as those obtained in other countries with live vaccine.

TABLE 1

POLIOMYELITIS IN EUROPE: AVERAGE ANNUAL NUMBERS OF CASES IN 1951–55 AND 1961–65, AND ANNUAL NUMBERS OF CASES IN 1966–68

	Average annual no. of cases in the following periods:		No. of cases in the following years:		
	1951–55	1961–65	1966	1967	1968
Austria	607	70	1	0	5
Belgium	475	79	8	3	2
Czechoslovakia	1 081	0	0	0	0
Denmark	1 614	77	1	0	1
Eastern Germany	1 187	1	0	0	—[a]
Fed. Rep. of Germany	3 702	1 058	17	54	59
Finland	372	7	0	0	0
France	1 672	837	211	108	79
Greece	367	276	3	54	58
Hungary	583	4	6	2	7
Iceland	193	1	0	0	—[a]
Ireland	121	33	1	0	1
Italy	3 335	2 138	133	104	78
Netherlands	599	34	14	2	9
Norway	979	40	2	0	1
Poland	2 226	41	11	5	493
Portugal	112	273	22	0	8
Romania	906	96	18	27	—[a]
Spain	1 004	1 170	238	341	162
Sweden	1 526	28	5	0	0
Switzerland	956	36	2	1	1
United Kingdom	4 381	322	38	28	40
Yugoslavia	361	44	97	95	16
Total	28 359	6 665	828	824	1 020 (527)[b]
Ratio to no. of cases in 1951–55		0.24	0.03	0.03	

[a] Data not available.
[b] Number in parentheses excludes Poland.

USA, CANADA, AUSTRALIA AND NEW ZEALAND

In the USA, Canada, Australia and New Zealand incidence has fallen steeply and progressively (Table 3). Compared with the years 1951–55, the reduction in 1966 was almost 400-fold and in 1968 it was 700-fold. In 1968 there was a slight increase in the number of cases in the USA but the total number of cases in the four countries combined was only 62, that is, 0.14% of the average annual incidence in 1951–55.

AFRICA, ASIA, AND CENTRAL AND SOUTH AMERICA

Information is given in Tables 4, 5 and 6 about the countries (mainly tropical or subtropical) in Africa, Asia, and Central and South America from which data were available.

TABLE 2

POLIOMYELITIS MORBIDITY IN THE USSR, AND IN SOME OF THE SOVIET REPUBLICS, BEFORE AND AFTER MASS VACCINATION WITH LIVE POLIOVIRUS VACCINES

	Yearly morbidity per 100 000 persons in the population [a]							
	Before vaccination		After vaccination					
	Years	Rate	1959–1962 [b]	1963	1964	1965	1966	1967
USSR	1956–58	6.4	1.6	0.30	0.19	0.13 [c]	0.12 [d]	0.06 [e]
RSFSR	1956–59	6.6	1.8	0.44	0.19	0.08	0.16	— [f]
Ukrainian SSR	1957–59	4.6	1.1	0.11	0.02	0.01	0.01	— [f]
Byelorussian SSR	1956–58	6.4	1.5	0.40	0.19	0.05	<0.01	— [f]
Kirghiz SSR	1957–59	6.1	1.2	0.20	0.20	0.10	— [g]	— [f]
Lithuanian SSR	1956–58	5.9	0.7	0.01	— [g]	<0.01	— [g]	— [f]
Latvian SSR	1955–58	12.0	0.5	— [g]	— [g]	— [g]	— [g]	— [f]
Estonian SSR [h]	1955–58	13.5	0.8	— [g]	— [g]	— [g]	— [g]	— [f]

[a] Data for 1955–62 from Drozdov (1967), for 1963–66 from Čumakov & Vorošilova (1967), for 1965–67, for the whole country, from Union of Soviet Socialist Republics (1968, p. 851).

[b] Data for USSR, RSFSR, Ukrainian SSR and Kirghiz SSR relate to 1960–62.

[c] 300 cases.

[d] 290 cases.

[e] 140 cases.

[f] Information not yet available.

[g] No cases reported.

[h] No cases reported in Estonian SSR since 1961.

