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POLIOMYELITIS AND ITS CONTROL

POLIOMYELITIS IN THE EASTERN MEDITERRANEAN REGION

1. INTRODUCTION

There is paleopathological evidence that poliomyelitis has existed in this part of the world since ancient times. Flinders Pitrie in 1932[1] discovered south of Cairo a skeleton dating back to about 3700 B.C., the left leg of which was much shorter than the right, and Van Rooyen suggests that the cause was probably anterior poliomyelitis. He also notes the paleographic evidence in an Egyptian stele of the eighteenth dynasty where a priest of the temple Astarte is shown with the right leg withered and the foot lying in the typical aquinus position. In Palestine it is also probable that the disease has been endemic since Biblical times.

The first description of the disease in modern times appears, however, to have been given in the second half of the nineteenth century. In the early part of the century a few outbreaks were reported in England and in the United States.

In 1840 Heine described the chief clinical features of the disease in an outbreak in German. Fifty years later Medin added to that description by giving a full review of a large outbreak in Sweden. As a result of the research of these two observers, the disease is sometimes known as Heine-Medin's disease.

Since the end of the nineteenth century poliomyelitis has assumed epidemic form. It became increasingly common, and sporadic outbreaks continued to occur, first in Scandinavia, then in the north-eastern part of the United States, in Australia and New Zealand, in England and in Europe. The outbreaks were

(1) International Committee (1932) Poliomyelitis. A survey organized by Jeremiah Milbank. Williams and Wilkins, Baltimore.

small, but in Scandinavia and more especially in the United States, large epidemics involving thousands of persons recurred from time to time. This tendency still continues, and poliomyelitis is on the increase, in contrast to most other infectious diseases.

Once the pattern of epidemicity has been started, it has apparently been irreversible.

Before the second World War, poliomyelitis was considered a rare disease in tropical and subtropical countries, but it is now well recognized that the incidence of paralytic cases in these areas, where the disease was known to be only endemic, does not reflect the incidence of infection. Within the past twenty-five years a marked increase of incidence of poliomyelitis has occasionally been evidenced in these areas. When outbreaks occurred in certain parts of the Eastern Mediterranean Region, Malta and South Africa, in keeping with the common idea that the disease did not exist in such climates, it was usually thought that a new disease or at least a new strain of virus had suddenly been introduced into the community. Careful investigation showed later that only the previously known viruses were present. The fact that the disease was endemic in these areas was only brought to light when groups of foreigners, such as military units, stationed there acquired poliomyelitis at far higher rate than would have been expected if they had remained in their home countries. Such was the case among the foreign troops in Libya, Egypt and Palestine in 1944 and 1945.

Serological surveys made in the last few years have enabled the epidemiologists to evaluate the immunological status in a number of countries in the Region and consequently to confirm the high endemicity of the disease in this part of the world. All three known types of poliovirus were found to be present in all the countries of the Eastern Mediterranean Region. Culture procedures however, proved that poliomyelitis is a disease of <u>infancy</u> in the middle east. The epidemic pattern is not yet a problem in the Region today.

Poliomyelitis, which was for a time considered a "respiratory infection", is now regarded as one in which the alimentary tract is of prime importance as a portal of entry and exit of the virus; from this a very important conclusion can be drawn. Communities with good sanitation and hygiene may expect few cases of poliomyelitis among the children, but will have epidemic outbreaks in the older population groups, with a high ratio of paralytic cases, while communities with poor sanitation and hygiene can expect the virus to remain endemic, showing itself continuously by a high rate of infection among infant and pre-school populations, with few, if any, cases in the older age groups, and very few paralytic cases.

The easy spread of infection due to the prevailing living conditions in this Region causes infection to be almost universal in young children, with the higher age population immune. Infants have the opportunity of coming into contact with poliovirus very early in life; few of them reach the age of three or four years without having been infected with at least one strain. Clinically, the infection at such ages is not usually apparent and the disease appears in its abortive form. Immunity is, therefore, acquired early in our Region without being noticed, and no large groups of susceptibles are built up. Consequently, no epidemics of the disease are liable to occur.

It is obvious that, as long as the virus is endemic in the younger age groups, the population of this Region will continue, as they grow older, to maintain a high level of immunity which will insure their protection against the disease in epidemic form. However, should the virus become less prevalent in the children, as it will with improvement in sanitation and personal hygiene, a corresponding diminution in the percentage of older immunes can be expected.

Nevertheless, the situation in the Eastern Mediterranean at present remains of particular epidemiological interest. Except for the lowest age-groups, the indigenous population is largely spared from paralytic attacks of poliomyelitis, but the disease continues to be a serious hazard for recently arrived immigrants whether adults or children, from foreign countries. Israel has experienced serious epidemics of poliomyelitis for the past few years. In the latter half of 1949 there was a tenfold rise in the number of cases and by April 1950 the disease had reached true epidemic proportions. There is some evidence that there has been a shift from the old sporadic form of poliomyelitis to that of the epidemic. Israel and Cyprus seem to be the only two countries in the Region where a sudden increase in incidence of poliomyelitis has recently occurred.

Periodical studies on immunity level in the pre-school population of this Region would seem to be recommendable. These would serve to warn us, should a shift from the endemic to the epidemic pattern occur. If the percentage of immunes shifts in this group, from the high levels already known from previous studies, to a lower percentage, it would indicate the need for more close attention and perhaps action. When the percentage of non-immunes begins rapidly to increase in the pre-school population and the virus becomes less common among this group, definite warning must be taken. As the environmental sanitation in this Region improves this change may be expected. At the earliest signs of change, measures to increase the percentage of immunes by vaccination must be taken.

It is interesting to note in this connexion that an inverse ratio between infant mortality rates and poliomyelitis case rates has been observed rather constantly in some parts of the world. Hence the point has been raised as to whether the infant mortality rate (the number of children dying in their first year of life per 1000 live births) could be used as an index for measuring the degree of sanitation which might reflect potentialities for the "epidemic state". Recent epidemiological studies on the relationship between infant mortality rates and poliomyelitis case-rates indicate that in those countries where the infant mortality rate falls below 75 per 1000 live-births, the poliomyelitis case-rate will bear watching, since although the disease may not have been much of a problem in such countries in the past, experience has shown that it may suddenly or gradually become one.

2. INCIDENCE OF POLIOMYELITIS

In considering morbidity statistics for infectious diseases, it should be noted that in general, for any given disease, the cases reported to the health authorities usually represent only a fraction of the cases actually existing. There can be no doubt that this fraction varies considerably according to the degree of development of the countries concerned. Poliomyelitis in particular is distinguished from most other notifiable diseases in that only its complicated forms, that is, paralytic poliomyelitis, are reported with any regularity to the health authorities, whereas its subclinical asymptomatic forms are not notified. There is also the fact that countries do not notify cases of poliomyelitis with the same regularity and exactness. Notification of communicable diseases is usually deficient or even non-existant in certain of the less developed areas. Form an investigation made by the Office, it appeared that in at least three countries of the Eastern Mediterranean Region notification of poliomyelitis is not compulsory.

Such sources of error and variability considerably limit the value of the official statistical data published, since besides the fact that these data do not give a true picture of the epidemiological situation in the country concerned, they do not allow the drawing of any parallels between them and the statistical data from other countries.

Cases of and deaths from acute poliomyelitis officially notified in a number of countries in the Region since 1951 are shown in Annex I.

The age distribution of cases of poliomyelitis differs in countries according to whether the disease is purely endemic or has shifted to epidemic pattern. Before the occurrence of the epidemics of the disease in the European and American countries towards the end of the Nineteenth Century, mainly children

under five years of age were attacked, hence the term "Infantile Paralysis". While this is no more the case in those well developed countries, the infantile type of poliomyelitis has remained an outstanding feature of the epidemiology of the disease in the other endemic areas of the world such as the Eastern Mediterranean Region. Reports, both official and unofficial, indicate that the greatest number of paralytic poliomyelitis occurs in infants and young children, under four years old. (See Annex II).

It has been repeatedly pointed out that under tropical and sub-tropical conditions the disease tends to occur more or less uniformly throughout the year. According to the statistical data collected from countries of the northern hemisphere the season during which the highest incidence is usually reached, is between August and October. In the countries of the southern hemisphere it is six months later. Nevertheless, many purely winter epidemics have been observed in various countries. Some observers have also indicated the tendency for epidemics in true tropical conditions to peak in the periods associated with the rain season.

With minor exceptions, data available from countries of the Region indicate a rather even distribution of cases by report periods. Reported cases of poliomyelitis by months or four-week periods for countries of the Region, for the year 1958, are found in Annex III.

The following is a summary of the epidemiological information gathered from countries of the Region, regarding the incidence, form and trend of poliomyelitis and its relation to local climatic, seasonal, social, economic and sanitation factors.

