IV

VIRAL HEPATITIS

A total of 323 cases of acute viral hepatitis were reported during the year as compared with 143 cases in 2001, an increase of 125.9%. The sources of notification were: Virology Section of the Department of Pathology (57.9%), restructured hospitals (25.1%), private hospitals (8.3%) and general practitioners (8.7%).

All cases were serologically confirmed: 236 as hepatitis A, 63 as hepatitis B and 24 as hepatitis E (*Table 4.1*).

No deaths were reported from acute viral hepatitis.

Cases were reported throughout the year (*Figs 4.1* and *4.2*), with the majority distributed in densely populated housing estates (*Figs 4.3* and *4.4*). All occupational groups were affected (*Table 4.2*).

Table 4.1
Classification of acute viral hepatitis cases, 2002

	No. of cases	%
Hepatitis A	236 (66)	73.1
Hepatitis B	63 (9)	19.5
Hepatitis E	24 (21)	7.4
Total	323 (96)	100

Hepatitis A = anti-HAV IgM positive

Hepatitis B = anti-HBc IgM positive

Hepatitis E = anti-HEV IgM positive

( ) Imported cases included in the total

Figure 4.1
Reported acute viral hepatitis cases in Singapore, June 1976 - 2002

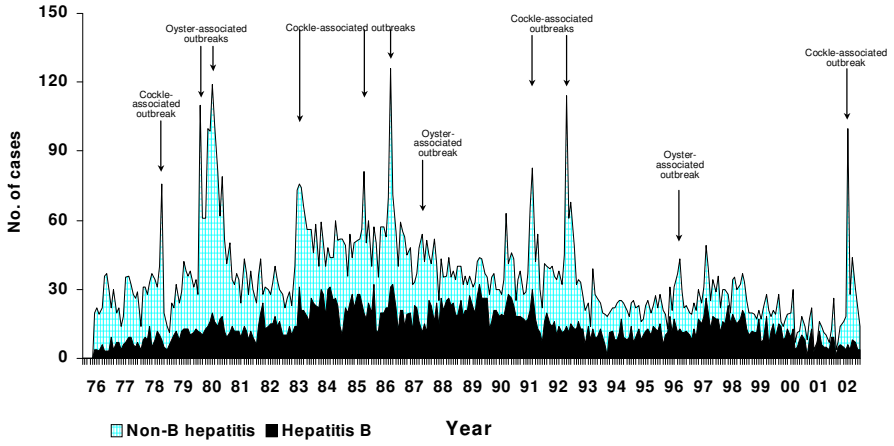


Figure 4.2
Monthly distribution of indigenous and imported cases* of acute hepatitis in Singapore, 2001 - 2002

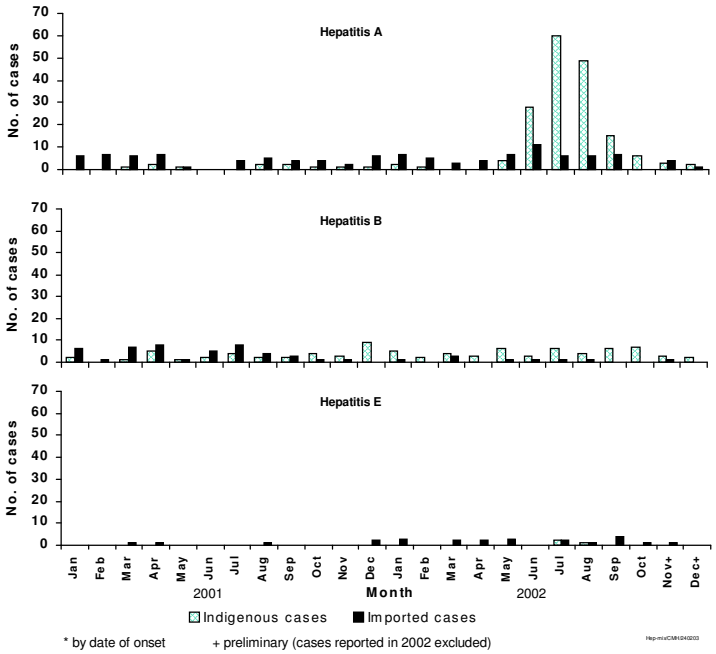


Figure 4.3
Geographical distribution of 54 indigenous acute hepatitis B cases in Singapore, 2002