TABLE 3

POLIOMYELITIS IN USA, CANADA, AUSTRALIA AND NEW ZEALAND: AVERAGE ANNUAL NUMBERS OF CASES IN 1951–55 AND 1961–65 AND ANNUAL NUMBERS OF CASES IN 1966–68

	Average annual no. of cases		No. of cases in:			Ratio to no. of cases in 1951–55			
	1951–55	1961–65	1966	1967	1968	1961–65	1966	1967	1968
USA	37 864	570	102	44	57	0.015	0.003	0.001	0.002
Canada	3 922	84	4	3	0	0.021	0.001	0.001	—
Australia	2 187	154	5	2	5	0.070	0.002	0.001	0.002
New Zealand	405	44	2	0	0	0.109	0.005	—	—
Total	44 378	852	113	49	62	0.019	0.003	0.001	0.001

TABLE 4

POLIOMYELITIS IN AFRICA: AVERAGE ANNUAL NUMBERS OF CASES IN 1951–55 AND 1961–65 AND ANNUAL NUMBERS OF CASES IN 1966–68

	Average annual no. of cases		Cases in:			Ratios for 1961–65/1951–55
	1951–55	1961–65	1966	1967	1968	
Algeria	33	172 [a]	172 [a]	—	— [b]	5.21
Angola	314	123	31	8	5	0.39
Botswana	3	6	2 [a]	— [b]	— [b]	2.00
Cameroon	16	30	6	52	112	1.88
Chad	5 [a]	9	34	12	6	1.80
Congo, Democratic Republic	925 [a]	478	377	437	522	0.52
Congo, People's Republic [c]	62 [a]	94	49	354	136	1.52
Dahomey	5	25	84	58	103	5.00
Ethiopia	10	159	61	95	134	15.90
Gabon	11 [a]	16	53	13	30	1.45
Ghana	59 [a]	29	7	5	10	0.49
Ivory Coast	26	43	57	94 [a]	272	1.65
Kenya	270	395	831	169	— [b]	1.46
Lesotho	5	17	35 [a]	— [b]	— [b]	3.40
Libya	26	269	465	168	— [b]	10.35
Madagascar	10	20	22	31	40	2.00
Malawi	16	69 [a]	121 [a]	— [b]	— [b]	4.31
Mali	31 [a]	96	89	420	412	3.10
Mauritius	80	1	5	— [b]	— [b]	0.01
Morocco	60	134	111 [a]	— [b]	— [b]	2.23
Mozambique	39	39	36	45	8	1.00
Niger	1 [a]	11	16	32	39	11.00
Nigeria	4	226	109	82	151	56.50
Portuguese Guinea	4	31 [a]	35	29 [a]	6	7.75
Réunion	7	7	22	12	1	1.00
Senegal	100 [a]	99	23	114	75	0.99
South Africa	616	233 [a]	107 [a]	— [b]	423	0.38
Southern Rhodesia	127	101	193 [a]	— [b]	— [b]	0.80
Tanzania [d]	121	321	465	112	247	2.65
Tunisia	23	81 [a]	6 [a]	— [b]	— [b]	3.52
Uganda	119	194	21	13	33	1.63
United Arab Republic	475	273	204 [a]	— [b]	— [b]	0.57
Upper Volta	18 [a]	55	88	— [b]	— [b]	3.06
Zambia	39	76 [a]	46 [a]	— [b]	— [b]	1.95
Total	3 660	3 932	3 983			1.07

[a] Data do not cover the whole period.
[b] Information not yet available.
[c] Previously known as Congo (Brazzaville).
[d] These data refer to that part of Tanzania previously known as Tanganyika

TABLE 5

POLIOMYELITIS IN CENTRAL AND SOUTH AMERICA: AVERAGE ANNUAL NUMBERS OF CASES IN 1951–55 AND 1961–65 AND ANNUAL NUMBERS OF CASES IN 1966–68

