

## The epidemiology of infectious hepatitis in Israel

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*(Received 14 October 1960)*

### INTRODUCTION

The countries along the Eastern Mediterranean coast have been recognized as highly endemic areas for 'catarrhal jaundice' at least since 1918 (Btsh, 1944). In Palestine, the native population, both Arabs and Jews, showed sporadic cases in children and adolescents while adult newcomers—police, troops and refugees—seemed particularly susceptible (Btsh, 1944; Cameron, 1943; Kligler, Btsh & Koch, 1944). The epidemic situation was last analysed by Olitzki, Bacchi & Kallner in 1948 and they estimated the incidence at about 1% for the total population.

Since 1948, there has been mass immigration to what is now Israel, of over a million persons from the four corners of the earth, and the present paper records some of the epidemiological consequences.

### SOURCES OF DATA

#### *Notification by physicians*

The notification of each case of infectious hepatitis is required by law. We have used the Central Infectious Diseases Register of the Ministry of Health which is based on these notifications and which forms the source of the incidence rates. Under-reporting is the rule and the true incidence may be 3–4 times higher (Davies, 1959). Until the end of 1957, an individual notification of each patient was demanded and this included the country of birth and precise address among other details. Since 1958, group notification of total cases by broad age class has been substituted.

Reporting of cases from the non-Jewish population is particularly poor and thus most of the usable data is confined to Jews.

#### *Worker's Sick Fund statistics*

The Sick Fund of the General Federation of Labour provides curative services for about two-thirds of the population and publishes an annual summary of morbidity among its members (Kupat Holim, 1960). These figures are based however on 'first diagnosis' and this may subsequently be changed.

*Hospitalization data*

Through the kindness of Dr Gertrude Kallner of the Central Bureau of Statistics all the IBM punched cards of hospitalized cases of infectious hepatitis, 1951–57, were made available. These cards represent a 25% or 50% random stratified sample of hospitalized cases.

*Demographic data*

Data on composition of the population by age, sex, country of origin, etc., have been taken from the annual 'Statistical Abstracts of Israel' published by the Government Printer.

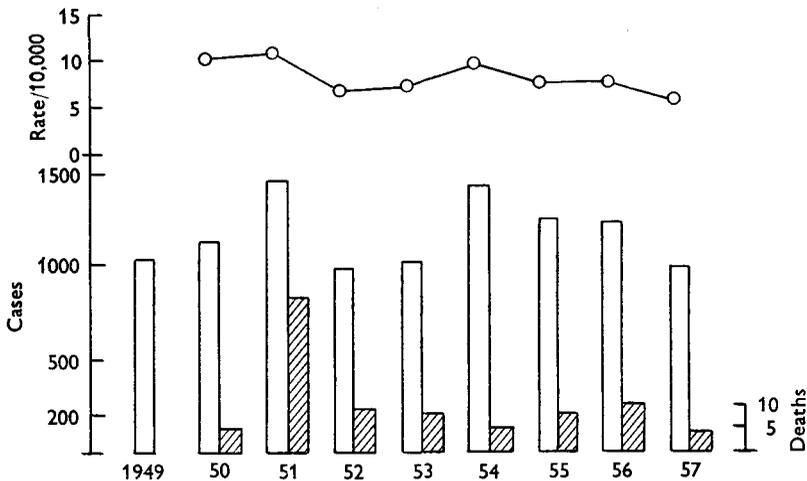


Fig. 1. Reported cases and deaths from infectious hepatitis, and incidence rates per 10,000 (Jewish population), 1949–57.

## RESULTS

*Incidence rates*

Fig. 1 shows the total reported incidence of infectious hepatitis between 1949 and 1957. The rates fluctuated between 5.7 and 11.4 per 10,000 for Jews, being equally divided between the sexes. A rise in incidence between 1949 and 1951, in 1954 and again in 1958, paralleled increased waves of immigration with a lag of up to two years. During 1948–50, from 50 to 85% of immigrants came from European countries, during 1953–56, a similar proportion was from the countries of North Africa (see below).

During the same period, the rates reported for members of the Workers' Sick Fund were three to four times higher.

Mortality from the disease is low, averaging about 5 and never more than 10 deaths per year (Fig. 1).

*Effect of age*

Infectious hepatitis in Israel is essentially a childhood disease (Fig. 2). Two-thirds of the cases were under 10, the highest morbidity rates being between 1 and 9 years of age (Table 1). Babies under 12 months of age constituted 1.3% of all cases in 1957, ages 2-6 contributing about 9% per year of life.