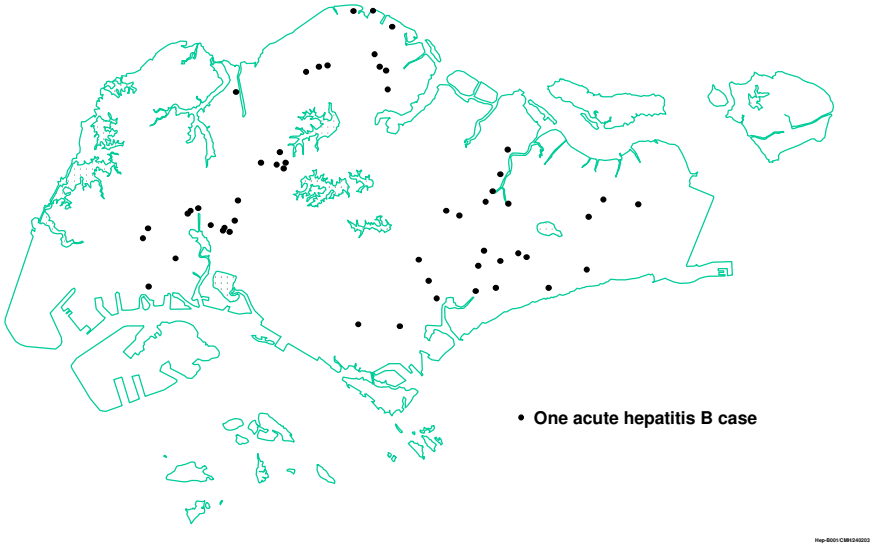


Figure 4.4
Geographical distribution of 170 indigenous acute hepatitis A cases and 3 cases of hepatitis E cases in Singapore, 2002

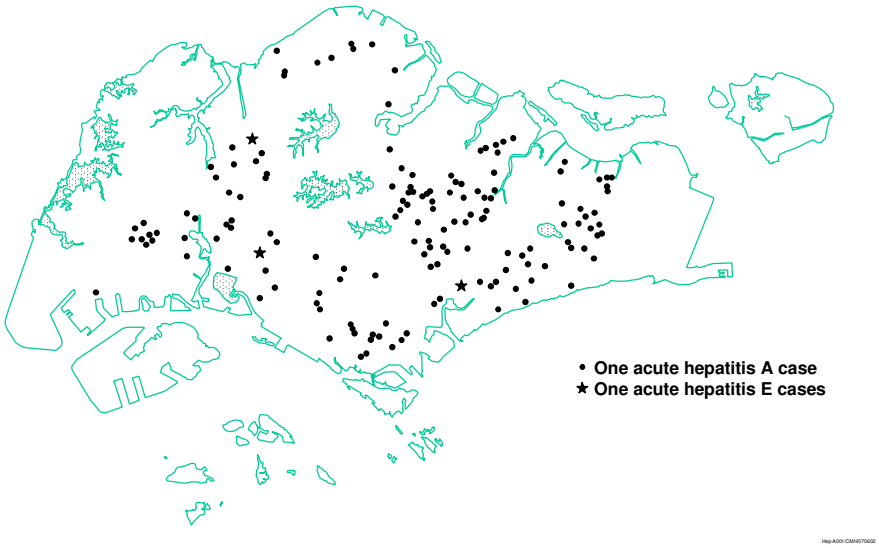


Table 4.2
Distribution of 343 cases of acute viral hepatitis by occupation*, 2002