ADEN

Poliomyelitis is not compulsorily notifiable in the Colony of Aden, and specific epidemiological information is not available. Acute poliomyelitis is hardly ever seen amongst the indigenous population; the disease is invariably met when patients come for the treatment of paralytic sequelae. The acute form is seen from time to time in adult immigrants. It is therefore assumed that the disease is endemic in the Colony. This would be expected from the low standard of environmented hygiene experienced by the greater part of the indigenous population.

The disease is experienced as sporadic "infantile paralysis". No change in the pattern has been noted, and there has been no epidemic to date.

CYPRUS

Poliomyelitis is compulsorily notifiable in Cyprus. The dystem of notification is satisfactory and embraces all medical practitioners in the island including those in the armed services.

Poliomyelitis occurs in the warm and hot dry months, that is, from March to October. It has not been a problem in the past.

Apart from sewerage schemes in the main military and air force cantonments and one plant serving the Nicosia general hospital and prison there are no sewerage schemes in the island. Sanitation in the towns is by septic tank and in the villages by pit latrine. Some villages possess no latrines.

The standard of living has risen considerably during the last decade and the following infant mortality statistics over the last ten years are of interest.

Year	Infant Mortality Rate
1949	71.71 per 1000 live births
1950	63.37 " " " "
1951	60.47 " " " "
1952	58.84 " " " "
1953	47.08 " " " "
1954	51.97 " " " "
1955	29.57 " " " "
1956	31.71 " " " "
1957	30.85 " " " "
1958	22.35 " " " "

Due to events from 1955 onwards and the resignation of village mukhtars responsible for the registration of births and deaths, the vital statistics should be regarded with caution and the figures shown for 1955-1958 are based on trends over the previous three years. The general impression, however, is that infant mortality is steadily declining.

The disease in the past has been a true sporadic infantile paralysis of low incidence. The situation, however, has been complicated by the arrival of a large number of non-immunes (British armed forces) from the United Kingdom since 1955.

There has been a change from sporadic infantile paralysis to epidemic poliomyelitis within the last three years and the following statistics are of interest:

Year	Notifications
1949	2
1950	5
1951	4
1952	2
1953	7
1954	13
1955	8
1956	27
1957	2
1958	150

The cases prior to 1956 affect Cypriot children; the breakdown of the 1956, 1957 and 1958 figures is as follows:-

1956

CYPRIOT		MILITARY (British)	
Cases	Age	Cases	Age
1	5 months	1	19 years
2	8 "	1	20 "
1	9 "	1	21 "
1	10.1/2 months	1	23 "
2	12 months	1	39 " (died)
2	14 "		
1	18 "		
3	2 years		
1	2.1/2 years		
2	3 years		
3	4 "		
1	6 " (died)		
1	14 "		
1	22 "		
22	1 death	5	1 death

Both deaths were due to bulbar paralysis.

1957

Only two cases were notified in adult British Military personnel. Both were paralytic in type and did not cause death.

1958

The most serious epidemic of poliomyelitis in the history of Cyprus struck the island during 1958 with a total of 150 paralytic cases and nine deaths. Although numerous non-paralytic cases must have occurred, none were notified and the incidence, therefore, of twenty-eight cases per 100,000 of the population does not present the whole picture; the actual incidence of the disease must have been very much higher.

The outbreak began in March, reached its peak in May and June and gradually died out during July, August and September. These months are the warm and hot weather periods of the year.

The outbreak began in Limassol with the notification of three adult and three child cases among R.A.F. personnel. In the ensuing months all races were affected and the epidemic became island-wide.

The following table shows the notifications by race and by month:-

Month	British	Greek	Turkish	Total
January	-	-	-	-
February	-	2	-	2
March	6	-	-	6
April	7	10	3	20
May	10	44	17	71
June	15	22	4	41
July	1	3	-	4
August	2	1	-	3
September	-	2	-	2
October	-	1	-	1
November	-	-	-	-
December	-	-	-	-
TOTAL	41	85	24	150

The following table shows the distribution of cases and deaths by district:

	Cypriot	British	Deaths
Nicosia District	47	22	5
Limassol District	28	15	2
Famagusta District	13	1	1
Paphos District	11	-	-
Kyrenia District	7	1	1
Larnaca District	3	2	-
TOTAL	109	41	9

Age distribution by race and sex is shown in the following table:

	British		Greeks		Turks		
Age Group	Male	Female	Male	Female	Male	Female	Total
0 +	-	-	5	2	1	-	8
1	-	-	16	13	4	5	38
2	-	-	11	10	2	3	26
3	1	4	6	1	3	1	16
4	1	-	3	4	-	1	9
5	1	1	3	1	-	-	6
6	2	-	1	2	2	1	8
7	1	-	1	1	-	-	3
8	-	-	1	-	-	-	1
9	-	1	1	-	-	-	2
10	1	-	2	-	-	-	3
11	1	-	-	-	-	-	1
12	--	1	-	-	-	-	1
13	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-
15 & over	16	10	1	-	1	-	28
TOTAL	24	17	51	34	13	11	150

Of the 109 Cypriot cases, eighty-eight (80.7%) occurred in children under the age of four while of the forty-one British cases twenty-six (63.4%) occurred in personnel over the age of sixteen. This epidemiological picture has been found in other parts of the world where large numbers of non-immunes arrive in an area in which the disease is endemic and manifests itself as a true infantile paralysis in the indigenous population.

Military personnel and their families have been in the island in large numbers since the end of 1955; there were no climatic or other untoward conditions to account for the outbreak.

All nine deaths occurred in Cypriot children, eight under the age of four and one aged ten. Death was due to bulbar paralysis.

The outbreak was found to be due to poliovirus Type I.

ETHIOPIA

According to the morbidity statistics, there have been altogether 123 cases of acute poliomyelitis among the 6,054,000 patients treated. However, the diagnosis may be rather unreliable in many cases. The cases are relatively equally distributed over the twelve provinces, and no information regarding climatic, seasonal, social and environmental sanitation factors are available.

The cases must all be counted as "sporadic cases". No epidemic has occurred.

SOMALILAND (French)

No cases of poliomyelitis have been reported within the last ten years in the territory. The rare cases reported in the past of paralytic and atrophic sequelae attributed to it may be classified as "sporadic" infantile paralysis.

As in all countries where sanitation has scarcely developed and where one may assume that poliovirus is abundant, the epidemic forms of poliomyelitis do not develop.

IRAN

Poliomyelitis is not compulsorily notifiable in Iran. It has been recently decided, however, to request the notification for epidemiological studies.

Poliomyelitis has been and is sporadic in this country and usually the cases are mild and occur in young children.

Improved hygienic conditions (espeically water supply) seem to cause more sporadic cases among the more well-to-do classes.

ISRAEL

As in most countries of the Middle East, poliomyelitis was formerly endemic in Palestine. Cases appeared sporadically, although infection with poliomyelitis viruses was probably widespread, as shown by the results of serological investigations. The annual number of cases during the years 1936-1948 varied between twenty to forty, with the exception of the year 1939, when there was a small outbreak with about seventy reported cases during the year.

In the second half of 1949 there was already a distinct increase in the montly number of cases and by the beginning of 1950 the disease had reached epidemic proportions. In 1950, the year of maximum incidence, with 1622 cases, the peak was reached in May (379 cases). After an interval of low incidence during the winter months of 1951, there was another seasonal rise. The epidemic was less severe than in the first year and the peak was reached in June. 1952 presented a similar picture.

The monthly figures for 1949-1951 are given in the following table:-

Month	1949	1950	1951
January	1	21	11
February	-	43	16
March	-	48	34
April	2	129	59
May	9	379	102
June	8	332	130
July	20	224	132
August	16	198	73
September	7	107	87
October	15	54	85
November	24	56	107
December	26	27	64
TOTAL	128	1618	900

If monthly attack-rates for various regions of the country are compared, a pattern of centrifugal spread becomes apparent for 1950. The epidemic started in the central coastal plain in March-April. In May, high rates prevailed in the whole settled part of the coastal plain up to the northern border and in the city of Jerusalem, while the north-east corner of the country (Eastern Galilee) and the extreme south still had low rates. In July, the epidemic reached these outlying areas, so that in July and August attack-rates - by then declining in the cities and in the coastal plain - were rising in these areas. In 1951 no such centrifugal spread was observed, a fact to be expected after the epidemic of 1950, which had seeded the virus all over the country. The areas which experienced a relatively high incidence in 1950 suffered less in 1951, and vice versa.

Large towns had the lowest attack-rate, while in the rural areas the smallholder settlements with their scattered families had a lower attack-rate than the rural towns with their greater density of population. The same phenomenon was observed in the 1945 Mauritius epidemic of poliomyelitis, namely, rates were higher in rural areas, and among these the rates were highest in the most densely settled parts, while the lowest incidence was in the one big harbour-town.