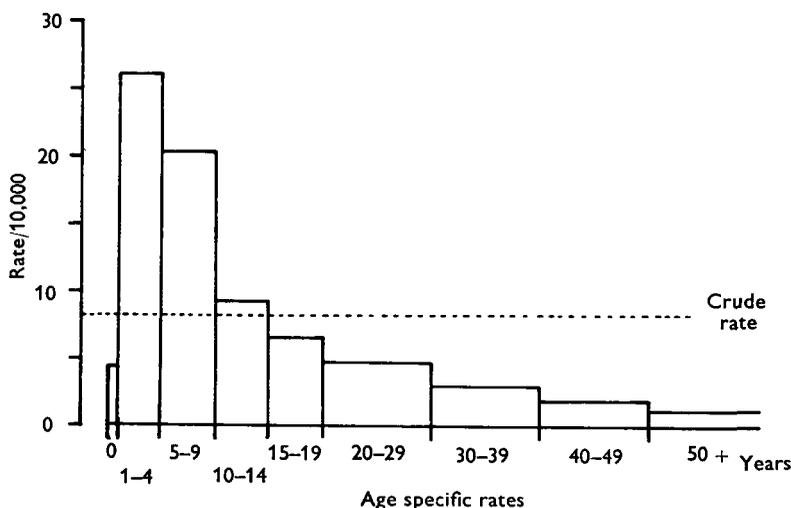


Fig. 2. Age specific rates of notified cases, 1953-57.

Table 1. *Infectious hepatitis, 1957 and 1959*

(Age specific rates.\*)

Year	Age				
	0	1-4	5-9	10-14	15+
1957	2.7	14.9	14.7	6.8	2.0
1959	8.5	20.8	15.4	8.5	1.7

\* Rates per 10,000, Jewish population only.

*Morbidity by region*

Regional analyses are presented for the years 1957 and 1959. In these years rates of more than 10 per 10,000 inhabitants were recorded for the Jerusalem, Sharon, Safed and Kinneret regions, while the rate for Tel-Aviv was less than 3 (Fig. 3).

These differences depend to a considerable degree on the standard of reporting in the respective areas. In 1957, for example, the rate for all Sick Fund members was 20.4 per 10,000, 3.6 times higher than the national reported rates. For Tel-Aviv, however, Sick Fund figures were over 15 times higher, for Jerusalem, only twice as high. Thus, in Tel-Aviv, where the proportion of private and semi-private practice is much higher than in the rest of the country, the degree of reporting is much worse and the rates, artificially low.

*Type of settlement*

Farms, agricultural schools, new immigrant towns and communal settlements (kibbutz) showed highest attack rates. Fig. 4 illustrates these findings for the year 1957. Workers' Sick Fund data for the same period showed highest rates in new immigrant towns and rural areas and lowest rates in towns.

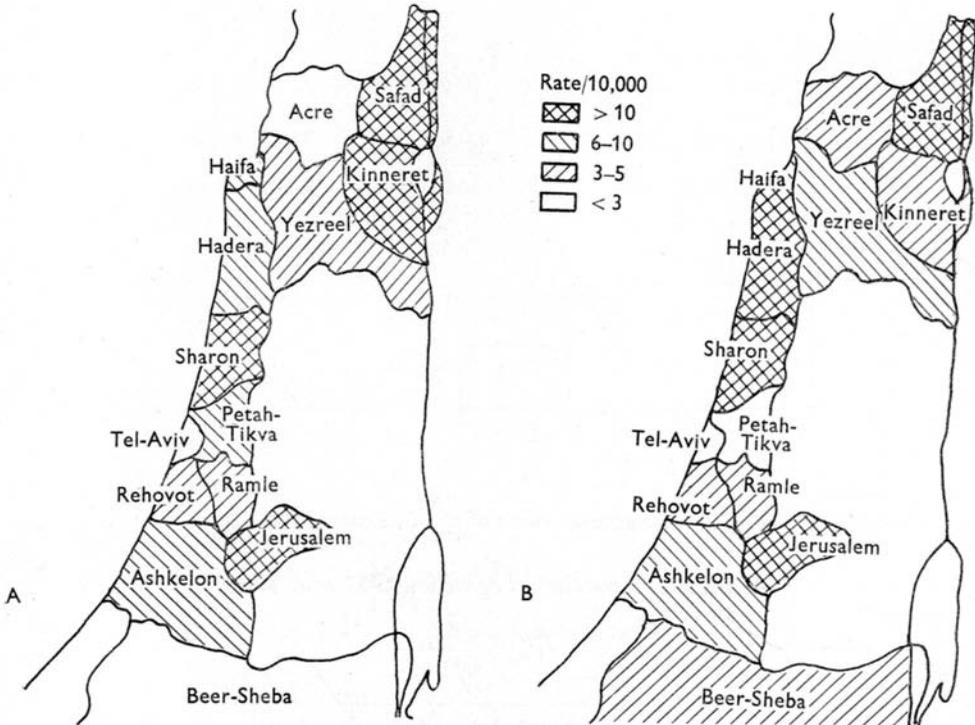


Fig. 3. Regional variation in attack rate of infectious hepatitis. A, 1957; B, 1959.