Occupation	Hepatitis			Total	%
	A	B	E		
Agricultural and fishery workers					
Fish and prawn farm worker	1	0	0	1	0.3
Cleaners, labourers and related workers					
Construction labourers and related workers,	5	14	9	28	8.7
Ship and ship tank cleaners	0	0	1	1	0.3
Laboratory attendants	1	0	0	1	0.3
Domestic helpers (general)	2	1	0	3	0.9
Clerical workers	17	4	0	21	6.5
Professionals/administrators					
Businessmen/self employed	17	9	0	26	8.1
Engineers/technicians/electricians	16	3	3	22	6.8
Senior officials of employer's organisation	2	1	0	3	0.9
Managers	10	2	1	13	4.0
Accountants/auditors	4	1	0	5	1.6
Teaching professionals	7	0	0	7	2.2
Medical doctors/nurses	2	0	0	2	0.6
Professionals not classified elsewhere	6	0	0	6	1.9
Plant and machine operators and assemblers					
Operators (machine operator not elsewhere),	1	0	0	1	0.3
Seamen	0	1	0	1	0.3
Drivers	4	1	0	5	1.6
Production craftsmen and related workers	1	1	0	2	0.6
Service workers and shop/market sales workers					
Air stewardesses/waitresses	3	0	0	3	0.9
Wholesale and retail trade salesmen	22	0	0	22	6.8
Hawkers/stallholders and assistants	3	0	0	3	0.9
Deliverymen	5	0	0	5	1.6
Policemen/security guards	1	1	0	2	0.6
Hairstylists/hairdressers	2	0	0	2	0.6
Travel guides	2	0	0	2	0.6
Undertakers	1	0	0	1	0.3
Unclassified					
Army personnel	8	0	0	8	2.5
Students	36	1	0	37	11.5
Housewives	19	4	1	24	7.4
Unemployed/retired	13	11	5	29	9.0
Prisoners	0	1	0	1	0.3
Pre-schoolers	1	0	0	1	0.3
Workers not reporting any occupation	13	5	2	20	6.2
Others (visitors/ foreigners seeking medical treatment)	11	2	2	15	4.6
Total	236	63	24	323	100

*Based on Singapore Standard Occupational Classification, 2000
(Department of Statistics, Singapore).

Hepatitis A

The age-specific incidence rate of the 236 cases of acute hepatitis A was highest in the 25-34 year age group (*Table 4.3*). The overall male to female ratio was 1.7:1. The ethnic-specific incidence rate of Chinese was 6.7 times that of Malays and 2.2 times that of Indians (*Table 4.4*).

Consumption of shellfish

There was a significant association between shellfish consumption and hepatitis A. Of the 236 sporadic cases of hepatitis A, 69 (29.2%) gave a history of ingesting raw or partially-cooked shellfish within 3 months prior to onset of illness compared with none from the 63 acute hepatitis B cases ($p<0.001$) (*Table 4.5*). One outbreak associated with cockle consumption was reported.

A shellfish-borne outbreak of hepatitis A

The incidence of indigenous hepatitis A was maintained at a low level with a monthly average of three cases during the period 1977-2001. Only 11 local cases were reported last year.

A sudden increase in the incidence of hepatitis A was noted in June 2002. Epidemiological investigations were immediately conducted to determine the source of infection and mode of transmission.

All cases of acute hepatitis A (IgM anti-HAV positive) reported during the outbreak period were investigated and relevant epidemiological data obtained. To determine the vehicle of transmission, a case-control study was conducted. The first 40 reported cases who had no contact or travel history were interviewed on a variety of locally available shellfish, fish, raw vegetables, ice cream, iced drinks and fruits consumed between 2 weeks and 2 months prior to onset of illness. For each notified case, 2-3 controls of the same age group, gender and ethnicity and with no past history of jaundice or travel/contact history were selected and asked identical questions regarding food consumption during the same time period.

Results

A total of 159 indigenous cases of acute hepatitis A were notified between 16 Jun and 16 Nov 2002 (*Fig. 4.5*). Cases were distributed all over Singapore with no clustering of cases in any locality by place of work or residence. No specific food establishment was implicated.

Most of the cases (91.8%) were Chinese. The age-specific attack rate was highest in the 25-34 year age group. The male to female ratio was 1.5: 1. All the cases were hospitalised. No death was reported.

Results of the case-control study showed that consumption of cockles and oysters was significantly associated with hepatitis A (*Table 4.6*). No other types of shellfish and food items were implicated. Multiple logistic regression analyses showed that cases were more likely to have consumed raw or partially cooked cockles than non-cases after controlling for oyster consumption (OR = 6.0; $p < 10^{-8}$; 95% CI 2.75-13.19).