The most striking feature in the incidence by type of locality was the similar, very high rates in Camps and Kibbutzim (communal settlements). The population of the former was composed of recent immigrants, mostly poor, with their children in a bad state of nutrition, and the sanitary and housing

conditions at a low level. The population of the latter - the Kibbuzim - was composed mainly of old residents, with a high standard of health, and living under relatively good housing and sanitary conditions. The common factor producing the high incidence during the poliomyelitis epidemic in these two otherwise very different types of society was presumably the close grouping of infants and small children in nurseries and elsewhere.

The preponderance of cases in the very young age-group was one of the striking features of the 1950-1951 epidemic in Israel. Eighty-five per cent of all cases occurred in children under five. The age distribution in the Israel epidemic showed a pronounced "infantile paralysis" pattern, such as was observed in the first outbreak in the USA over thirty years ago, and in the more recent outbreaks in Malta and Mauritius, while outbreaks during recent years in European and North-American countries show a shift towards the five to nine and older age-groups. It should be admitted that children in Israel are highly exposed to infection during their first years of life, with many non-apparent or abortive infections, leading to a high degree of immunity from the fourth or fifth year onwards. These conditions must have been already prevalent in the pre-epidemic period. It should be noted that surveys made in another Middle East country, Egypt (1948) showed the same age-distribution picture, under endemic conditions there, as that in Israel under highly epidemic conditions. It should be noted also that the sporadic cases in Palestine between 1928 and 1931 had a similar distribution, with 85% under four years. The following table shows poliomyelitis cases and attack-rates in infants in Israel, 1950:-

Age (months)	Number of Cases	Age specific rate per 10,000
0	1	4
1	7	26
2	12	44
3	23	85
4	15	55
5	40	148
6-11	307	189
Total, first year of life	407	126
Second year of life	459	159

It may be noted from this table that in the Israel epidemic the highest attack-rate actually occurred in infants aged six to eleven months, although the rate for the whole of the first year is below that of the second year of life on account of the low attack-rate in the first six months (newly born infants seem to be protected during their first months of life by the acquired maternal antibodies).

Clinical description of the 1950 epidemic showed that of 1544 cases, 28.5% were non-paralytic. Twenty per cent of the paralytic cases recovered completely, 36.3% had paralytic sequelae and 14.6% died. Of the paralytic cases, 18.1% were bulbar, 27.3% spinobulbar and 54.6% spinal. Nearly all the fatal cases were in the last two categories.

It would have been interesting to calculate attack-rates for the several ethnic groups of which the population of Israel is composed. It was found, however, that the collected data were sufficiently complete and reliable for the separation of only one ethnic group, namely, Yemenites. The analysis was therefore limited to a comparison between Yemenites and all others. During the period 1920-1949 about 30,000 Jewish immigrants reached Palestine from Yemen. About 45,000 Yemenites arrived in Israel within the space of a few months (September 1949 to January 1950). Such sudden and massive movement of population coincided with the start of the recent epidemic. This coincidence gave rise to the popular theory that the Yemenite immigration was in some way responsible for the epidemic. The analysis of data has indicated, however, that the factor determining the sensibility to infection is not inherent to one ethnic group but can be found in the environmental conditions under which certain groups of the population live, and which are favourable to the spread of the disease. The influence of bad nutrition as a factor in the host, which helped to increase the invasiveness and pathogenicity of poliomyelitis virus or viruses already present in the country, was suggested. This factor, however, had to be disregarded as there was no evidence of higher attack-rates in children with a poorer nutritional status, while on the contrary the attack-rates in infants in agricultural communal settlements which had the best standard of nutrition in the country were extremely high. The only possible factor which could be thought of, that might have played the preponderant part in causing the epidemic was temporary overcrowding. The epidemic in Israel was preceded by war and immigration on an immense scale, resulting in acute housing shortage, dislocation and crowding. Sudden crowding in the pre-epidemic period has also been described in the 1942 epidemic in Malta (effect of aerial bombardment) and in Mauritius in 1945 (result of a typhoon). However, the important factor was not the crowding, that is, density of population, per se, but the suddenness of the

crowding resulting in unusual mixing and close aggregation of families and children of different ages, and the breaking up of the usual family and inter-family pattern of contact.

Under these conditions it was assumed that enhanced circulation facilitated the production of virus mutants with increased virulence, that is, invasiveness and capacity for producing neurological lesions. This increased virulence - not severe enough to break the resistance of older age-groups might in a country like Israel in which the disease had hitherto been endemic, have resulted in a higher proportion of clinically recognisable disease in infants and young children.

The viruses isolated in 1950 and during the following years all belonged to type I Brunhilde poliomyelitis viruses.

The following table, which gives the attack-rates of poliomyelitis and percentage under five in the years following the epidemic, illustrates clearly that there has been no age shift in incidence of poliomyelitis in Israel:-

Year	Attack-rate per 10,000	Percentage under age 5
1952	5.5	84
1953	4.1	92
1954	4.6	91
1955	2.6	90
1956	3.2	86
1957	0.3	89
1958	3.0	90

JORDAN

Poliomyelitis in Jordan has not yet reached epidemic form; however, in 1958 an appreciable increase in the incidence of the disease was noted. Poliomyelitis cases reported during the last four years are shown in the following table:-

Year	1955	1956	1957	1958
Number of cases	60	40	24	178

The fluctuation of the incidence indicates the sporadic nature of the disease, the deviation occurring in 1958 and the mode of the spread show an increase in the sporadic cases, and do not conform with an epidemic pattern. Many reasons are attributed to this increase, the most important being better diagnosis, better reporting and the extension of medical services. Moreover, the increase might be due to the importation of a new strain from other countries especially with the pilgrims who visit the Holy Land during the feasts.

This last conjuncture needs laboratory proof and more evidence to establish.

The disease is more prevalent among the lower economic and social classes. Most of the cases are children between the ages one to three.

The seasonal and regional number of cases (1958) are shown as follows:-

Season	East Jordan Population			West Jordan Population			Total
	South 99,571	Middle 337,233	North 249,947	South 145,088	Middle 342,678	North 363,471	
Winter	1	11	-	-	8	3	33
Spring	2	36	17	7	33	31	162
Summer	2	5	2	3	6	3	21
Autumn	1	1	1	-	2	2	7

It is clearly seen that the disease occurs all through the year with a maximum peak in spring and a minimum incidence in autumn. The disease occurs in summer and in winter at equal rates.

Climate does not vary very much and does not play an important rôle in the occurrence of this disease.

LEBANON

The following table gives the monthly distribution of the cases of poliomyelitis which were recorded in Lebanon during the period of the past four years:-

Month	1956	1957	1958	1959
January	3	-	5	9
February	1	2	5	4
March	2		9	4
April	5	2	9	9
May	8	2	6	16
June	26	8	4	
July	11	9	18	
August	16	4	8	
September	9	4	5	
October	3	6	8	
November	3	7	5	
December	1	3	7	
TOTAL	88	47	89	42

It will be noted from the above table that cases of poliomyelitis occur during all the months of the year, although an increase in number is recorded during the months May to September, and particularly in the months of June and July. It seems that summer is more favourable to its development. The Ministry of Health, therefore, advises the public to vaccinate their children, mainly during the first three months of the year.

Poliomyelitis in Lebanon does not make any differentiation as regards social or economic conditions. Cases are scattered here and there in all classes of the community, that is, it has more than one single focus. About 40% of the cases have sequelae, 40% are curable paralytic forms and 20% are fatal cases due to bulbar attacks.

As regards the non-apparent mild forms, these are not easily detected.

No recent change of the epidemiological behaviour of poliomyelitis has been noted in Lebanon.

LIBYA

Poliomyelitis does not constitute a major public health problem in Libya.

The number of cases reported by month during 1958 are as follows:-

Month	Number of cases
January	14
February	11
March	27
April	-
May	7
June	report not received
July	" " "
August	2
September	4
October	1
November	4
December	report not received
TOTAL	70

Most of the cases occurred among the group of children of one to three years of age.

This shows that the viruses of poliomyelitis exist in the country; the majority of children are exposed to a mild infection, from which they acquire some immunity against the disease.

No change of the epidemiological behaviour has been noted.

PAKISTAN

Sporadic cases of poliomyelitis are reported in the provinces of Pakistan. One localised outbreak occurred in Hyderabad town in 1956. This outbreak occurred in the month of July, and no relation with such factors, as climate, season, social or economic conditions have been noticed, except the one mentioned above which occurred in Hyderabad and was found to be related to insanitary conditions in the town.

SUDAN

At present poliomyelitis is not a problem in Sudan. However, small outbreaks occur from time to time in various parts of the country and were reported in the last few years particularly in Kordofan and Upper Nile provinces.

The incidence is usually in children from four to seven years old and may result in paralysis.

There has been no shift to the epidemic form.

The first mention of poliomyelitis in the Annual Reports of the Sudan Medical Services was in 1951.