	Average annual no. of cases		Cases in:			Ratios for 1961–65/1951–55
	1951-55	1961-65	1966	1967	1968	
Argentina	1 071	812	404	78	214	0.76
Chile	468	355	130	71	54	0.76
Colombia	103	443	273	422	184	4.30
Costa Rica	232	25	10	7	4	0.11
Cuba	144	79	0	0	— [a]	0.55
Dominican Republic	3 [b]	91	12	61	30	30.33
Ecuador	43	121	148	796	52	2.81
El Salvador	49	58	36	139	67	1.18
Guatemala	71	156	118	241	141	2.20
Guyana	3	99	0	0	— [a]	33.00
Honduras	40 [b]	78	38	79	54	1.95
Jamaica	168	33	6	7	0	0.20
Mexico	1 365	511	787	636	860	0.37
Nicaragua	82	77	3	461	8	0.94
Paraguay	58	42	8	57	69	0.72
Peru	107	592	152	207	270	5.53
Puerto Rico	146	5	1	0	0	0.03
Trinidad and Tobago	42	7	2	3	1	0.17
Uruguay	158	27	28	19	— [a]	0.17
Venezuela	286	292	134	67	484	1.02
Total	4 639	3 903	2 290	3 351		0.84

[a] Information not yet available.
[b] Data do not cover the whole period.

Africa

In Africa (Table 4), 34 countries are listed and in 24 of them the average annual number of cases in 1961-65 increased, compared with the period 1951–55 and in 16 the increase was 2-fold or greater. In 3 countries there was no change and 7 showed a reduction, usually small.

Central and South America

A total of 20 countries in Central and South America are listed (Table 5). In 8 the annual average number of cases was greater in 1961–65 than in 1951–55, and in 11 there were reductions, some of which were substantial. In 1 there was practically no change.

Asia

The information for Asia is scanty, data being available from 17 countries, the populations of which represent only a small proportion of the total Asian population. As shown in Table 6, 12 of the 17 showed increases in 1961–65 compared with the period 1951–55; in the other 5 countries there were decreases.

TABLE 6

POLIOMYELITIS IN ASIA: AVERAGE ANNUAL NUMBERS OF CASES IN 1951–55 AND 1961–65 AND ANNUAL NUMBERS OF CASES IN 1966–68

	Average annual no. of cases		Cases in:			Ratios for 1961–65/1951–55
	1951–55	1961–65	1966	1967	1968	
Cambodia	29	24	11	13	—[a]	0.83
Ceylon	196	591	367	138	1 101	3.02
Hong Kong	34	155	33	6	15	4.56
Indonesia	129	52	26	22	—[a]	0.40
Iran	60[b]	464	328[b]	—[a]	—[a]	7.73
Iraq	74	231	497	—[a]	243	3.12
Israel	704	51	9	34	19	0.07
Japan	2 414	604	32	27	20	0.25
Jordan	46	104	75	157	62	2.26
Laos	1	157	280	20	6	157.00
Lebanon	34	284	483	197	227	8.35
Macau	2	9	3	2	8	4.50
Malaysia	124	174	97	38	268	1.40
Philippines	295	497	573	—[a]	301[b]	1.68
Singapore	55	39	10	3	4	0.71
Taiwan	478[b]	535[b]	563[b]	—[a]	—[a]	1.12
Turkey	43	676	1 975	814	2 069	15.72
Total	4 718	4 647	5 362			0.98

[a] Information not yet available.
[b] Data do not cover the whole period.

TRENDS IN TROPICAL AND SUBTROPICAL COUNTRIES

Considering the 71 tropical and subtropical countries listed in Tables 4–6, it is found that during 1961–65 the incidence increased, compared with the period 1951–55, in 45 and that in these countries the total number of cases in 1966 was 9163 compared with an annual average of 3010 in 1951–55: a 3-fold increase. The accompanying figure represents the general trend of poliomyelitis morbidity in these countries compared with that in Europe, USA, Australia and New Zealand. The data for 1967 and 1968 are not yet sufficiently complete to allow the curve to be extended to include these years.

The most disquieting feature of Tables 4–6 is that in many countries large numbers of cases were recorded in 1966–68. In this 3-year period, 100 or more cases *per annum* were recorded one or more times in 38 of the 71 countries listed, 200 or more cases in 26, and 400 or more cases in 18. The largest numbers of reported cases in any one of the three years were 831 in Africa (Kenya), 860 in the Americas (Mexico) and 2069 in Asia (Turkey).

