WORLD HEALTH ORGANIZATION

الهيئة الصحية العالمية
المكتب الإقليمي لشرق البحر الأبيض

ORGANISATION MONDIALE DE LA SANTÉ

REGIONAL OFFICE FOR THE EASTERN MEDITERRANEAN

BUREAU RÉGIONAL DE LA MÉDITERRANÉE ORIENTALE

REGIONAL COMMITTEE FOR THE EASTERN MEDITERRANEAN

EM/RC9B/Tech.Disc/11
1 September 1959

Ninth Session

ORIGINAL: ENGLISH

Agenda item 17

TECHNICAL DISCUSSIONS - SUB-COMMITTEE B

POLIOMYELITIS

POLIOMYELITIS IN UNDERDEVELOPED COUNTRIES

by

Habibuz Zaman M.B.B.S., M.S., F.C.A.P.
Asst. Professor of Pathology
Dow Medical College, Karachi, Pakistan

Till recent years it was thought that poliomyelitis was a rare disease or perhaps did not exist at all in the tropical and underdeveloped countries. As a matter of fact, in those parts of the world where poliomyelitis was known to be prevalent, infants alone were affected and only sporadic cases were seen. One of the earliest recorded epidemics of poliomyelitis occurred in the Scandinavian countries around 1870. Soon after Northern Europe was involved. The United States has been affected by epidemics of poliomyelitis only since the turn of the century (7). In recent years this change in the epidemiology of the disease has been witnessed in some of the underdeveloped and tropical countries also. During the last twenty years epidemics have occurred, amongst other places, in the Carribeans, Malta, Puerto Rico and Hawaii (7). This emergence of poliomyelitis from an endemic disease of infants to an epidemic disease of infants and children and even young adults (in few places) is certainly an outstanding feature of the study of epidemiology in recent years. It is believed that poliomyelitis may sooner or later present itself as a problem in those parts of the world now considered to be safe. It is thus important for us to understand the nature of this challenge so as to be prepared to tackle it effectively if and when the occasion arises.

It has been said that epidemics of poliomyelitis have occurred in recent years in some of the tropical and underdeveloped countries. The point naturally comes to mind: was the poliovirus freshly introduced into those areas or did the virus already exist there? If the latter is true, one would have to explain the apparent absence of the disease in the past in those regions.

One of the earliest recorded evidence that the poliovirus existed in tropical and underdeveloped countries, though not understood at that time, was the finding in 1935 of a much higher percentage of positive results of neutralization tests among the relatively young adults in these regions than other areas where the disease was thought to be much more prevalent(8). In 1936 Hillman(3) noted a higher attack rate of poliomyelitis amongst American soldiers stationed in Manila than among the local inhabitants. Important observations of similar nature were highlighted during World War II. The rates of attack were found to be much higher amongst U.S. and British soldiers stationed in the Middle East(9); India(6), Burma and the Philippines than had ever been noted amongst the local population. Furthermore, these rates were also several times larger than were experienced by troops in their own countries (Fig. I)(10). These findings pointed sharply to the presence of virus in the community.

Since the introduction in 1949 by Enders(2) of technics for the growth of poliovirus in non-nervous tissue, the study of the epidemiology of poliomyelitis on a large scale has been made possible. Expensive and crude neutralization tests in monkeys have now given way to reliable tests which can be carried out with ease. The neutralization and complement fixation tests have been applied in studying the status of immunity in different populations. A few studies have happily been made in the countries included within the Eastern Mediterranean Region of the World Health Organization. The results are seen in figures 2(11), 3(12) and 4(13). It is apparent that the population is exposed to the poliovirus rather early in life as antibodies are present to one or more types of the virus in over 90% of the population above four years of age. As seen in Fig. 2 the most susceptible age group (seven months to four years), as measured by the presence of neutralizing antibodies, is also the one in which the maximum number of paralytic cases occur. Thus, there is a good correlation, in the case of poliomyelitis, between antibody level and the protection it affords. Figure 4 presents an excellent comparison of the neutralization and complement fixation patterns between two distant populations. It is known that the neutralizing antibodies are life-lasting whereas the complement fixing antibodies persist for three to five years only. It is thus seen that in Cairo, Egypt, 90% of the population have reached immunologic maturity before the age of five - there is hardly any further rise in the curve for the neutralizing antibodies. In contrast, the figures for Charleston W.Va, U.S.A indicates a gradual rise in the level of neutralizing antibodies and 90% of the population only above the age of 30 have developed similar protection. There is also a progressive rise in the curve for the complement fixing antibodies up to the age of 25 years in this population as opposed to the situation in Cairo, Egypt, where these antibodies gradually fall in level after the fourth year.