Table 4.3
Age-gender distribution and age-specific incidence rates of acute viral hepatitis (local residents), 2002

Age group	Hepatitis A				Hepatitis B				Hepatitis E			
	Male	Female	Both (%)	Incidence rate per 100,000*	Male	Female	Both (%)	Incidence rate per 100,000*	Male	Female	Both (%)	Incidence rate per 100,000*
0 - 4	0	0	0	0	0	0	0	0	0	0	0	0
5 - 14	12	5	17 (8.2)	3.4	0	1	1 (2.3)	0.2	0	0	0	0
15 - 24	25	10	35 (16.8)	8.2	2	2	4 (9.3)	0.9	0	0	0	0
25 - 34	37	26	63 (30.3)	11.4	14	3	17 (39.6)	3.1	2	0	2 (25.0)	0.4
35 - 44	33	14	47 (22.6)	7.3	4	1	5 (11.6)	0.8	1	0	1 (12.5)	0.2
45 - 54	16	12	28 (13.5)	5.4	6	1	7 (16.3)	1.4	1	0	1 (12.5)	0.2
55+	8	10	18 (8.6)	3.5	8	1	9 (20.9)	1.7	2	2	4 (50.0)	0.8
Total	131	77	208 (100)	6.2	34	9	43 (100)	1.3	6	2	8 (100)	0.2

*Rates are based on estimated mid-year population, 2002
(Source: Department of Statistics, Singapore)

Table 4.4
Ethnic-gender distribution and ethnic-specific incidence rates of acute viral hepatitis, 2002

Ethnic group	Hepatitis A				Hepatitis B				Hepatitis E			
	Male	Female	Both (%)	Incidence rate per 100,000*	Male	Female	Both (%)	Incidence rate per 100,000*	Male	Female	Both (%)	Incidence rate per 100,000*
Chinese	119	73	192 (81.4)	7.4	26	6	32 (50.8)	1.2	3	2	5 (20.8)	0.2
Malays	3	2	5 (2.1)	1.1	2	2	4 (6.3)	0.9	2	0	2 (8.3)	0.4
Indians	8	1	9 (3.8)	3.3	4	0	4 (6.3)	1.5	1	0	1 (4.2)	0.4
Others	1	1	2 (0.8)	3.8	2	1	3 (4.8)	5.6	0	0	0	0
Foreigners	20	8	28 (11.9)	-	18	2	20 (31.7)	-	16	0	16 (66.7)	-
Total	151	85	236 (100)	5.7	52	11	63 (100)	1.5	22	2	24 (100)	0.6

*Rates are based on estimated mid-year population, 2002
(Source: Department of Statistics, Singapore)

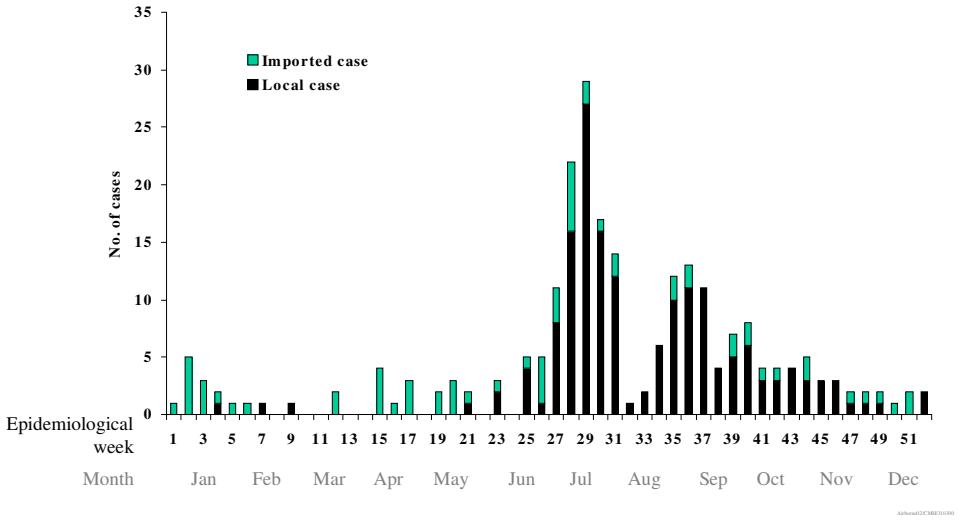
Table 4.5
Association between shellfish consumption and hepatitis A, 2002