The following table gives the number of cases of poliomyelitis and their geographical distribution in the Sudan during the period 1951-1952, 1956-1957:-

Provinces	1951-52	1952-53	1953-54	1954-55	1955-56	1956-57
Bahr el Ghazal	1	-	-	... (*)	...	...
Blue Nile	-	-	-	...	...	...
Darfur	-	-	1	...	...	...
Equatoria	7	-	1	...	...	...
Kassala	-	-	-	...	...	...
Khartoum	11	2	2	61	172	...
Kordofan	-	-	-	26	...	...
Northern	-	-	1	...	...	...
Upper Nile	-	8	-	...	...	...
TOTAL	19	10	5	99	176	38

(*) ... data unavailable.

TUNISIA

Tunisia is not an exception to the general increase of poliomyelitis cases detected. Some foci appear every year regularly. Most of the cases come from damp coastal districts, whilst dry areas are less threatened.

Poliomyelitis is more frequent in young children and attacks mainly those under the age of five years.

Although the incidence is not very high in Tunisia, it is nevertheless obvious that since 1945 this disease has assumed a sporadic character.

A summary of the cases notified from 1954 to 1958 is given below:-

Year	1954	1955	1956	1957	1958
Cases	31	8	9	11	5

U.A.R, PROVINCE OF EGYPT[1]

Until recent years notification of poliomyelitis was undoubtedly inadequate, for only a few cases - nearly all of them fatal- used to be reported to the Ministry of Health. Thus in the year 1938, for example, the Ministry of Health reported for all of Egypt (16 million people), only three cases of poliomyelitis, with two deaths; and in 1939, eight cases and eight deaths. The yearly median number of cases of poliomyelitis recorded during the period 1945 to 1951 was only eight cases divided on four-week periods as follows:-

		Four-Week Periods											
	Total	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
M.1945-51	8	1	1	1	-	1	-	-	-	-	-	1	1	2

A review of the incidence of poliomyelitis as given in Annex I shows that there has been a sudden increase in the number of reported cases in Egypt in 1952. From a median of eight in the preceding seven years to 260 cases in 1952. This increase continued year after year: 551 (in 1953), 681 (in 1954), 865 (in 1955), 585 (in 1956), 548 (in 1957), and 744 (in 1958). There is convincing evidence that during recent years there has been a marked improvement in reporting the disease.

In an epidemiological survey made in Cairo, in the year 1943, information on the incidence of poliomyelitis was obtained from the Children's Hospital Dispensary, as follows:-

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[1] Information not officially provided; gathered from various publications.

Year	New Cases	Total New Patients Admitted to Dispensary	Approx. Rate per 1,000 admissions
1933	71	58,000	1.2
1934	74	73,000	1.0
1935	24	77,000	0.3
1936	48	100,000	0.5
1937	22	110,000	0.2
1938	96	116,000	0.8
1939	41	122,000	0.3
1940	149	184,000	1.0
1941	110	160,000	0.7
1942	201	165,000	1.2

Data in the above table indicate a fairly high endemic rate for the population of Cairo, and confirm the general belief that the Egyptian Province is an endemic area of the disease.

Poliomyelitis seems to be more of an all-year-round disease in Egypt, with maximal incidence in March, April and May and again in October. It is interesting to mention that in Egypt the breeding seasons of the housefly are in the spring and again in autumn which corresponds more or less to the two periods of maximal incidence of poliomyelitis.

Poliomyelitis in Egypt seems to be a disease of young children - a fact which becomes evident from a glance at the following table which gives the number of reported cases by age for Egypt during 1953 and 1954:-

	Years of age						
Year	-1	1-4	5-9	10-14	15-24	25-54	Total
1953	146	390	23	3	4	6	572
1954	191	369	22	6	1	1	590

It is seen that the majority of cases occur in the population below the age of five years. This seems characteristic of the disease in the endemic era and probably represents true "Infantile Paralysis".

The predominant poliovirus type identified for paralytic cases of poliomyelitis during a survey made in Cairo in 1955 was Type II. However, the findings in a recent survey of the same area made in 1957-1958 indicate that a shift has occurred from poliovirus Type II to poliovirus Type I predominance.

There is no evidence, however, that a change in the epidemiological pattern from endemic to epidemic has so far occurred.

U.A.R., PROVINCE OF SYRIA

The recorded cases of poliomyelitis during the past three years are given in the following table:-

		Four-Week Periods												
Year	Total	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
1956	8	-	2	-	-	1	3	2	-	-	-	-	-	-
1957	23	3	-	-	-	-	10	8	-	-	-	1	1	-
1958	37	4	2	1	-	3[a]	2[a]	-	3	3	12	5[a]	1	1
1959		-[a]	1	-	-	2	-	-	-[a]					

Nineteen of the cases recorded in 1958 were treated in the Damascus Infectious Diseases Hospital. Infectious diseases hospitals are the health institutions in which cases of poliomyelitis are admitted for treatment.

3. POLIOMYELITIS SURVEYS

Two kinds of laboratory investigations are usually undertaken in surveying the epidemiological situation of poliomyelitis in a given area.

1) Serological surveys of neutralizing antibodies against the poliomyelitis viruses in the sera of the population.

2) Virological investigations for the isolation and identification of the predominant type of poliomyelitis virus in the area.

The main purpose for which serological surveys are made is to determine the local frequency of infection by ascertaining how many people in a given area have developed antibodies to any of the poliomyelitis viruses. These surveys serve as a means of determining both the historical and the current prevalence of the disease. They differ from estimates based on attack-rates of clinical cases recorded within a given area during a given period of time in that the serological investigations detect with some degree of accuracy the sub-clinical and non-apparent infections as well as the clinical. In other words, these investigations yield measurements comparable to those found in tuberculin-test or Schick-test, that is to say they differentiate the immune from the susceptible persons within a given population. This differentiation can be made in various age-groups within different segments of the population. The relative frequency with which representatives of each of the three types of poliovirus have caused infection can also be determined by serological surveys. Furthermore, the surveys offer more accurate means for determining the incidence of poliomyelitis in various socio-economic levels of the population than do case-finding and case-reporting.

a) Three weeks.

The importance of serological surveys is mostly recognised when the question of vaccination of the population against poliomyelitis is considered. The problem which will then confront the health authorities will be to decide which age-groups in the various sections of the population seem to be in most need of immunisation and to estimate the benefits likely to be obtained in relation to the cost (poliomyelitis vaccine is still very expensive).

In countries with accurate records of the age incidence of paralytic poliomyelitis over a number of years, a reasonable decision and estimate may be made on that basis alone. However, in many countries (and this applies to practically all the countries in this region) such records are not available or are incomplete. In these countries, serological surveys can often serve to give information on the general immunological status of these population groups. From them one can often determine which are the most vulnerable local age-groups, and one might be able to make better estimates of benefits which could be gained than could be done in the absence of such information.

In order to estimate the endemicity of poliomyelitis in some countries and territories of the Eastern Mediterranean Region a number of serological surveys were made during the last fifteen years.

In a small serological survey made in Aden, where only Type II antibodies were measured the results obtained indicated that 50% of the population at ages 0-2 years and approximately 10% of those at ages 0-10 years showed no antibody detectable to the type of virus used in the test.

Virological and serological investigations were carried out in Cyprus on 13 cases of paralytic poliomyelitis. The results are shown on the following page.

All the cases were infants or young children between 13 months and 3 years of age; all suffered clinically from "paralytic polio".

Taking the results of all three tests in conjunction, it is seen that eleven of the thirteen cases have had a current Poliovirus Type I infection.

Case No.	Stools: Tissue Culture	Complement-fixing antibody in serum against Poliovirus			Neutralizing antibody in serum against Poliovirus			Comments
		Type I	Type II	Type III	Type I	Type II	Type III	
I	+ve Type I	ϕ	-	-	+	-	-	Current Poliovirus Type I infection.
2	+ve Type I	ϕ	-	-	+	-	+	Current Type I infection; recent Type III infection.
3	+ve Type I	-	+	-	ϕ	-	-	Current Type I infection; recent Type II infection.
4	+ve Type I	ϕ	-	-	ϕ	+	-	Current Type I infection; recent Type II infection.
5	+ve Type I	ϕ	-	-	ϕ	-	-	Current Type I infection.
6	.....	ϕ	-	-	+	-	-	Current Type I infec.
7	.....	-	-	-	(+)	-	-	Inconclusive; ? recent Type I infection
8	.....	ϕ	-	-	+	-	-	Current Type I infec.
9	+ve Type I	ϕ	-	-	ϕ	-	-	Current Type I infec.
10	+ve Type I	ϕ	-	-	+	-	-	Current Type I infec.
11	Contaminated	ϕ	-	-	ϕ	-	-	Current Type I infec.
12	NEGATIVE		.....			.....		-
13	+ve Type I		.....			.....		Current Type I infec.