As is now well known poliovirus is excreted in the feces. Contamination with human excreta is a simple matter in the underdeveloped countries with primitive methods of sanitation. Thus is afforded the opportunity for infection early in life with development of immunity with or without clinical disease. It is recognized that poliomyelitis is relatively less severe in young children than in older children and adults (Fig. 5)[4] with fewer cases of paralysis in the younger population. The few cases of paralysis that do occur in these areas are often labelled as "acute paralysis". The numerous non-paralytic cases and inapparent infections are not reported at all. It must be remembered that only one to two percent of those infected by the virus turn out to be frank cases of poliomyelitis with involvement of the central nervous system with or without paralysis whereas over 90% suffer from entirely inapparent infections detected only by serologic tests (Fig. 6). Thus, for the vast majority of the population the benefit of exposure to the virus is obtained without clinical evidence of the disease. This explains the mystery of the inapparent nature of poliomyelitis in the tropics. It is obvious, then, that this situation in the underdeveloped countries is the result of an excess of virus in the community rather than an absence of the same.

In contrast, in those parts of the world where sanitation and living standards have improved, the younger children have been more protected and denied the benefit of exposure to the virus with lack of antibody production and immunity. When inevitably exposed to the virus at a higher age the disease is likely to be more severe with more cases of paralysis. With a larger number of susceptibles in the population more widespread epidemics have resulted. The rising age of poliomyelitis patients in developing community is well illustrated in Fig. 7 [13]. Whereas thirty years ago only 8% of poliomyelitis patients were above the age of fifteen, today more than 35% of patients may be of fifteen years of age or older.

With the progress that is inevitable in this part of the world better sanitation and improved standards of living will surely come about in course of time. With these changes there is every likelihood that poliomyelitis will emerge as an epidemic disease in our region. Within recent years in the Carribeans alone, epidemics have appeared in Cuba, Jamaica, Trinidad, Costa Rica and more recently in British Guiana.

As an index of the status of sanitation in a community the infant mortality rate could reflect on the likelihood of poliomyelitis epidemics. This is, indeed, the case as very well illustrated in Fig. 8 from Payne of the WHO advanced countries such as Sweden, Australia, U.S.A., Switzerland, Denmark,

Canada, England, and Wales where the infant mortality per 1000 live births is less than forty, have had more than 100 to 200 cases of poliomyelitis per million population per year. In contrast less developed countries like Egypt, Chile, Yugoslavia, Mexico and Columbia have had around ten cases or less of poliomyelitis per million population per year.