	Consumption of raw and partially-cooked shellfish within past three months				
	Yes	%	No	%	Total
Hepatitis A	69 (16)	29.2[a]	167 (50)	70.8	236 (66)
Hepatitis B	0	0[b]	63 (9)	100	63 (9)
Hepatitis E	0	0	24 (21)	100	24 (21)

a vs b: p <0.001

( ) Imported cases included in the total

Figure 4.5
Time distribution of reported acute hepatitis A in Singapore, 2002



Comments

Consumption of contaminated raw or inadequately cooked cockles [*Anadara granosa (Linnaeus*)] and oysters have been responsible for several outbreaks of hepatitis A in Singapore (*Fig. 4.1*). Cockles-associated outbreaks were reported in 1978 (57 cases, Sep), 1983 (161 cases, May-Sep), 1985 (36 cases, Oct), 1986 (37 cases, Aug-Sep), 1991 (71 cases, Jun-Jul) and 1992 (70 cases, Sep-Oct). Cockles have also been implicated in sporadic cases of hepatitis A during the non-outbreak period.

The cockles imported into Singapore are reared from spawns in farms located along muddy coastal estuaries in countries in the region. As cockles are filter feeders, they can concentrate viruses from coastal water that is minimally polluted with sewage. The risk of faecal contamination is higher in farms where human settlements are located in the vicinity. There is no proper sanitary control over the cultivation and harvest of cockles. No health certificate is required for their import into the country. The

live cockles are packed in 60-65 kg sacks and transported unrefrigerated by lorries all the way from the production areas to Singapore. On arrival, the cockles are distributed by 8 wholesalers to hotel restaurants, supermarkets, wet markets and other retail outlets. In June 2002, 2.1 million kg of live cockles were brought in, mainly from West Malaysia. For the whole of last year, 104,854 tonnes were imported.

The pattern of the epidemic curve in this outbreak indicated that two consignments of live cockles imported into the country were contaminated. However, hepatitis A virus was not detected by RT-PCR from several consignments sampled.

In all the cockles-associated outbreaks of hepatitis A, most of the cases were Chinese. Unlike the Malays and Indians, the ethnic Chinese prefer to eat cockles ("see-hum") that are raw or partially cooked. The "see-hum" is an ingredient of "satay bee hoon", "char kway teow", and "laksa". It is also prepared by a quick dip in boiling water and eaten with "belachan" and lime.

The temperature attained by the traditional method of preparation prior to consumption is insufficient to inactivate the hepatitis A virus that might be present in the core of the shellfish.

The public should be advised to refrain from consuming semi-cooked cockles. As cockles imported into Singapore have also been found to be contaminated with a wide spectrum of enteropathogens such as *Vibrio parahaemolyticus*, enteropathogenic *E. coli*, *Salmonella*, *Shigella*, *Clostridium welchii* and *Vibrio cholerae,* consumers should be warned that they could come down with severe food poisoning and other food-borne diseases even if they are immune to hepatitis A either through vaccination or previous infection. If cockles are to be eaten, they should be cooked properly.

Table 4.6
Results of matched case-control analysis in an outbreak of hepatitis A, June – Nov 2002