..... = Sample not submitted

ϕ = Rise in titre of antibody, indicated current infection

\+ = Raised but not rising titre of antibody, indicating recent infection.

During 1954 in connection with a large scale screening programme regarding virus diseases, a preliminary serological poliomyelitis survey was carried out in Iran by the Pasteur Institute of Teheran in collaboration with the University of Maryland, U.S.A. A limited number of sera collected from rural and urban areas were tested for the presence of antibodies. Antibodies to all three types have been demonstrated in all the sera of the children and adolescents from Akinlon, an isolated village in Kurdistan. Also nearly 100% of children 1-10 years of age from Teheran demonstrated antibodies to all three types. Specimens from Teheran were collected from the lower socio-economic group of the city. During 1957 a detailed immuno-epidemiological survey was undertaken by the virus research laboratory, newly established in the Pasteur Institute of Teheran. The results of this recent surveyal, though not yet complete, show that nearly all of the indigenous children are infected and immunized at a very young age.

A survey of neutralizing antibodies against the Lansing (Type II) strain was undertaken in 1955 in Israel. Altogether, 392 sera were examined, of all ages in several groups of the population. The results show that by the age of three years, 70% of the children already have high titres of neutralizing antibodies in their blood, and by the age of eight the percentage approaches 100. This finding fits in well with the epidemiological picture of incidence by age in the 1950-1951 epidemic of poliomyelitis in Israel, with the highest rates in the first two years of life and a rapid decrease of rates from the fourth year of life upwards.

A great similarity was also found between the immunological picture of various ethnic groups of the population and recent arrivals to Israel, including a group of Yemenites from whom blood-samples were taken before their arrival in the country, in the collecting camp at Aden.

It should be noted that the antibodies examined in this survey were those against Type II virus. However, it is now accepted that the rise of antibody titres against Lansing virus is a fairly good general index of the rate of infection and degree of immunity of all poliomyelitis virus strains.

During the period 1 July 1955 to 30 June 1956 virological and serological investigations have been carried out in Israel. The following strains have been isolated from poliomyelitis cases:

Type I	.....	30 strains
Type II	.....	8 "
Type III	.....	4 "
Not neutralized	.....	8 "
Total number of isolated strains		50

A serological survey on the presence of antibodies against the three types of poliovirus has also been carried out. Sera from 155 children in a new housing project near Jerusalem were collected and examined. From the age of two to three years onwards more than 50% of the sera showed antibodies against the three types of poliomyelitis. In the age group 6-7 years 95% of the sera contained antibodies against all three types. Antibodies were more frequent in children of families where crowding and a low degree of cleanliness were present. Under the conditions observed no influence of the economic status of the family was apparent.

In connection with a study undertaken for a different purpose, a serological survey was performed in Eastern Saudi Arabia. Serum specimens were obtained from 57 persons who were life-long residents of Eastern Saudi Arabia and tested for neutralizing antibodies against the three types of poliomyelitis virus. Of the 57 sera tested, 55 were positive against one or more types. Antibodies to Type I were detected in 75%, against Type II, 77% and against Type III, 70%. It seems probable from the results of this survey, that all three types of poliomyelitis are endemic in the area and that exposure occurs at an early age.

In 1953 a small serological survey was carried out in Upper Nile Province in Sudan. All sera tested neutralized Lansing (Type II) poliovirus in significant amounts.

A second survey was lately undertaken in the Sudan in order to evaluate the position in the country as regards the incidence and spread of poliomyelitis. Blood specimens were collected from two groups of Sudanese children. One group consisted of 48 children from the rural region of Kassala, and the other group consisted of 46 children from the Urban area of Khartoum town. The children ranged in age from eighteen months to fourteen years. The following table gives the results of the tests showing locality and presence or absence of antibodies against the three types of poliovirus:

Type of antibody present	Rural Kassala children	Urban Khartoum children
I only.....	1	3
II only	2	1
III only.....	4	Nil
I and II	1	2
I and III	6	2
II and III	3	3
I, II and III	31	35
None detected	Nil	Nil
TOTAL	48	46

As it is obvious from the above results, all sera from both areas are positive to one or other of the three types of virus.

In 1943 a virological study was performed on 35 stool specimens taken from 35 patients (and contacts) among the British and American troops in Egypt. The stool test as a confirmatory means of diagnosis in clinical poliomyelitis was used in 15 cases of typical poliomyelitis, 17 atypical cases, and 3 contacts.

which occurred in the troops stationed in the Middle East. From the 10 fatal cases of poliomyelitis the isolation of virus from stools was accomplished in 9 instances. Negative findings have been encountered in the remaining 5 (non fatal) cases of poliomyelitis, and negative results were likewise encountered in 20 "atypical" Cases (and contacts).

Although this study demonstrated the prevalence of poliomyelitis in "immigrant soldiers" in Egypt, the belief remained that the disease was rare in that area among the local population.

As the subject of incidence of poliomyelitis in Egypt merited further investigation, a virological and serological study was again attempted during 1950.

For the serological survey, serum samples were obtained from residents of a rural health district, known as Qalyub, located some 20 kilometers north of Cairo, 65 serum samples from children below two years age, 86 from 2-6 years, and 98 from 7 years upwards. In all, 249 serum samples were collected for neutralization tests.

The serum samples were tested against the three types of poliovirus. However, as a representative strain of type I virus, a locally isolated strain (Egypt 1950) was used for the tests.

The results obtained leave no doubt that:

1) Paralytic poliomyelitis is not uncommon in the form of cases of "infantile paralysis" in urban Egyptians;

2) The disease in the native population is almost entirely confined to infants and very young children; and

3) all the three types of antibodies are also acquired at an early age among native Egyptians. For Type II (Lansing) more than 50 per cent of the infants have antibodies before they are two years of age, and for all 3 types, 75 per cent or more before they are four years old.

During 1957-1958 a virological study was undertaken to define the types of poliovirus associated with paralytic poliomyelitis in Cairo (UAR). 830 rectal swab specimens were examined, of which 497 yield enteroviruses; 447 have been shown to be polioviruses while the other 50 were enteroviruses other than polio. It is interesting to note that the findings in this study are in contrast to an earlier survey made in Cairo during 1955. It seems that a shift has occurred from poliovirus type II to poliovirus type I predominance.

4. CONTROL OF POLIOMYELITIS

In countries of the Eastern Mediterranean Region, where poliomyelitis is not compulsorily notifiable no measures are taken for the control of the disease. In the other countries where poliomyelitis is notifiable, the health services are responsible for applying the standard sanitary measures usually taken with any infectious disease in an endeavour to check its spread, such as isolation, disinfection and measures regarding the contacts and the community. It has to be admitted, however, that poliomyelitis does not constitute at present a major public health problem in many of the countries of this Region. It has also been recognized that the general methods of control as applied by health officers with many infectious diseases have been found to be of little avail in poliomyelitis. Part of the reason for the apparent failure of isolation and quarantine measures to prevent the spread of infection may lie in the fact that, for every case of paralysis, there may be large numbers of persons with mild or non-apparent infections. Although this may be true in very extensive and severe epidemics, virological studies of certain communities have indicated that the virus has been found mainly in the intimate associates of the paralytic case. For this reason, it appears possible that some reduction in the number of paralytic cases may be achieved by quarantine measures centred particularly around the first paralytic cases occurring in a community.

It should be noted that the actual measures to be applied in a given country will depend on the epidemiological circumstances in that country. Public health measures are particularly indicated in countries in which poliomyelitis occurs in the form of severe epidemics. Where the disease is still largely endemic, there is little need for extensive public health measures as they would not be likely to have much effect. It is believed, however, that control measures should not be completely neglected. Such measures as notification of cases, isolation and care of patients, disinfection, protection of contacts and the community, and the awareness of the paralytogenic factors in the form of inoculations and operations, should be kept in mind.

5. IMMUNIZATION

Many attempts have been made in the past to use convalescent serum as a prophylactic or therapeutic measure in poliomyelitis, without any conclusive evidence of its efficacy having been obtained.

Improved methods of the fractionation of plasma have encouraged the use of the gamma-globulin of pooled human plasma for prophylactic purposes.

It is now clear however that with the introduction of active immunization the whole picture of the control of poliomyelitis has changed and some of the older procedures have been largely discarded. The use of convalescent serum or gamma globulin is now regarded as outmoded.

It is generally agreed, at present, that active immunization of the susceptible population in a community is the only effective method of prevention of poliomyelitis.

a) Inactivated Poliovirus Vaccine:

Since the results of the trial of the Salk vaccine were reported ir 1955, there has been a continually expanding use of inactivated poliovirus vaccine in many parts of the world. If we review the situation with regard to poliomyelitis in various regions of the world, it will be noted that a marked reduction in the incidence of paralytic cases has been reported in many countries where Salk vaccine or other similar vaccines of the inactivated type have been extensively used.