AGE INCIDENCE OF POLIOMYELITIS IN TROPICAL COUNTRIES

Poliomyelitis in tropical countries is still an infantile disease, most of the cases occurring in children below the age of 5 years (Table 7). The information on age incidence has been confirmed in serological surveys carried out by numerous workers. However, there are indications that, due to factors

TABLE 7

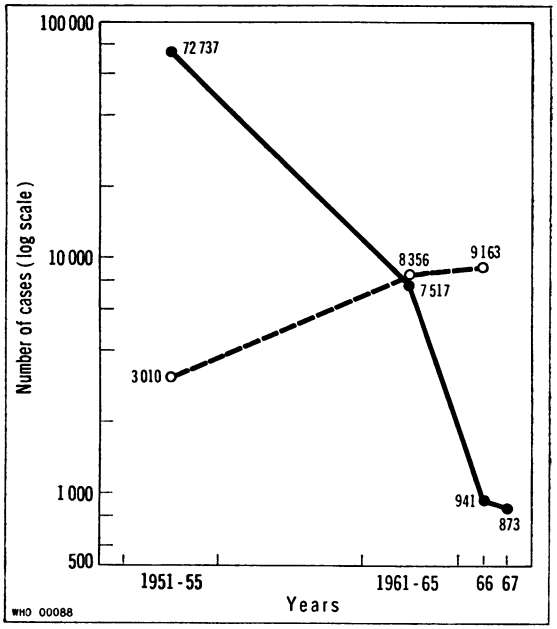
POLIOMYELITIS; PERCENTAGE OF PATIENTS IN THE 0–4 YEARS AGE-GROUP IN CERTAIN COUNTRIES IN AFRICA, ASIA, AND SOUTH AND CENTRAL AMERICA

	Percentage of patients in the 0–4 years age-group		
	1955–57	1958–61	1962–65
Africa			
Angola	54	83	56
Mozambique	70	70	55 [a]
Southern Rhodesia	65	71	— [b]
South Africa	61	70	82 [a]
Americas			
Argentina	75	80	84 [a]
Chile	83	85	79
Colombia	65	74	80
Costa Rica	81	84	81 [a]
Jamaica	48	60	77
Mexico	88	95	94 [a]
Nicaragua	91	94	79 [a]
Paraguay	61	85	89
Peru	88	94	96
Puerto Rico	71	85	59 [a]
Venezuela	86	82	88
Asia			
Hong Kong	64	86	94
Israel	88	77	95
Japan	79	83	47
Jordan	96	94	94 [a]
Lebanon	92	94	98 [a]
Philippines	82	72	73
Taiwan	96	97	97 [a]
Turkey	64	66	89 [a]

[a] Data do not cover the whole period.
[b] No data available.

which are not clearly understood, the proportion of young children experiencing contact with natural infections is decreasing. Table 8, which contains information on the age distribution of children with antibody to the three types of poliovirus in Ibadan,

AVERAGE ANNUAL NUMBERS OF CASES OF POLIOMYELITIS IN 1951–55 AND 1961–65, AND ANNUAL NUMBERS OF CASES IN 1966 AND 1967



For 23 European countries plus the USA, Canada, Australia and New Zealand.

For 45 countries in Africa, Asia and South and Central America.

Nigeria, illustrates this point. Considerably less than 50% of the children aged between 5 months and 24 months were immune to any one of the three types of poliovirus. This increase in age at first infection may be due to increasing urbanization or to some other environmental factors and it may explain, to some extent at least, the rising incidence of poliomyelitis in tropical countries.