Food items	Cases (n = 40)			Controls (n = 113)			Risk ratio	95% CI	P value
	Ate	Did not eat	Ate %	Ate	Did not eat	Ate %			
Cockles – raw/partially cooked*	27	13	67.5	29	84	25.7	6.016	2.75-13.19	$<10^{-6}$
Cockles – cooked	0	40	0	20	93	17.7	-	-	Ns
Oysters – raw	7	33	17.5	13	100	11.5	-	-	ns
Oysters – partially cooked	14	26	35	18	95	15.9	2.84	1.25-6.47	0.011
Mussels – raw/partially cooked	0	40	0	2	111	1.8	-	-	ns
Mussels – cooked	1	39	2.5	8	105	7.1	-	-	ns
Clams – raw/partially cooked	0	40	0	3	110	2.7	-	-	ns
Clams – cooked	8	32	20	16	97	14.2	-	-	ns
"Tua tow" – raw/partially cooked	0	40	0	3	110	2.7	-	-	ns
"Tua tow" - cooked	7	33	17.5	10	103	8.8	-	-	ns
"Gong Gong"	2	38	5	2	111	1.8	-	-	ns
"Cuit Cuit"	2	38	5	2	111	1.8	-	-	ns
Crabs - raw/partially cooked	0	40	0	2	111	1.8	-	-	ns
Crabs – cooked	13	27	32.5	44	69	38.9	-	-	ns
Prawns - raw/partially cooked	1	39	2.5	6	107	5.3	-	-	ns
Prawns - cooked	23	17	57.5	85	28	75.2	-	-	ns
Lobster - raw/partially cooked	2	38	5	3	110	2.7	-	-	ns
Lobster - cooked	2	38	5	15	98	13.3	-	-	ns
Cuttlefish - cooked	9	31	22.5	45	68	39.8	-	-	ns
Cuttlefish – raw/partially cooked	0	40	0	8	105	7.1	-	-	ns
Fish – cooked	20	20	50	105	8	92.9	-	-	ns
Fish - raw/partially cooked	4	36	10	16	97	14.2	-	-	ns
Crayfish- cooked	4	36	10	12	101	10.6	-	-	ns
Crayfish- raw/partially cooked	0	40	0	0	113	0	-	-	ns
BBQ seafood/shellfish	3	37	7.5	26	87	23	-	-	ns
Ice cream	4	36	10	78	35	69	-	-	ns
Iced drinks	18	22	45	80	33	70.8	-	-	ns
Cut fruits/fruit juice	18	22	45	90	23	79.6	-	-	ns
Cold dessert	8	32	20	54	59	47.8	-	-	ns
Prawn paste – rojak	12	28	30	36	77	31.9	-	-	Ns
Raw vegetables	3	37	7.5	29	84	25.7	-	-	Ns

* including cockles served in "laksa", "char kway teow" and "satay bee hoon".

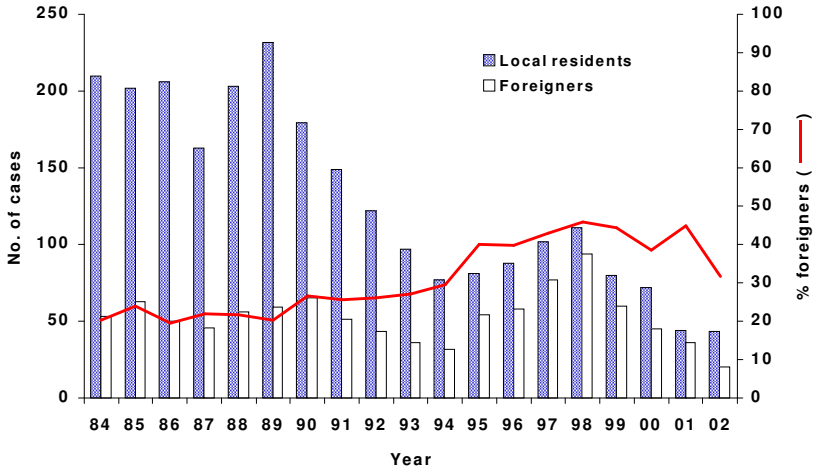
Hepatitis B

The highest age-specific morbidity rate occurred in the 25-34 year age group (*Table 4.3*). The overall male to female ratio was 3.8:1. Among the three major ethnic groups, Indians had the highest incidence rate (*Table 4.4*).

Hepatitis B among foreigners

In 2002, 20 (31.7%) of the reported cases of acute hepatitis B were foreigners (*Fig. 4.6*), compared with 36 (45%) in 2001. Of these 11 (55%) originated from the Indian subcontinent, 7 (35%) from Southeast Asia, 1 (5%) from East Asian countries and 1 (5%) from United States *(Table 4.7).* Of the foreigners, 8 (40%) acquired infection abroad and 12 (60%) acquired infection locally *(Table 4.8).* Majority of those with local infection were males (83.3%). The highest incidence rate was in the 25-34 year age group (66.7%*)*. As for those with imported infection, majority (75%) were cases seeking local medical treatment. Of all these foreigners, 10 (50%) worked in the construction/manufacturing industries (*Table 4.8*).

Figure 4.6
Reported cases and proportion of acute hepatitis B among local residents and foreigners, 1984 - 2002



Exposure to parenteral procedures and razor blades

None of the acute hepatitis B cases gave a history of exposure to any parenteral procedures, such as surgery, blood transfusion and tattooing within 6 months prior to onset of illness.