In the U.S.A., in 1956, over 70 million inoculations of vaccine were administered and the effectiveness of the vaccine was shown by a shift in the age distribution of paralytic cases from the most extensively vaccinated groups to less vaccinated age-groups. In individual age-groups the frequency of paralysis among reported cases was significantly less among vaccinated as compared with non-vaccinated individuals and, further, the paralytic attack rate in the vaccinated group was significantly less than in non-vaccinated.

Large-scale vaccination was also undertaken in Australia, Canada, Denmark, Israel, Sweden and the Union of South Africa, and important but less extensive programmes have been undertaken in a number of other countries.

In the countries where evaluation of the programmes was possible, there was evidence suggesting a protective effect of the vaccine of the same order of magnitude as that observed in the USA.

It was noted in the Union of South Africa and in the USA, especially in the course of severe outbreaks in Hawaii and Chicago, that vaccination in the face of an epidemic did not appear to shorten its course.

Laboratory and field studies have shown that vaccination does not prevent infection or interfere with dissemination of the virus in the community.

Reactions following vaccination have been few and generally mild.

Special attention has been given to the occurrence of paralysis within 30 days following inoculation. In the USA, for example, in non-epidemic areas, for every 300,000 inoculation, one paralytic case occurred within 30 days of the injection, but in only 21 of 229 cases was there correlation between the site of injection and the site of paralysis. This might well have been due to chance.

The production of vaccines continues, however, to present problems and difficulties which demand constant and close supervision of the procedures.

The nature of the reaction between formalin and the virus remains a controversial point and it is agreed that the inactivation of the virus cannot adequately be described as a first order reaction.

Filtration is also considered of marked importance in ensuring a safe vaccine product.

Evidence based on experiments undertaken recently in the USA clearly shows that filtration through Seitz filters gives more consistent results than filtration through fritted-glass filters.

However, repeated filtrations may be associated with a considerable loss in immunogenic potency of the final product.

In order to avoid filtration and minimize the loss of antigenic potency, and as an additional safeguard, some producers combine initial formaldehyde treatment with a second step of inactivation, using for this purpose either another chemical agent or ultraviolet irradiation.

There is, at present, general agreement on the following questions:

1. It is desirable to find a strain of less virulence but of equal or better immunogenic capacity than the Mahoney strain as the representative of type I poliovirus. In selecting a replacement for the Mahoney or other strains currently in use, only strains of high immunogenic potency and stability should be considered.

2. The antigenicity test in monkeys is not completely satisfactory and it is recommended that other tests using other animals such as guinea-pigs and chicks should be further investigated. Such studies should include a comparative study of the response to the vaccines under test of children who have been shown to lack antibody to each of the three types of poliovirus.

3. Particular care must be taken in transporting vaccine in order to avoid overheating or freezing such as may occur in non-insulated compartments of aeroplanes.

4. It is not recommended at present to diminish the dose by such means as intradermal inoculation or the use of adjuvants. The vaccine in 1 ml. doses should be given subcutaneously or intramuscularly with an interval of three to five weeks or more between the first and second, and seven months or more between the second and third injections, respectively.

5. The value of vaccination in the face of an epidemic has not been fully assessed. There might be some hesitation in vaccinating for the first time during an epidemic in a crowded community in which the epidemic may run its course before any immunity can be conferred. On the other hand, where there are extensive peripheral regions in which outbreak can be expected to spread over a period of months, much may be gained by instituting vaccination as early and as extensively as possible.

6. There is no indication for withholding various immunizing injections such as diphtheria and pertussis from fully vaccinated individuals during epidemics of poliomyelitis or at any other time. However, until evidence to the contrary is accumulated, it would be advisable to continue the prohibition of elective tonsillectomies and adenoidectomies during the so-called poliomyelitis season.

For the production of the inactivated poliomyelitis vaccine, there are at present a number of different manufacturing and testing procedures, which are in use in various countries. These procedures differ mainly in the incorporation of different virus strains, the inactivation and filtration methods and the use of preservatives and adjuvants in the final vaccine.

As an essential step in the World Health Organization project of promoting greater uniformity in the field of essay methods and requirements for important biological preparations, a Study Group was convened in June 1958 in Geneva to draw up an International Recommendation on the requirements which should be fulfilled by a preparation of poliomyelitis vaccine in order to ensure that the product is a safe, reliable and potent prophylactic agent.

An International Recommendation on Requirements would tend to facilitate the exchange of vaccines between different countries, and would also provide guidance to responsible workers in those countries who wish to start the production of poliomyelitis vaccine and who may have difficulties in deciding upon appropriate methods of essay and control.

The Study Group included among its recommendations that an international study be undertaken to investigate the various methods of testing the antigenic activity. The study would include a common reference vaccine, as well as other vaccines and the participating laboratories would be asked to test the vaccines by a specified chick test, a specified guinea-pig test, and a specified antibody-combining test, as well as by other methods in routine use in these laboratories.

The value of the inactivated poliovirus vaccine in the prevention of paralytic poliomyelitis is now well recognized, and its continued wide use is strongly recommended. However, the decision to introduce or expand existing programmes of vaccination should be made by the health authorities of the country concerned. Each country can evaluate best the relative importance of its poliomyelitis problem to other urgent public health needs and give its judgement accordingly. This judgement certainly depends on the seriousness of the problem, that is, the prevalence and the severity of the disease in the country. In some areas, poliomyelitis takes the form of a disease of infants of low reported incidence as is the case in most parts of this Region. In other areas, it represents an epidemic disease of children and adults, where it tends to be more severe. There are also the cost and the practicability of vaccination campaigns to be considered. The indications for the use of poliomyelitis vaccine vary therefore according to the local circumstances.

In considering whether or not immunization procedures should be undertaken, it is important that each country should not only bear in mind its past experience, but also attempt to estimate what may happen in the next decade. This applies particularly to countries like most of those in this Region where the reported cases have been few and real epidemics unknown. It might not seem right to advise such countries to embark on extensive vaccination programmes in view of the poor returns they could expect. However, it has been noted that in many parts of the world poliomyelitis has recently tended to show a sharp increase in prevalence, sometimes in the form of severe epidemics. This change may be related in part to general improvement in housing and environmental sanitation and in part to the introduction of new and more virulent strains of poliovirus. It is worthy of note in this connection that the actual trend in the Eastern Mediterranean Region is towards an industrial and urban development.

One of the signs that may suggest the imminence of epidemic poliomyelitis is an improving trend in infantile mortality. As it was mentioned above, when infantile mortality falls below a rate of about 75 per 1000 live births, it is common to find that poliomyelitis rates begin to increase above that of 3 or 4 per 100,000. A second sign which indicates a shift in the direction of increased activity of poliomyelitis is the appearance of cases of poliomyelitis in older children as well as infants. More especially when 20% or more of the paralytic

cases are recorded in children over 10 years of age, such an increased activity can be looked for.

In this respect, an important recommendation was made by the WHO Expert Committee on Poliomyelitis during its second session,(1) urging that special efforts be made to improve the reporting of poliomyelitis in all countries. This is particularly important in countries where the disease is apparently restricted to the infantile age-group such as the countries of this Region. Even though the annual number of cases may be small, an analysis of any changes in age incidence may provide important warnings.

It is therefore recommendable that poliomyelitis should be made compulsorily notifiable in the countries of this Region where it is not yet so.

The decision to introduce vaccination against poliomyelitis in a community depends - as mentioned above - on a true knowledge of the incidence of the disease in the area and the susceptible age-groups which should have the priority for immunization. In countries where health statistics exist, a good picture of the epidemiological situation may be obtained from the paralytic attack rates in the various age-groups, especially if these are available for a good number of years. Valuable information may also be gained by properly designed clinical surveys looking for residual paralysis such as that carried out in Cairo in 1950.(2)

Statistic data are, however,not available everywhere and in many countries the accuracy of such data as exist may be doubted. In these circumstances a serological survey of the prevalence and age distribution of poliomyelitis antibodies will provide an estimate of the susceptibility of a population and the age-groups at risk.

Both neutralizing and complement-fixing antibodies can be assessed. The latter are of a less permanent character and may serve as an indication of recently acquired infection. Neutralizing antibodies on the other hand express the experience of a population with poliomyelitis virus in the past and reflect its immunological status.

The results of a number of serological surveys which have been undertaken in various parts of the Eastern Mediterranean Region (see above) have clearly demonstrated the similarity of the immunological status of the populations of practically all the countries of the Region. It may be regarded as certain

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(1) WHO Techn. Rep. Ser., 1958, 145.

(2) Paul, Melnick, Barnett and Goldblum Am. J. Hyg., Vol.55, No.3 May 1952.

that all fall into one group[1] - the group in which 50% of the sera of the population at the age-group 0-2 years and 10% of those at the age-group 0-10 years show no detectable antibodies, or in other words, the group in which the percentage of susceptibles diminish rapidly.