RELATIONSHIP BETWEEN THE INCIDENCE OF POLIOMYELITIS AND INFANT MORTALITY RATES

Payne (1955) has shown that when infant mortality rates fall clinical poliomyelitis tends to increase. There has been a considerable fall between 1951–55 and 1961–65 in infant mortality rates in most warm-climate countries for which information is available (Table 9). In 1951–55, 14 of the 25 countries in the table had infant mortality rates of 75 or more per 1000 live births but by 1961–65 only 5 countries remained in this category. Paul (1958) has tated that when the infant mortality rate in a country falls below 75 per thousand it is well to

TABLE 8

AGE-DISTRIBUTION OF CHILDREN WITH POLIOMYELITIS VIRUS ANTIBODY BEFORE VACCINATION IN IBADAN, NIGERIA [a]

Age-group (months)	Poliovirus type 1	Poliovirus type 2	Poliovirus type 3
5–7:			
No. tested	21	21	20
Immune (%)	4.8	0	15.0
8–11:			
No. tested	62	64	63
Immune (%)	14.5	3.1	26.9
12–15:			
No. tested	68	66	66
Immune (%)	29.4	12.1	48.5
16–19			
No. tested	69	67	69
Immune (%)	50.7	13.4	47.8
20–23:			
No. tested	20	20	20
Immune (%)	45.0	5.0	50.0
≥24			
No. tested	50	52	50
Immune (%)	68.0	48.0	68.0
Total:			
No. tested	290	290	288
Immune (%)	37.2	15.5	44.8

[a] This table is taken from Poliomyelitis Commission of the Western Region Ministry of Health, Nigeria (1966).

watch carefully for an increase in the incidence of poliomyelitis, and it is interesting that of the 9 countries in which the rate fell below 75 per thousand between the two periods under review, 6 reported an increasing number of cases—namely, El Salvador and Guyana in the Americas and Ceylon, Jordan, Malaysia and the Philippines in Asia. Nicaragua, where the fall in infant mortality rate was accompanied by a reduction in the incidence of poliomyelitis up to 1965, experienced a large epidemic in 1967. Costa Rica, where fewer cases were reported, established an effective vaccination programme before 1965.

DIFFERENT TYPES OF POLIOVIRUSES IN PARALYTIC POLIOMYELITIS BEFORE AND AFTER THE INTRODUCTION OF POLIOVIRUS VACCINES ON A MASS SCALE

Little is known about the comparative epidemiological importance of the three different types of poliovirus prior to the introduction of vaccination.

TABLE 9

RELATIONSHIP BETWEEN THE INCIDENCE OF POLIOMYELITIS AND INFANT MORTALITY RATES [a] IN SOME COUNTRIES OF ASIA AND CENTRAL AND SOUTH AMERICA

	Infant mortality rates [b]		Average annual no. of cases of poliomyelitis	
	1951–55	1961–65	1951–55	1961–65
Americas				
Argentina	63.8	59.4	1 071	812
Chile	*131.3*	114.0	468	355
Colombia	*109.8*	86.6	103	443
Costa Rica	*82.2*	74.2	232	25
Ecuador	*115.4*	94.7	43	121
El Salvador	*80.8*	69 2	49	58
Guatemala	*99.3*	89.9	71	156
Guyana	*76.4*	47.4	3	99
Honduras	62.0	45.4	40 [c]	78
Jamaica	69.8	45.7	168	33
Mexico	*89.7*	66.8	1 365	511
Nicaragua	*75.3*	56.0	82	77
Peru	*98.3*	88.1	107	592
Puerto Rico	62.0	55.6	146	5
Uruguay	50.9	46.3 [c]	158	27
Venezuela	73.4	48.8	286	292
Asia				
Ceylon	*75.6*	54.4 [c]	196	594
Hong Kong	69.2	31.5	34	155
Israel	36.2	28.9	704	51
Japan	48.0	23.4	2 414	604
Jordan	*80.9*	50.0	46	104
Malaysia	*86.2*	56.3	124	174
Philippines	*96.4*	71.3	295	497
Singapore	63.5	29.6	55	39
Taiwan	33.4	26.4	478 [c]	535

[a] Deaths per 1000 live births.
[b] Values in italics are infant mortality rates in excess of 75 per 1000 live births in 1951–55.
[c] Data do not cover the whole period.