This brings us to the consideration of the use of vaccine for the Eastern Mediterranean region. On the basis of the serologic work done in Cairo, Egypt (Fig. 4) and Morocco (Fig.3) and in other areas we can assume that about 90% of the population above the age of four or five years in our region have developed antibodies to one or more types of the poliovirus. It is also known that up to the age of seven months antibodies obtained from the mother are present in the circulation of the infant. In our region, therefore, the need for the use of a vaccine would be limited, for all practical purposes, to the age-group seven months to four years (Fig 2). It is now established that protection against poliomyelitis has been afforded in a very large proportion of vaccinated individuals by the use of Salk's killed virus vaccine. In the small number who have had the disease in spite of receiving the vaccine the disease has been less severe and almost free of paralysis[16]. The exact period for which the vaccine would remain effective, however, is for the future to tell - life-long immunity may not be imparted even after the three shots are administered. Repeated doses may be necessary. The administrative difficulties of bringing a child in three times for the shots (especially in underdeveloped areas) are well recognized. In view also of the infrequency of paralytic cases in this age group, and the almost complete assurance of sub-clinical infection with the concomitant development of antibodies, the need for artificial immunization against poliomyelitis in this part of the world becomes less urgent. The number of cases of infantile paralysis in our region are probably so few as would not justify adoption of a massive vaccination programme against this disease even when restricted to the seven months to four years age group. For countries like Pakistan, where an easily preventable disease like smallpox still occurs in epidemics resulting in several hundred to over thousand deaths annually, the time is not ripe yet for an expensive vaccination programme against poliomyelitis. On the other hand, trials with an easily administrable "live" attenuated poliovirus vaccine are in the experimental stage [5,15,1]. The prospect of a vaccine of this type either supplementing or substituting the Salk killed vaccine does exist. Till such date as these developments take a concrete shape the only positive step which need to be recommended is that young individuals from advanced countries , say up to the age of thirty years or over, visiting our area may be required to get vaccinated against poliomyelitis in the interest of their own protection.

While at the moment it has been considered impractical to institute a vaccination programme against poliomyelitis in this part of the world, it is suggested that serologic surveys are carried out every few years, preferably under the auspices of the World Health Organization, to determine any appreciable change in the antibody status as related to the age of the population. In the light of past experience such change seems inevitable. Pilots serologic studies, at regular intervals, in different parts of our region, would indicate the proper time for action against poliomyelitis in this part of the world. Advantage could then be taken of an easier and more effective method of immunization against poliomyelitis, which it is hoped, will be developed in the not too distant future.

REFERENCES

1. Dane, D.S. et al (1957) Brit. med. J. I, 59.
2. Enders J.F., Weller, T.H. & Robbins F.C. (1949) Science, 109, 85.
3. Hillman, C.C. (1936) Milit. Surg. 79, 48.
4. Horstman, D.M. (1955) Ann. N.Y. Acad. 61, 964.
5. Koprowski, H. et al (1956) J. Amer. med, Ass. 160, 954.
6. Mc Alpin, D. (1945) Lancet 2, 130.
7. Paul, J.R. (1958) Poliomyelitis in Clinical Epidemiology, Chicago,p.206.
8. Paul, J.R. and Trask, J.D. (1935) J. exp. Med. 61, 447.
9. Paul, J.R., Havens W.P. Jr. and Van Rooyen, C.E. (1944) Brit. med.J. I, 841.
10. Paul, J.R. (1949) Amer. J. Hyg. 50, 57.
11. Paul, J.R. (1956) J. Amer. Med. Ass. 162, 1585.
12. Paul, J.R. & Horstmann, D.M. (1955) Amer. J. trop. Med. 4, 512.
13. Paul, J.R. (1955) Epidemiology of Poliomyelitis. Monograph Series No. 26, Geneva, World Health Organization.
14. Payne, A.M. M. (1955) Poliomyelitis as a World Problem. In: International Poliomyelitis: papers and discussions presented at the Third International Poliomyelitis Conference, Rome 1954, Philadelphia.
15. Sabin, A.B. (1956) J. Amer. med. Ass. 162, 1589.
16. Salk, J.E. (1957) Amer. J. publ. Hlth. 47:I.

KEY TO FIGURES

Fig. I - RATES (PER 1000) AT WHICH POLIOMYELITIS WAS CONTRACTED BY UNITED STATES TROOPS stationed in different areas during the period 1940-1948, Paul J.R. (1949) Amer. J. Hyg., 50, 57.