It is advisable therefore that if any vaccination campaign against poliomyelitis has to be undertaken in a country in this Region, it should be directed to cover infants and young children up to three years of age.

Information gathered so far on the experience of the countries of this Region regarding the use of inactivated poliovirus vaccine are briefly as follows:

With the exception of Israel, where inactivated poliovirus vaccine is locally produced, all other countries and territories of the Region import their vaccine from France, Germany, the United Kingdoms, U.S.A. and other foreign sources.

The vaccine used is the formalized Salk-type or other similar types incorporating strains of the three known types of poliovirus.

Vaccinations against poliomyelitis is not used in Ethiopia or Pakistan and only occasionally used by private practitioners on a few individuals in Iran, the Sudan and Syria (U.A.R.).

Inactivated poliovirus vaccine is available to the public on request in Aden.

For the last three years, the Colonial Office has provided a scheme offering poliomyelitis vaccination to overseas officers and their families while on leave or before going to Cyprus. The Military authorities now do likewise. In Cyprus itself Salk vaccine is available free to those who cannot afford to pay for it for children from the age of six months to fifteen years and for pregnant women. It is intended to increase the scope of inoculation in Cyprus to wider age-groups. During 1958, some 147,116 doses of vaccine were administered without incident. It is too early as yet to evaluate the campaign.

European children are vaccinated at the request of their parents against poliomyelitis when they return from French Somaliland to France.

In Israel, Salk vaccine is available for all children from three to four months. The response is over 90%. Inactivated poliovirus vaccine is manufactured locally. It is composed at present of 50% Type I, 25% Type II and 25% Type III.

The efficiency of this vaccine (two injections) is about 60% against Type I poliovirus in age-group six to eighteen months. Efficiency with three injections is 97%.

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[1] See document WHO/Polio/25, page 12

A vaccination campaign against poliomyelitis was launched during the winter and spring of 1957 in Israel. Over 60,000 infants and young children received two inoculations, spaced by one month, 0,3 to 0,5 ml each by the intracutaneous and subcutaneous routes respectively. No untoward reactions were noted and the vaccine proved to be safe. Serological tests indicated that children with no pre-antibody to all three types of poliovirus, develop Types II and III antibodies to a significant titre following the inoculation of two doses of vaccine. The development of Type I antibodies in such children was much less striking; only 40-50 per cent of infants developed measurable Type I antibodies after receiving two doses of the vaccine. However, the Type I "booster" effect in children with low Type I pre-antibody titres was very marked. Experiments with attenuated live virus are planned at present in Israel.

Vaccination of the contacts of cases of poliomyelitis is compulsory in Jordan. No vaccination campaigns were held in the country. However, 30,000 children were immunized against poliomyelitis during 1958. It is planned that vaccination of all children and pregnant women will be made compulsory in future.

No immunization campaign against poliomyelitis has been undertaken in Lebanon. Vaccination is used as a preventive measure and the Health authorities advise the public to vaccinate their children mainly during the first three months of the year. The method used is to give three intra-muscular injections with an interval of one month between the first and second dose, and of seven months between the second and third injection.

Although poliomyelitis does not constitute a major public health problem in Libya, an immunization campaign, comprising all children of Tripolitania within the age-group one to three years, has been launched. It is intended to start a similar campaign in Cyrenaica.

The vaccine against poliomyelitis which is used in Tunisia is inactivated by formeline and heat. This makes it absolutely inocuous. It contains low quantities of antibiotics. The vaccine is provided by the Pasteur Institute of Paris. It is administered in three successive injections with an interval of three to four weeks between doses. A booster dose is given the following year. Vaccination campaigns have not been undertaken in Tunisia. Physicians recommend vaccination to individuals attending their clinics.

In the course of 1958 quantities of poliomyelitis vaccine became available to the United Nations Relief and Works Agency for Palestine Refugees, and so a vaccination campaign was carried out in Gaza and to a smaller extent in a few areas of Jordan. The total number of first vaccinations carried out was 11,238 in Gaza and 2,566 in Jordan among the refugee population.

6. LIVE POLIOVIRUS VACCINE

The use of the inactivated vaccine during the last four years on more than 100 million children has established its undoubted value in reducing the number of paralytic, bulbar and fatal cases of poliomyelitis.

This vaccine, however, does not prevent alimentary infection and vaccinated persons are liable as non-vaccinated ones to have unapparent infection and to excrete the virus from the stools. The inactivated vaccine, as currently used, has no modifying effect on the circulation of the virus within the community.

The injection into susceptible persons of the inactivated vaccine creates specific humoral immunity, which suppresses the danger of viremia developing and of the causative agent then becoming generalized in the central nervous system. It does not, however, form local immunity of the intestinal tract which helps to suppress the multiplication of the virus in the main organ which is sensitive to it, preventing thereby the circulation of the poliovirus in the human community. Furthermore, the very important question of how long post-vaccinal immunity lasts after injection of the inactivated vaccine still requires elucidation.

Recent investigations on attenuated poliovirus have led to the isolation of strains that show only minimal residual neurotropism when inoculated in the C.N.S. of monkeys in large amounts.

In the last few years live poliovirus vaccines have been developed incorporating these attenuated strains of the three types of poliovirus.

The vaccine viruses are given orally and cause unapparent infection. They multiply in the alimentary tract like natural polioviruses and the vaccinated subjects develop an immunity which is probably similar to that following an infection with one of the less invasive naturally occuring strains.

Investigations showed that alimentary infections with attenuated viruses were followed by antibody formation in the blood of individuals who had no homotypic antibody.

It is evident that the attenuated poliovirus vaccine has many advantages over the inactivated vaccine.

The live vaccine is cheaper to produce, easier to administer as it is given by mouth, and it may give a better immunity and come nearer to eliminating paralytic poliomyelitis. Inactivated poliovirus vaccine, to be fully effective, must be given in three or more widely-spaced inoculations, a fact which limits its use as an emergency measure in epidemic control. Live virus on the other hand can be used in the face of an epidemic. Attenuated virus vaccine may also

give a broader type of immunity which prevents or at least modifies subsequent infection of the alimentary tract with poliovirus.

The live attenuated poliovirus vaccine would not only confer a more solid immunity against poliomyelitis, but it might possibly eliminate or reduce the movement of virulent polioviruses within a given community - a result which could not be achieved with the inactivated virus vaccine.

The unapparent infection caused by the live attenuated poliovirus, like any alimentary infections, may spread under favourable conditions to the contacts and the community of the vaccinee resulting in immunization of the vaccine and his associates.

Nevertheless, one of the most important questions in the use of an orally administered live-virus vaccine concerns the safety of those who are fed the live-virus and the community as a whole if changes in virulence occur in that virus after its multiplication in the human alimentary tract.

Although increase in neurovirulence has been noted in attenuated virus isolated from the stools of persons who were fed the vaccine, preliminary tests on attenuated poliovirus in the hands of several investigators have not revealed signs of illness or other harmful effects in the vaccinees or their associates.

In view of this fact and after consideration of the data available on the use of live-attenuated polioviruses as immunizing agents against poliomyelitis, the WHO Expert Committee on Poliomyelitis strongly recommended, at its second session, 15-20 July 1957, that trials on tens or hundreds of thousands of people should be carried out in order to establish whether the theoretical expectations of safety from using live vaccines can be confirmed in actual practice.

More than twenty field trials of attenuated vaccine have been undertaken in many countries during the past two years; about four to five million children were given the vaccine. While some of these trials have been organized in populations already partly inoculated with the inactivated vaccine, most of the studies have been made in highly susceptible populations which had not been given inactivated vaccine.

Both small and large-scale studies have usually involved the sequential feeding of children, of 0 to 12 years, with the three types of attenuated poliovirus, but in some of the most recent studies the simultaneous administration of all three types has been done with apparent demonstration of immunization to all three types. Following the oral vaccination, there has usually been a period of surveillance lasting several months in which both vaccinated persons and their associates have

been closely observed. In the larger studies, serological investigations have been made on selected samples of the population.

The efficiency of the vaccines used in the various field trials, calculated on the basis of antibody response of vaccinated children who lacked antibodies before vaccinations, ranged between 50 and 100 per cent. The antibody response depends on the successful establishment of alimentary infection and evidence was produced to indicate that agents which interfere with this alimentary infection will limit the development of immunity.

Generally, infants and children have been found to respond better than adults. The immune status of the individual prior to taking the vaccine obviously had an important bearing on this response. The dose of the vaccine also influenced the development of immunity.

It appeared from the reports on field trials of live vaccine that the degree of spread of infection to contacts of vaccinees varied considerably in different situations, but in families and in closed institutions, spread was common. In countries with a low degree of natural immunity in childhood, considerable spread may occur in the non-vaccinated population. On the other hand, in communities where immunity is acquired at an early age, the spread of the vaccine virus may be restricted.