In the first large study—the typing in 1948–52 of 196 strains of poliovirus isolated from cases between the years 1909 and 1951 in 19 countries in different parts of the world—82% belonged to type 1, 10% to

TABLE 10

TYPE DISTRIBUTION OF POLIOVIRUS STRAINS ISOLATED FROM PARALYTIC CASES OF POLIOMYELITIS IN USA IN 1952 AND IN 1958–67 [a]

Year	Total no. of poliomyelitis cases registered	No. of paralytic cases registered	No. of poliovirus strains isolated and typed	Type distribution of strains isolated					
				type 1		type 2		type 3	
				No.	%	No.	%	No.	%
1952			794	637	80.2	111	14.0	46	5.8
1958	5 787	3 301	1 121	898	80.1	29	2.6	194	17.3
1959	8 425	5 472	2 119	1 881	88.8	10	0.5	228	10.8
1960	3 190	2 218	823	603	73.3	1	0.1	219	26.6
1961	1 312	829	382	231	60.5	6	1.6	145	37.9
1962	910	691	408	300	73.5	8	2.0	100	24.5
1963	449	336	197	160	81.2	6	3.0	31	15.7
1964	122	91	51	21	41.2	6	11.8	24	47.0
1965	72	81	38	19	50.0	8	21.1	11	28.9
1966	125	102	74	55	74.3	13	17.6	6	8.1
1967	47	41	29	16	55.2	6	20.7	7	24.1
Average									
1952 [b]			794		80.2		14.0		5.8
1958–61 [c]	4 678	2 955	1 111		81.3		1.0		17.7
1962–64 [d]	494	373	219		73.3		3.0		23.7
1965–67 [e]	81	68	47		63.9		19.1		17.0

[a] Data for 1952 are taken from Shelokov, Habel & McKinstry (1955); data for 1958–67 are taken from US Public Health Service Poliomyelitis Surveillance Reports prepared by the National Communicable Disease Center, Atlanta, Ga., USA.

[b] Before the introduction of inactivated poliovaccine.

[c] Intensive use of inactivated poliovaccine.

[d] Start of vaccination programmes and intensive use of live poliovaccines.

[e] Follow-up vaccination programmes (with both inactivated and live vaccines).

type 2 and 8% to type 3 (Committee on Typing of the National Foundation for Infantile Paralysis, 1953). In subsequent studies in several countries it was shown that although type 1 predominated, types 2 and 3 also caused poliomyelitis but that their prevalence fluctuated in different countries in different years.

Cockburn (1962) drew attention to the apparent proportional increase of isolations of type 3 virus from paralytic cases in different parts of the world after the introduction of vaccination. Other data also showed that the proportion of paralytic cases due to type 3 poliovirus increased during the use of both inactivated and live vaccines. In Table 10, data are given for the USA and similar findings have been reported from Hungary (Dömök, personal communication; Kátay, 1966, 1967) and from Poland (Kulesza, 1966). Some observers, e.g., Lee, Lim & Kanagaratnam (1965) reporting from Singapore, did not find such a change.

For several years WHO has been privileged to receive information on the isolation of viruses in laboratories in some 30 countries. The details of the distribution of poliovirus types according to the information collected for the years 1954–67 are given in Table 11. North America and Europe are more adequately covered than other parts of the world and there are definite limitations to the conclusions which can be drawn from the incomplete data available.

The countries have been grouped by region, and within regions those with an incidence of polio-