Fig. 2 - MEASURES OF IMMUNITY TO POLIOMYELITIS IN NORTH AFRICAN POPULATIONS
The age period in which less than 90% of the population lacks antibodies (indicated by vertical lines) is brief (upper panel); when paralytic cases occur (lower panel) they are virtually confined to the youngest of the age groups. Age group to be vaccinated here need hardly extend beyong age 5. Reproduced from Paul J.R. (1956) J.Amer. med.Ass. 162, 1586.

Fig. 3 - NEUTRALIZING ANTIBODIES to the three types of poliomyelitis virus in French Morocco. Reproduced from Paul J.R. & Horstmann, D.M. (1955) Amer. J. Trop. Med. 4, 523.

Fig. 4 - COMPARISON OF NEUTRALIZING ANTIBODY PATTERNS WITH COMPLEMENT FIXING ANTIBODY PATTERNS IN TWO POPULATIONS. (A: CAIRO, EGYPT, B: CHARLESTON, W.VA, U.S.A.).

The values indicated in this group correspond to the age groups 1,2,3,4,5 - 9, 10- 14, 15-29 and 30+years.

- — · — · — · — = Neutralizing 1:2 dilution of serum

———————— = Complement-fixing 1:4 dilution of serum

— — — — — — = Complement-fixing 1:16 dilution of serum.

Reproduced from Paul J.R. (1955) Epidemiology of Poliomyelitis. Monograph Series No. 26, Geneva, World Health Organization.

Fig. 5 - CLINICAL TYPES OF POLIOMYELITIS RELATED TO AGE: per cent non-paralytic, spinal paralytic and bulbar cases in each age group, New York City, 1951 to 1953. Data from Dr. Morris Greenberg, Director, Bureau of Preventable Diseases, New York City Dept. of Health cited by Horstmann D.M. (1955) Ann. N.Y. Acad. Science 61, 964.

Fig. 6 - SCHEMATIC DIAGRAM OF THE CLINICAL AND SUB-CLINICAL FORMS OF POLIOMYELITIS correlated with the times at which virus is present in various sites and the development of antibodies. From Paul J.R. (1955) Epidemiology of poliomyelitis. Monograph series No. 26 Geneva, World Health Organization.

Fig. 7 - THE RISING AGE OF POLIOMYELITIS PATIENTS IN CONNECTICUT, U.S.A.
Reproduced from Paul J.R. (1955) Epidemiology of Poliomyelitis. Monograph Series No. 26 Geneva, World Health Organization.

Fig. 8 - COMPARISON OF INFANT MORTALITY RATES AND POLIOMYELITIS INCIDENCE IN TWENTY-TWO COUNTRIES
Re-drawn from Payne, A.M.-M. (1955) Poliomyelitis as a world problem. In: International Poliomyelitis Congress, Poliomyelitis. Papers and discussions presented at the Third International Poliomyelitis Conference, Rome 1954, Philadelphia.