Table 4.7
Countries of origin of foreigners with acute hepatitis B infection, 2002

	Locally acquired n = 12		Imported n = 8		Total n = 20	
	No.	%	No.	%	No.	%
Indian subcontinent						
- India	4	33.3	1	12.5	5	25.0
- Bangladesh	4	33.3	2	25.0	6	30.0
Southeast Asia						
- Malaysia	1	33.3	3	37.5	4	20.0
- Thailand	1	8.3	0	0	1	5.0
- Indonesia	1	8.3	0	0	1	5.0
- Vietnam	0	0	1	12.5	1	5.0
Other countries						
- China	1	8.3	0	0	1	5.0
- United States	0	0	1	12.5	1	5.0

Table 4.8

Characteristics of acute hepatitis B infection among foreigners, 2000-2002

	2000 n=45		2001 n=36		2002 n=20	
	No.	%	No.	%	No.	%
Source of infection						
Acquired abroad	34	75.6	37	75.0	8	40.0
Acquired locally	11	24.4	9	25.0	12	60.0
Occupation						
Construction/factory workers	33	73.3	25	69.4	10	50.0
Others	12	26.7	11	30.6	10	50.0
Among foreigners who acquired infection abroad						
Work permit/employment pass holders	27	79.4	23	85.2	2	25.0
Tourists	1	2.9	1	3.7	0	0
Cases seeking medical treatment	6	17.6	3	11.1	6	75.0
Among foreigners who acquired infection locally						
Gender						
Male	9	81.8	8	88.9	10	83.3
Female	2	18.2	1	11.1	2	16.7
Age group						
15-24	1	9.1	2	22.2	4	33.3
25-34	8	72.7	5	55.6	8	66.7
35-44	2	18.2	1	11.1	0	0
45-54	0	0	1	11.1	0	0

Hepatitis E

24 cases of hepatitis E were reported during the year (*Table 4.1*) compared with 3 cases in 2001. 21 cases were imported (*Table 4.9*).

Imported viral hepatitis

Of the 323 cases of viral hepatitis, 96 (29.7%) were imported (*Table 4.9*). These comprised 66 cases of hepatitis A, 9 cases of hepatitis B and 21 cases of hepatitis E. The majority of the infections were acquired in Southeast Asia (66.7%) and the Indian subcontinent (24%).

Local residents accounted for 48 (50%) of the imported cases (47 hepatitis A and 19 hepatitis B cases) (*Table 4.10*). Majority of them were male adults in the 35-44 year age group *(Table 4.11*). The ethnic distribution is shown in *Table 4.12*.

The purpose of travel for these local residents was mainly for vacation *(Table 4.13).* Most of them were away in the endemic countries for less than 2 weeks *(Table 4.14),* and developed symptoms 2-5 weeks after returning home *(Table 4.15)*. The duration of hospitalization was usually 1-2 weeks *(Table 4.16).*

Table 4.9
Imported acute viral hepatitis cases in Singapore by country of origin, 2002

Country of origin	Hepatitis			Total	%
	A	B	E		
Southeast Asia					
Indonesia	18 (10)	1	3 (2)	22 (12)	22.9
Malaysia	24 (2)	3 (3)	3 (1)	30 (6)	31.3
Thailand	9 (3)	0	1	10 (3)	10.5
Philippines	0	0	1 (1)	1 (1)	1.0
Vietnam	0	1 (1)	0	1 (1)	1.0
Indian subcontinent					
Bangladesh	1	2 (2)	9 (9)	12 (11)	12.5
India	7 (3)	1 (1)	2 (2)	10 (6)	10.5
Sri Lanka	1 (1)	0	0	1 (1)	1.0
Other Asian countries					
China	5	0	1	6	6.3
Korea	0	0	1	1	1.0
Japan	0	0	0	1	1.0
Others					
United States	0	1 (1)	0	1 (1)	1.0
Total	66 (19)	9 (8)	21 (15)	96 (42)	100

( ) Foreigners

Table 4.10
Classification of imported acute viral hepatitis cases by population group, 2002

Population group	No. of cases				
	Hepatitis A	Hepatitis B	Hepatitis E	Total	%
Local residents who contracted the disease overseas	47	1	6	54	56.3
Foreigners seeking medical treatment in Singapore	8	6	1	15	15.6
Work permit/employment pass holders	4	2	10	16	16.6
Tourists from other countries	3	0	1	4	4.2
Others	4	0	3	7	7.3
Total	66	9	21	96	100