TABLE 11

DISTRIBUTION OF TYPES OF POLIOMYELITIS VIRUS IN CERTAIN WORLD AREAS, 1964–67

Area	Virus type	Source and numbers of specimens							
		Disease of central nervous system			Disease not affecting central nervous system			No information	Grand total
		Paralytic cases	Non-paralytic cases	Total	Cases with pyrexia and/or gastro-intestinal symptoms	Symptom-less excreters or unrelated illnesses	Total		
North America	1	15	14	29	5	38	43	7	79
	2	7	15	22	19	50	69	10	101
	3	9	20	29	14	78	92	7	128
	Total	31	49	80	38	166	204	24	308
Latin America (mainly Mexico)	1	950	1	951	17	12	29	65	1 045
	2	15	0	15	1	1	2	0	17
	3	43	0	43	1	1	2	3	48
	Total	1 008	1	1 009	19	14	33	68	1 110
Europe; France	1	89	30	119	19	110	129	10	258
	2	30	9	39	2	27	29	4	72
	3	18	4	22	6	29	35	0	57
	Total	137	43	180	27	166	193	14	387
Europe; other countries	1	69	51	120	45	238	283	23	426
	2	24	42	66	76	309	385	31	482
	3	50	37	87	70	301	371	20	478
	Total	143	130	273	191	848	1 039	74	1 386
South Africa	1	472	32	504	12	13	25	143	672
	2	38	1	39	6	5	11	17	67
	3	98	11	109	8	10	18	27	154
	Total	608	44	652	26	28	54	187	893
Asia; Thailand	1	105	0	105	2	2	4	0	109
	2	10	1	11	0	3	3	0	14
	3	2	0	2	0	4	4	0	6
	Total	117	1	118	2	9	11	0	129
Asia; Japan	1	1	1	2	0	3	3	0	5
	2	1	3	4	7	7	14	3	21
	3	11	1	12	5	6	11	0	23
	Total	13	5	18	12	16	28	3	49
Asia; Indonesia, Hong Kong, Singapore	1	124	3	127	5	0	5	2	134
	2	3	0	3	5	2	7	9	19
	3	5	1	6	1	0	1	1	8
	Total	132	4	136	11	2	13	12	161
All areas	1	1 825	132	1 957	105	416	521	250	2 728
	2	128	71	199	116	404	520	74	793
	3	236	74	310	105	429	534	58	902
	Total	2 189	277	2 466	326	1 249	1 575	382	4 423

myelitis known to be higher than average are differentiated. The total number of strains identified from all sources was 4423 and 61% belonged to type 1, 18% to type 2 and 20% to type 3. Of the strains from paralytic cases, 83% belonged to type 1, 6% to type 2 and 11% to type 3. The distribution of strains from non-paralytic cases was similar to that from paralytic cases. In contrast, almost equal numbers of the different types were isolated from persons without disease of the central nervous system, many of whom were symptomless excreters. Probably, many of these strains were vaccine strains but there is no definite information on this point.

The most interesting feature of Table 11 is that in areas without adequate vaccination programmes, type 1 poliovirus is responsible for much of the disease of the central nervous system but in areas with good vaccination programmes approximately equal numbers of the three types are isolated from patients with disease of the central nervous system and from patients with other diseases or no illness.

DISCUSSION

Despite their deficiencies, the data presented demonstrate very clearly that there are two distinct groups of countries, namely, those in which poliomyelitis has been reduced to a level where it is no longer a serious public health problem and those in which the disease is apparently increasing.

Some of the countries in which the incidence has fallen have depended on live vaccines and others on inactivated vaccines, seemingly with equal success. Not only has the incidence of disease been reduced but it has become difficult to isolate " wild " polioviruses, in spite of the diligent efforts made by workers in countries using live vaccines (e.g., Dömök & Molnar, 1963; Drozdov, 1967; Zacek, personal communication) and in countries using inactivated vaccines (e.g., Böttiger et al., 1966). In these conditions, the disease is likely to decrease even further if effective vaccination of susceptible persons entering the community, by birth or population movement, is continued. The need for such programmes using vaccines containing all three types of virus is probably shown by the outbreak due to type 3 in 1968 in Poland where, since 1962, the live vaccine has contained only types 1 and 2 and since 1966 no inactivated vaccine has been employed. Furthermore, in order to ensure the maintenance of a high level of immunity in all age-groups, it is desirable to carry out serological surveys from time to time on adequately sized groups of randomly chosen individuals and to establish a scheme for the detection of wild virus in communities, for example by the examination of sewage or of faecal samples from children.

In countries where the reported incidence of poliomyelitis is increasing, the situation grows more serious every year as outbreaks become more common and larger in extent. In terms of numbers of cases, the epidemics have not yet reached the levels of those common in Europe and North America before vaccines were available but their size is increasing year by year.