Figure 1

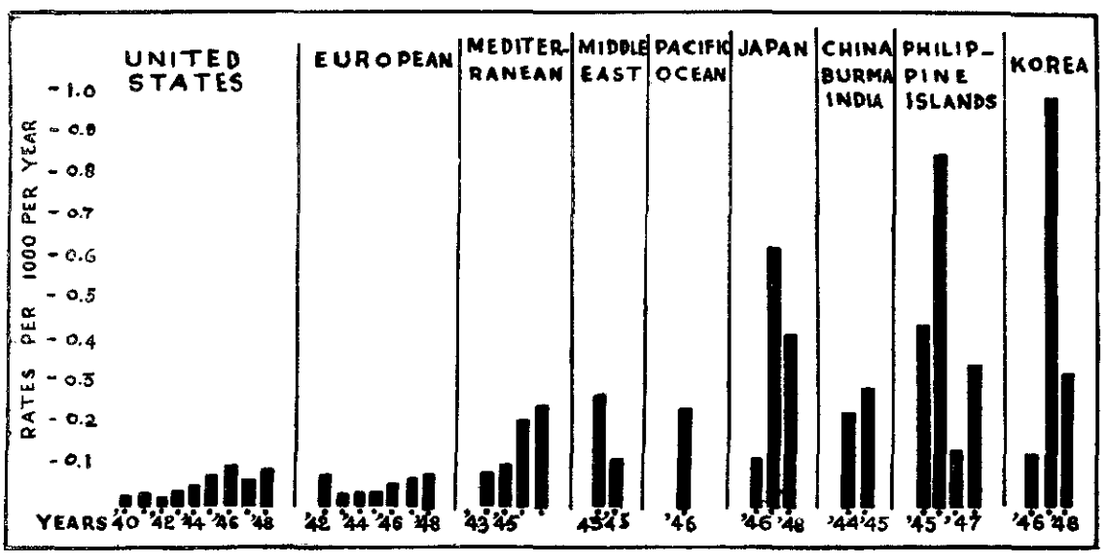

Figure 2

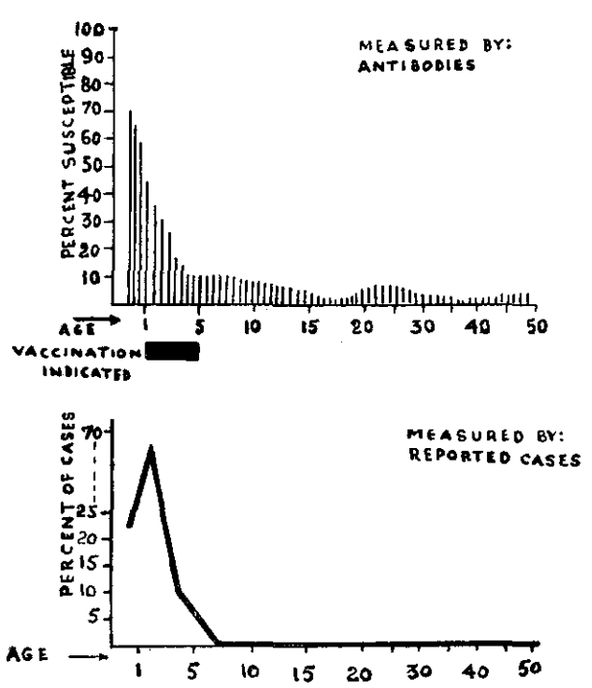

Figure 3