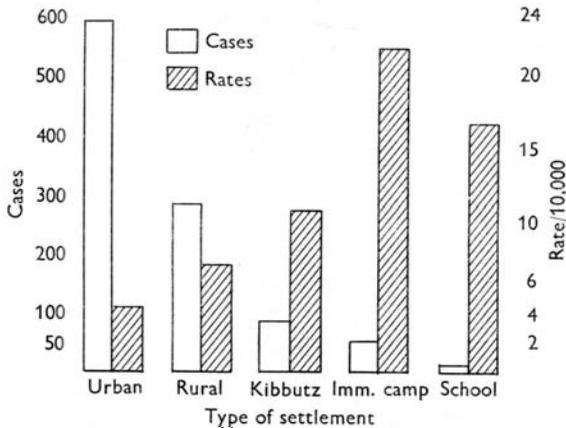


Fig. 4. Attack rate by type of settlement, 1957.

*Seasonal incidence*

The incidence curve shows a summer fall and a winter rise. During the years 1953-59, the standard monthly rate (S.M.R.) for December was nearly twice that of the mean, while that for May and June was less than half (Fig. 5).

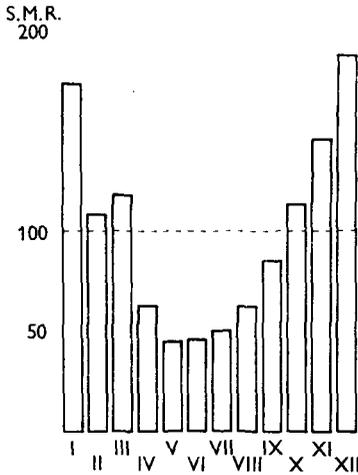


Fig. 5

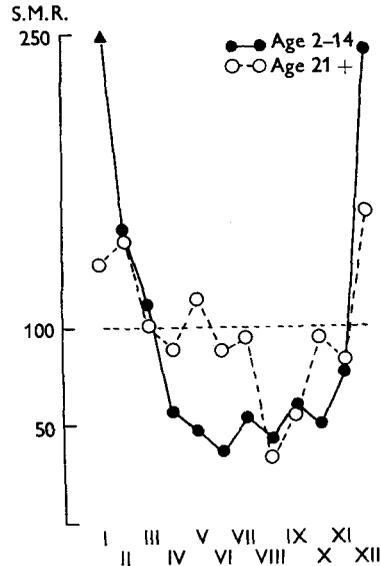


Fig. 6

Fig. 5. Seasonal variations in incidence of infectious hepatitis: standardized monthly rate (S.M.R.) as a percentage of the mean, 1953-59.

Fig. 6. Effect of age on standardized monthly rate, 1957.

Table 2. *Distribution of population and reported cases of infectious hepatitis by country of origin, 1957*

Country of origin	% of population	% of patients
Europe, America	56.1	58.0
Middle East	19.9	17.9
Yemen	5.4	6.3
North Africa	15.5	16.0
Non-Jews (Israel)	10.8	1.5

When the cases are divided into age-groups, the effect of season is seen to be much more marked in the case of children and much less so in the case of adults. Data for 1957 are illustrated in Fig. 6.

*Country of origin*

Table 2 shows that the morbidity by country of origin in 1957 was roughly proportional to its representation in the general population. For purposes of calculation, children born in Israel were grouped according to the country of origin of the father. On the other hand, the non-Jewish community showed only

one-seventh of the expected incidence: this difference is as likely to be due to under reporting as to low morbidity.

Examination of hospitalized cases, 1951–57, similarly shows no significant difference in rate as between the different countries of origin. Total hospitalization rates for a given ethnic group were however higher for the year or so following mass immigration of that group (see below). There is some bias of hospital data due to age selection and the different age structures of the various ethnic groups. For example, European immigrants tend to be older, North African immigrants younger with more children.