If past experience in temperate-climate countries is a guide, some countries in the tropics and subtropics may have to deal with widespread epidemics before their health services are sufficiently well developed to provide an adequate and regular vaccination programme. Every effort should be made to give priority to programmes of vaccination against those diseases for which effective vaccines are available since they are among the most successful and least expensive control measures available. However, it is unrealistic to suppose that the difficulties can be overcome quickly. In these circumstances, a useful and practicable step within the means of health authorities in all countries is to plan ahead to control upsurges of poliomyelitis (and other infectious diseases) as soon as they are recognized. Arrangements should be made for the isolation and rapid identification of the epidemic agent and for sufficient vaccine to deal with the first stages of the control campaign to be available.

There is considerable evidence (Montefiore et al., 1963; Winter et al., 1963; Lee, Lim & Kanagaratnam, 1965) that, as measured by antibody production, live poliovirus vaccines in warm-climate countries do not produce the high proportions of conversions that have been obtained in countries with temperate climates, but some workers (Sabin et al., 1960; Hozinskij, Karaseva & Svežinina, 1961) have had more success. This subject is one for further scientific study of possible factors such as interference from other enteroviruses present in the gut when the vaccine is administered orally, the presence of antibody in breast milk, the development of cell-resistance due to previous exposure to natural polioviruses (or perhaps to related viruses), or protein deficiency. Whatever the ultimate scientific explanation may be, practical experience has shown that the administration of vaccine, preferably in repeated doses, to a high proportion of the

presumed susceptible population in an epidemic area is as effective a means of cutting short an epidemic in a warm-climate country as it is in a temperate-climate country. Moreover, a high degree of population immunity can be achieved in warm-climate countries by the use of an adequate number of doses of live vaccine on a regular basis for susceptible new recruits into communities.

RÉSUMÉ

LA POLIOMYÉLITE DANS LE MONDE

Les auteurs analysent la situation mondiale en matière de poliomyélite et présentent, dans une série de tableaux, les données relatives à l'incidence de la maladie pour les périodes 1951-1955 et 1961-1965 et, plus récemment, pour les années 1966-1968. La plupart de ces informations sont extraites des publications de l'Organisation mondiale de la Santé et basées sur les notifications en provenance des divers pays. Leur exactitude est certes sujette à caution et leur valeur relative. Cependant, étant donné que la fréquence réelle de la poliomyélite est très vraisemblablement supérieure à celle qui ressort des données statistiques, on peut admettre que ces dernières fournissent des indications valables sur les tendances épidémiologiques générales de l'affection.

Pour l'exposé de la situation, les pays ont été répartis en trois groupes: *a*) Europe; *b*) Etats-Unis d'Amérique, Canada, Australie et Nouvelle-Zélande; *c*) Afrique, Asie, Amérique centrale et Amérique du Sud. Depuis la mise en œuvre de la vaccination antipoliomyélitique, l'incidence de la maladie a diminué de plus de 30 fois en Europe et de plus de 700 fois en Amérique du Nord et en Océanie. Par contre, dans le reste du monde, on a enregistré en règle générale une augmentation du nombre des cas. Cette tendance à la recrudescence de la poliomyélite persiste actuellement et on signale des poussées épidémiques importantes dans bon nombre de pays d'Afrique, d'Asie, d'Amérique centrale et d'Amérique du Sud. Bien que ces épidémies n'atteignent pas encore l'ampleur de celles qui ont atteint l'Europe et l'Amérique du Nord avant l'ère de la vaccination, elles présentent pour les pays concernés un danger de plus en plus menaçant.

Il est avéré que dans les pays tropicaux et semi-tropicaux les taux de séroconversion obtenus après emploi de vaccins antipoliomyélitiques vivants ne sont pas aussi élevés que ceux que l'on enregistre dans les pays à climat tempéré. Plusieurs hypothèses peuvent être avancées pour expliquer ce phénomène. Quels que soient les facteurs en cause, il est néanmoins possible d'enrayer les épidémies de poliomyélite qui surviennent dans les pays chauds en administrant le vaccin, de préférence à doses répétées, à une grande partie de la population présumée réceptive. En outre, la mise en œuvre régulière de programmes de vaccination bien conçus devrait permettre d'assurer aux habitants de ces pays un degré élevé d'immunité et de réduire fortement l'incidence de la maladie.

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