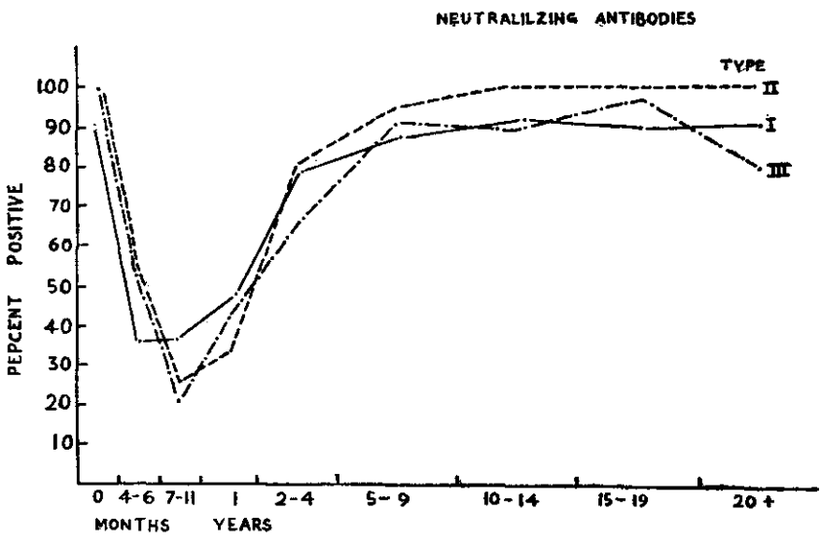

Figure 4

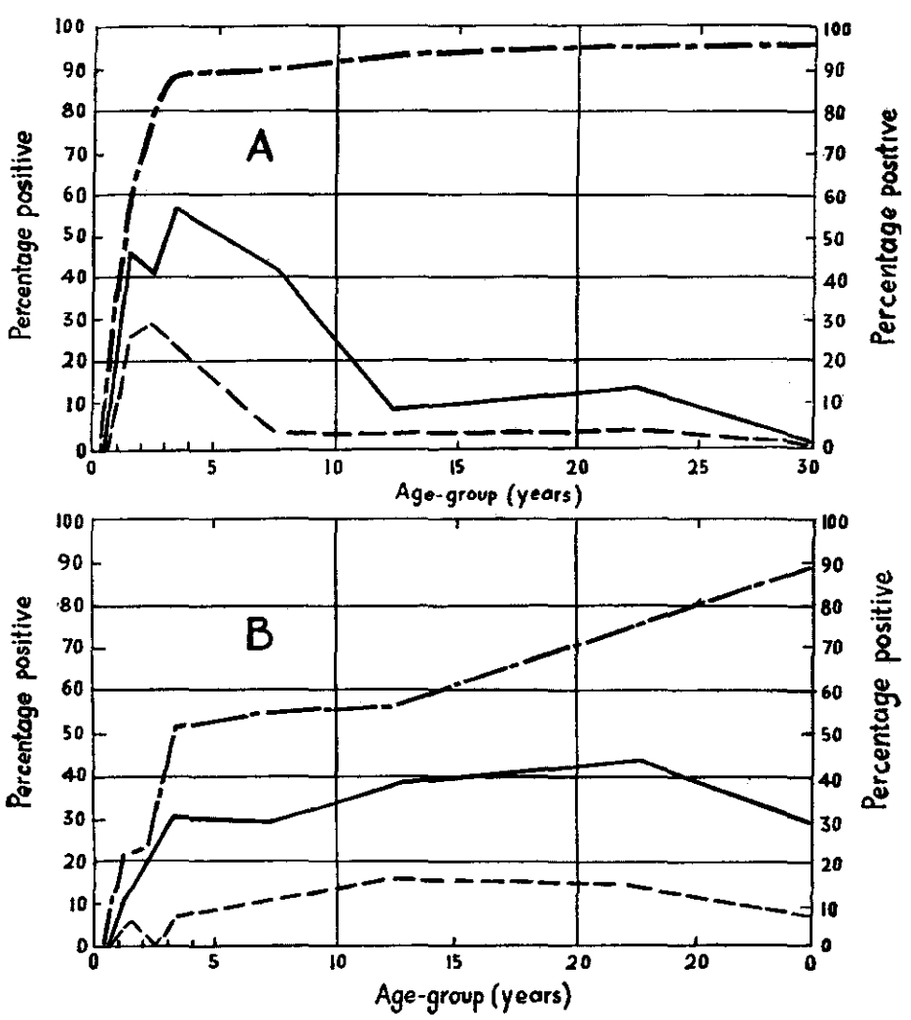

Figure 5

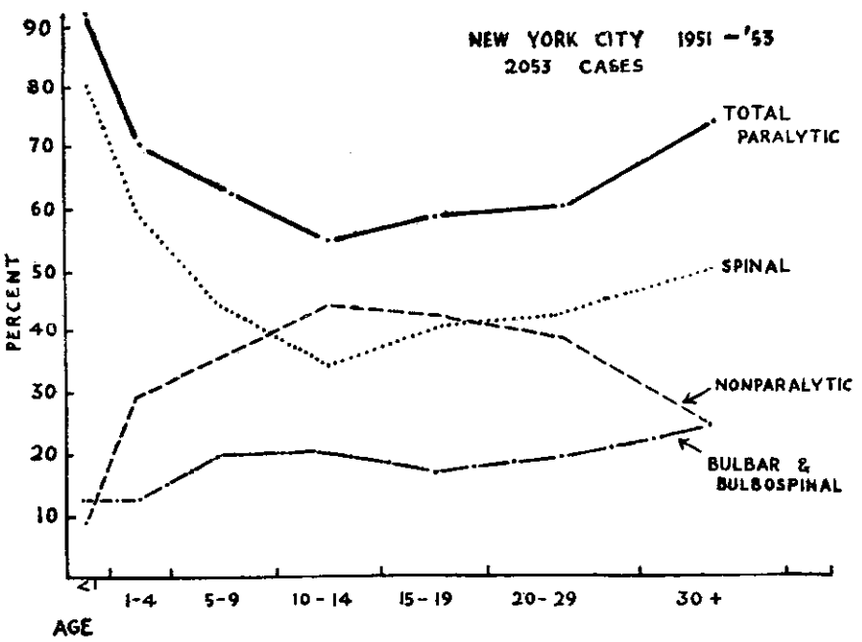