Table 3. *Infectious hepatitis, 1957, mean age by country of origin*

Country of origin	All patients	Under age of 10
Total population	12·8	5·2
Europe, America	18·0	6·0
Middle East	11·0	4·8
Yemen	13·8	3·5
North Africa	11·2	3·7

Table 4. *Notification and hospitalization rates per 10,000,\* 1951–57*

Year	Notified morbidity	Hospitalization
1951	11·0	3·9
1952	6·9	3·8
1953	7·2	2·8
1954	9·6	3·3
1955	7·6	2·8
1956	7·6	3·4
1957	5·7	3·2

\* Jewish population.

The mean age at onset of the disease (Table 3) was 12·8 years in 1957, higher in European–American immigrants and lower in those from the Middle East and North Africa. In order to reduce the bias due to variations between the mean ages of the different ethnic groups, mean ages at onset were calculated separately for children under 10. North African and Yemenite children are affected earlier, while infection is delayed in children of immigrants from Europe and America (Table 3). During 1957 there were only thirteen cases under 1 year of age, seven of them from North African families.

### *Hospitalization*

The hospitalization rate varied from year to year, being highest in 1951–52 but not following the curve of reported incidence (Table 4).

More cases were hospitalized than was expected from the notification data, a further indication of under-reporting of notified cases. The proportion hospitalized is high in the first year of life (35% of all cases), falls to an average of 8% of notified cases in school children and rises thereafter to 35% in persons over

60 (Fig. 7). The selection by age explains to some extent, why in years with an increased immigration of young adults and older persons, the hospitalization rates rose disproportionately to the rise in total incidence.

*Sojourn in Israel*

Details of time in the country are incomplete in much of the notification data, and thus recourse was had to hospitalization data. For a sample of 983 patients hospitalized with infectious hepatitis, during 1951–57, the rate fell from 8·1 per 10,000 during the first year in the country to 2·1 for those who had been in Israel

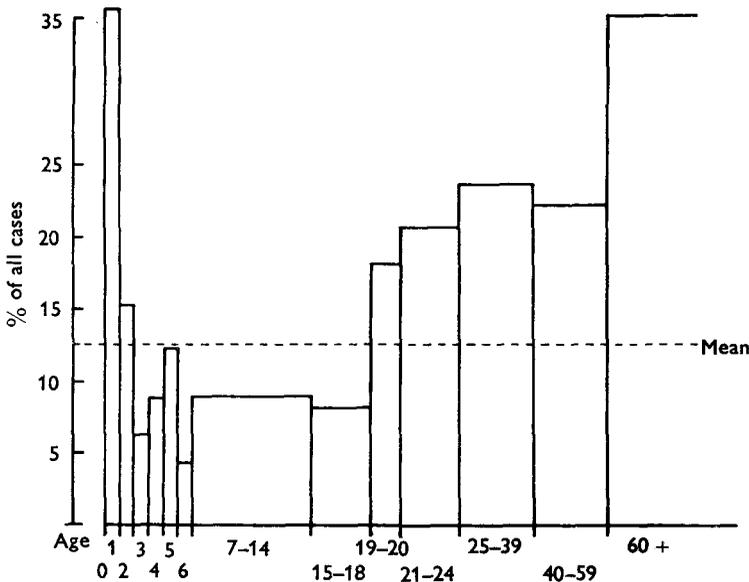


Fig. 7. Percentage of cases hospitalized by age-group, 1957.

Table 5. *Hospitalized cases of infectious hepatitis, 1951–57*

(Age specific rates\* per 10,000 according to sojourn in Israel.)

Age	Years in Israel							Native born	Totals
	1	2	3	4	5	6–10	11–		
0–9	5·3	2·4	1·5	2·4	2·7	1·8	—	3·6	3·6
10–19	5·5	5·6	3·8	1·3	1·8	1·4	5·4	1·5	2·5
20–29	11·6	10·1	4·3	4·0	4·4	2·6	2·3	1·3	3·8
30–39	8·7	6·2	5·1	3·0	3·0	3·0	3·4	1·4	3·8
40–49	4·9	3·1	1·5	0·9	1·6	1·5	2·3	1·0	2·0
50–59	5·7	4·7	2·1	2·3	1·7	2·3	6·2	1·2	3·4
60–	11·1	2·5	3·5	2·3	2·9	1·2	3·3	1·5	3·3
Totals	8·1	5·2	3·2	2·4	2·7	2·1	3·3	2·7	3·3

\* Based on a sample of 983 hospitalized cases.