There has been no evidence that the use of the attenuated vaccines has been followed by either paralysis or any other effects that could be certainly attributed to the vaccine itself, whether in the trials of great magnitude involving millions of persons or in the smaller, and therefore more controllable trials in small communities. There have been cases reported after vaccination, but that would be expected by chance since the vaccine is not 100 per cent effective, and it has been used in situations where poliomyelitis was epidemic, or at least present in the area. However, we know nothing as yet about long-term safety when vaccine virus is spreading through the community. We obviously have to wait for more information.

While the serological studies undertaken in relation to the field trials of attenuated vaccines have uniformly shown significant increases of antibody for polioviruses, and therefore presumed protective value, there has been no attempt, in most of the trials, to assess the effectiveness of vaccine other than by measurement of increase in antibody.

A conference was held under the joint auspices of the World Health Organization and the Pan American Health Organization in Washington from 22 to 26 June 1950 to discuss the whole problem of the live attenuated poliovirus vaccine.

After reviewing the various studies reported on the difficult problems in relation to the development, control and evaluation of the safety and effectiveness of experimental live-attenuated poliovirus vaccine, and in view of the marked difference of opinion among the experts, noted during the discussions, it was not easy for the Conference to give definite conclusions or recommendations. The solution to many of these problems still remains to be found.

There was general agreement that the three sets of vaccine strains reported upon at the Conference were of low virulence for primates. It was apparent, however, that the results being obtained on inoculation of monkeys by different investigators varied considerably - a circumstance attributed by some experts to differences in technique and, perhaps, animal susceptibility. For this reason the Conference emphasized the desirability of standardization of the techniques.

The criteria of attenuation of poliovirus have depended so far upon reduction of neurovirulence for monkeys. Several delegates expressed, however, the need for study of properties other than neurovirulence which might be used as additional evidence for the safety of vaccine strains.

Recent investigations indicate that the study of genetic "markers" related to virulence may prove very useful. The Conference, therefore, emphasized that more work should be done with these new markers.

Studying the stability of the vaccine virus on human passage, several investigators compared the neurovirulence of the vaccine virus with the virus subsequently excreted. As low monkey neurovirulence was the criteria for selecting the strains in the vaccines, this property was regarded by many as the most important measurable character as to whether or not the virus changed in the course of multiplication in the human alimentary tract. Evidence that there was reversion towards increased monkey neurovirulence in the virus excreted after vaccination was obtained by several workers in different countries. However, in the studies reported to the Conference there was no evidence of progressive increase in neurovirulence for monkeys during prolonged multiplication in the vaccinated individual or after serial passage of virus in human beings.

In this connection, the conference emphasized again the need for more work on the subject of the genetic markers of poliovirus and their possible use for detecting altered strains with greater neurovirulence than that of the vaccine virus itself. This will certainly help in differentiating excreted vaccine from "wild" strains of poliovirus.

The fact that there has been, so far, no clinical evidence of trouble resulting from reversion to a significant degree of virulence on human passage seems to justify the continuation of trials even though laboratory studies have shown that a degree of reversion may occur. Further observations on this vital point are needed.

The problem of spread of vaccine virus is intimately linked with the problem of reversion, since if reversion did not occur spread might be considered desirable. If significant reversion does occur spread must be avoided if possible. Studies of these two problem should therefore be combined.

Some viruses found in the alimentary tract, as well as naturally occurring polioviruses, have been found to prevent the infection with attenuated vaccine virus from being established. These naturally found viruses interfere with, and suppress the multiplication of the orally given vaccine virus.

This phenomenon of interference is apparently most serious under conditions of poor sanitation, as those prevailing in our Region and similar areas in the tropical and subtropical zones, where the viruses are very widely spread. Such interference with the establishment of infection with the vaccine virus may make the vaccine ineffective or partially so, in just those areas where its uses would seem to be specially indicated. It was clear to the conference that this is a problem which needs much more study.

Earlier reports had suggested that, if all three types of poliovirus were administered simultaneously, there was interference between them. However, recent studies have indicated that when either a higher dosage of each virus type is used in a trivalent preparation or when the preparation is fed more than once, the results were at least as good as, or better than, those achieved by feeding the strains consecutively.

Use was made of the interference phenomenon in the reverse direction in the trial in Singapore, where type 2 was fed during a type I epidemic (last months of 1958 and the first two months of 1959) in the hope that the presence of type 2 virus in the alimentary tract would interfere with the establishment of the type 1 virus causing the natural infection. There may be suggestion that it did so but it was not found easy to confirm this suggestion from the data provided.

In view of the above it would be concluded that it does not seem advisable at present to encourage countries to embark on the application of the attenuated poliovirus vaccine as a routine control measure. It may be justified to encourage its experimental application in certain circumstances, but each situation should

be considered on its merits. In particular, when its use is proposed, provision should be made for the most careful supervision and suitable arrangements should be made to ensure that evaluation is possible.

The World Health Organization is willing to advise on any specific situation that might arise.

The inactivated (Salk-type) vaccine should be still considered the public health measure of choice and its use should be encouraged when circumstances demand it and when it is a practical proposition.

ANNEX I

CASES AND DEATHS REPORTED ACUTE POLIOMYELITIS SINCE 1951

Country		1951	1952	1953	1954	1955	1956	1957	1958
Iraq	C	45	92	72	55	107	b) 146	172	181
	D	--	2	--	--	1	2	3	7
Israel	C	a) 918	a) 874	a) 636	a) 785	a) 467	a) 533	67	636
	D	177	163	130	89	51	45	1	30
Jordan	C	39	15	54	54	67	41	24	179
	D	6	3	9	6	--	3	--	3
Lebanon	C	5	58	25	c) 51	30	82	47	89
	D	...	7	1	...	...	...	...	--
Tunisia	C	46	10	24	31	8	9	11	d) 6
	D	...	...	...	...	...	...	...	...
UAR(Egypt)	C	18	260	551	681	865	585	548	744
	D	12	23	44	56	66	...	...	...

a) Jewish population only.

b) 11 months

c) Preliminary, approximate or estimated data

d) 22 ten-day periods

... Data not available

-- Nil or magnitude negligible

ANNEX II

SEX AND AGE DISTRIBUTION OF CASES OF POLIOMYELITIS

Country	Year		All ages	Age groups in years						
				0	1-4	5-9	10-14	15-19	20-24	25&+	?
Israel	1955	T	402	109	250	30	5	1	5		2
		M	216	...	...	...	...	...	...		...
		F	186	...	...	...	...	...	...		...
Lebanon	1955	T	30	5	23	1	--	1	--	--	--
UAR(Egypt)	1954	T	590	191	369	22	6	1		1	--
		M	340	111	208	15	5	--		1	--
		F	250	80	161	7	1	1			--

T = both sexes

M = male

F = female

... data not available

-- nil or magnitude negligible

ANNEX III

REPORTED ACUTE POLIOMYELITIS

Seasonal Distribution of Cases and Deaths

1958

Country		Months or four-week periods												
		J I	F II	M III	A IV	M V	J VI	J VII	J VIII	A IX	S X	O XI	N XII	D XIII
Aden Colony[a]	C	--	--	--	--	--	--	--	--	--	--	--	--	--
	D	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyprus	C	--	2	6	20	71	41		4	3	2	1	--	--
Ethiopia[a]	C	--	--	1	1	1	--	--	--	2	2	--	--	
	D	--	--	--	--	--	--	--	--	--	--	--	--	
Iraq	C	43	30	32	17	10	9		10	16	14	14	31	17
	D	1	--	--	1	--	1		1	3	--	--	--	--
Israel	C	2	8	12	12	31	158		195	129	44	23	10	12
	D	--	--	1	--	4	6		7	8	--	2	--	2
Jordan	C	5	7	17	27	37	46		18	8	4	4	6	--
	D	--	--	1	--	--	--		--	1	--	1	--	1
Lebanon[a]	C	5	5	7	9	5	5	[c] 11	10	7	[c] 8	6	4	7
Libya	C	14	11	27	--	7	...		...	2				
	D	--	--	--	--	--	...		...	--				
Palestine Refugees[a&b]	C	2	3	5	13	6	11	7	1	3	1	3	5	1
Somaliland (British)[a]	C	--	--	--	--	--	--	--	--	--	--	--	--	--
	D	--	--	--	--	--	--	--	--	--	--	--	--	--
Somaliland (French)	C	--	--	--	--	--	--		--	--	--	--	--	
	D	--	--	--	--	--	--		--	--	--	--	--	
Sudan[a]	C	--	--	--	--	2		--	--	--	--	--	--	
	D	--	--	--	--	--	--	--	--	--	--	--	--	
UAR (Egypt)[a]	C	68	75	78	56	81	71	47	13	20	84	36	52	63

[a] Four-week periods ending

[b] cases among Palestine Refugees (about 900,000) in Jordan, Lebanon, Syria and Gaza Territory

[c] 3 weeks

-- Nil or magnitude negligible

... Data not available