Figure 6

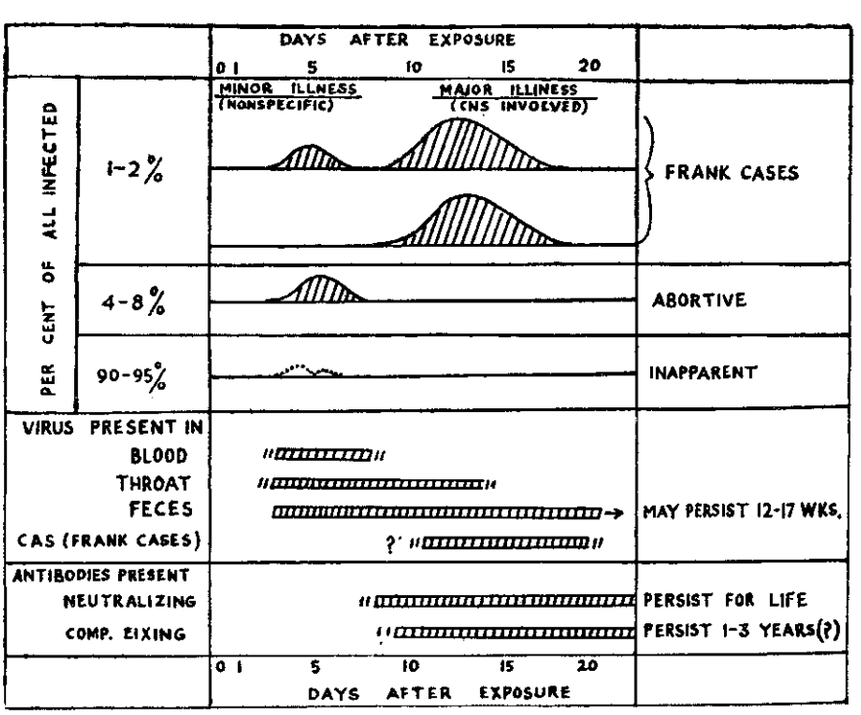

Figure 7

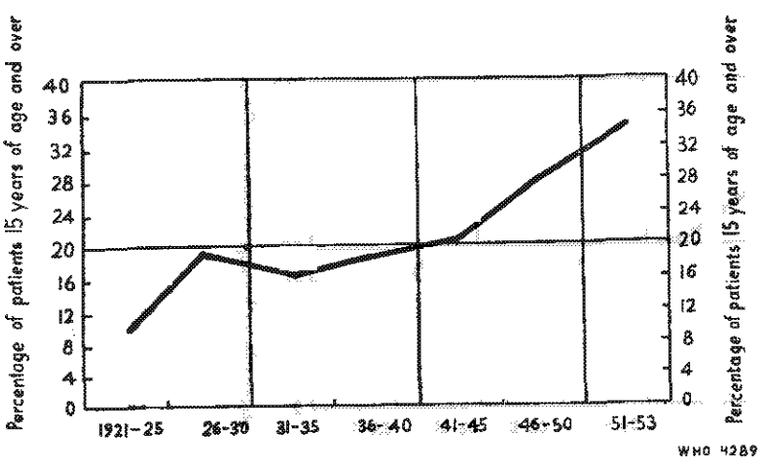

Figure 8