There is a significant effect of age,  $F = 3·31$ ,  $P < 0·01$ ; while the effect of sojourn in the country is highly significant,  $F = 10·78$ ,  $P \ll 0·001$ .

for 6–10 years (Table 5). The rise to 3·3 per 10,000 in persons 11 years or more in Israel is partly due to increased hospitalization in the older age-groups. The mean rate for the native born was 2·7.

#### DISCUSSION

The Middle East has long been known as an endemic area for infectious hepatitis with a relatively low incidence among the native inhabitants. Newcomers, particularly troops, have experienced high attack rates in Malta for over 100 years (Army Medical Department, 1839; Dixon, 1944) while troops from all countries suffered epidemics during the Second World War in North Africa (Hellmann, 1943; Havens, 1944; Gauld, 1946) and in Egypt (van Rooyen & Gordon, 1943). Gauld (1946) and Hellman (1943) in North Africa, and Dixon (1944) in Malta, noted that infectious hepatitis was uncommon among native civilians.

In Palestine, Jossem (1940) first described 'endemic jaundice' in civilian newcomers, and his observations were confirmed and extended by Leffkowitz (1943), Btsh (1944) and Kliger *et al.* (1944). These authors, together with Olitzki *et al.* (1948) noted that among the native born, mainly children, were affected and in them, the disease was mild. Thus adult newcomers, lacking immunity, suffered an apparently higher attack rate as the clinical course of the disease was more severe (cf. Steinitz, 1959). In the present study it has been found that country of origin had no effect on the attack rate, immigrants from North Africa showing the same incidence and hospitalization rates as those from Europe. Immigrants from Middle Eastern countries with a high endemicity should have been relatively resistant to the disease, and their susceptibility can only be explained on the hypothesis of a different agent or by the crowded and unsanitary conditions of their early months in Israel with increased exposure to infection. The most important factor in attack rate was the length of sojourn in the country, a high proportion of cases being infected within the first year or two of arrival. The low rates in the non-Jewish population may be due in part to a mild (? non-icteric) form of the disease, and in part to a low standard of reporting.

The curve of endemicity with a winter peak resembles that seen in the U.S. (Sherman & Eichenwald, 1956) and in Scandinavian countries (World Health Organization, 1958), and is the inverse of the curve of incidence of diarrhoeal diseases seen in this country. The seasonal effect is most marked in children under 14, the group with the highest incidence. This fact points to a contact-respiratory form of spread and the high rates in immigrant camps, schools and communal settlements support this view. Further indications that spread can be other than by the oral-faecal route come from the work of Gauld (1946) and Ipsen, Donovan & James (1952). During the 8 years of the present study there were no explosive outbreaks that could have been attributed to dissemination by food or water.

Although the over-all susceptibility of new immigrants is independent of their country of origin, the age at attack of children under 10 (frequently born in Israel) is affected by it. Children of North African immigrants showed a mean

age at onset of 3·5 years compared to the 6·0 years of children of European immigrants. A similar picture at even younger ages was observed in the 1958 epidemic of poliomyelitis (Davies, Marberg, Goldblum, Levine & Yekutieli, 1960) where the younger age at attack of North African children was attributed to crowding and poorer socio-economic conditions, the better home conditions of European children delaying infection.

Thus in spite of the fact that two-thirds of the population are new immigrants, the basic picture of infectious hepatitis remains the same. Among the native born it is a childhood disease, among immigrants from every country, it is acquired mainly within a year or two of arrival.

#### SUMMARY

1. The incidence of infectious hepatitis calculated from official notifications fluctuated between 5·7 and 11·4 per 10,000 during the years 1949–57, while reports of the Workers' Sick Fund indicated a rate three to four times greater. The highest rates were between the ages 1 and 9, two-thirds of the cases being under 10. Mortality was very low.

2. Highest attack rates were seen under conditions of crowding, i.e. in agricultural schools, communal settlements and new immigrant towns. This fact, together with the winter peak of incidence, suggests a contact-respiratory form of spread.

3. Immigrants, regardless of country, showed particular susceptibility during their first year or two in Israel. In the long run there was no difference in attack rate between immigrants from Western and from Middle Eastern countries, in spite of the known endemicity of the disease in the Middle East. In communities such as those from Yemen and North Africa, with large families and with, on the whole, a lower economic status, the mean age at onset was significantly younger. Among the non-Jewish population, the incidence was lower than expected due partly to under-reporting and partly, perhaps, to a mild form of the disease in the very young.

Grateful thanks are due to Miss Pearl Weiskopf, B.A., for the statistical analyses, and to Mr Zvi Cochavi for help in assembling the data. Dr Gertrude Kallner kindly provided the data on hospitalization.

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