Table 4.11
Age-gender distribution of local residents with imported acute viral hepatitis, 2002

Age group	Hepatitis A			Hepatitis B			Hepatitis E		
	Male	Female	Both (%)	Male	Female	Both (%)	Male	Female	Both (%)
0 – 4	0	0	0	0	0	0	**0**	**0**	**0**
5 – 14	4	1	5 (10.6)	0	0	0	**0**	**0**	**0**
15 – 24	9	2	11 (23.4)	0	0	0	**0**	**0**	**0**
25 – 34	7	2	9 (19.2)	0	0	0	**2**	**0**	**2 (33.3)**
35 – 44	11	3	14 (29.8)	0	0	0	**1**	**0**	**1 (16.6)**
45 - 54	3	2	5 (10.6)	1	1	1 (100)	**0**	**0**	**0**
55 +	1	2	3 (6.4)	0	0	0	**1**	**2**	**3 (50.0)**
Total	35	12	47 (100)	1	0	1 (100)	**4**	**2**	**6 (100)**

Table 4.12
Ethnic-gender distribution of local residents with imported acute viral hepatitis A and B, 2002

Ethnic group	Hepatitis A			Hepatitis B			Hepatitis E		
	Male	Female	Both (%)	Male	Female	Both (%)	Male	Female	Both (%)
Chinese	27	11	38 (80.9)	0	0	0	**2**	**2**	**4 (66.6)**
Malays	3	1	4 (8.5)	1	0	1 (100)	**2**	**0**	**2 (33.3)**
Indians	5	0	5 (10.6)	0	0	0	**0**	**0**	**0**
Others	0	0	0	0	0	0	**0**	**0**	**0**
Total	35	12	47 (100)	1	0	1 (100)	**4**	**2**	**6 (100)**

Table 4.13

Purpose of travel of local residents with imported acute hepatitis A and B, 2002

Purpose	Hepatitis A		Hepatitis B		Hepatitis E	
	No. of cases	%	No. of cases	%	No. of cases	%
Visit friends / relatives	1	2.1	1	100	2	33.3
Business / employment / study	6	12.8	0	0	0	0
Pleasure/vacation	33	70.2	0	0	3	50.0
Unknown	7	14.9	0	0	1	16.6
Total	47	100	1	100	6	100

Table 4.14

Duration of stay of local residents with imported acute hepatitis A and B in endemic countries, 2002

Duration in weeks	Hepatitis A		Hepatitis B		Hepatitis E	
	No. of cases	%	No. of cases	%	No. of cases	%
<1	17	36.2	0	0	4	66.6
1	17	36.2	0	0	0	0
2	2	4.3	1	100	1	16.6
3	0	0	0	0	0	0
4	1	2.1	0	0	0	0
5+	5	10.6	0	0	1	16.6
Unknown	5	10.6	0	0	0	0
Total	47	100	1	100	6	100

Table 4.15

Interval between return to Singapore and development of illness among local residents with imported acute hepatitis A and B, 2002

Interval in weeks	Hepatitis A		Hepatitis B		Hepatitis E	
	No. of cases	%	No. of cases	%	No. of cases	%
<2	12	25.6	0	0	2	33.3
2	5	10.6	1	100	2	33.3
3	5	10.6	0	0	2	33.3
4	6	12.8	0	0	0	0
5+	14	29.8	0	0	0	0
Unknown	5	10.6	0	0	0	0
Total	47	100	1	100	6	100

Table 4.16
Duration of hospitalisation of local residents with imported acute hepatitis A and B, 2002

Duration in weeks	Hepatitis A		Hepatitis B		Hepatitis E	
	No. of cases	%	No. of cases	%	No. of cases	%
<1	27	93.0	0	0	1	20.0
1	1	3.5	0	0	1	20.0
2	1	3.5	0	0	2	40.0
3	0	0	0	0	1	20.0
Total	29	100	0	0	5	100

Note:
16 hepatitis A cases and 1 hepatitis E case were not hospitalised during their illness

2 hepatitis A and 1 hepatitis B cases were still hospitalised during time of investigation