PREVENTION OF MENTAL SUBNORMALITY IN SINGAPORE CHILDREN

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INTRODUCTION

Although care of the mentally retarded is important, it is even more important to prevent mental retardation as many direct or predisposing factors may contribute towards mental deficiency. A survey of mental subnormality in Singapore children over a fifteen year period showed that prenatal, natal and postnatal factors formed approximately 20% of the causes of mental subnormality (Paul 1971). Table 1 shows that 19.5% of children were associated with prenatal, natal and postnatal conditions and it is this vital group that we have concentrated on from a preventive point of view to control the physical environment and to control the genetic environment. Figures show that 19.5% of prenatal, natal and postnatal causes in 1963 were reduced to 11% in 1971 with a further drop to 5% in 1977 (Table 2).

I. Environmental Control of the Causes of Mental Subnormality in Singapore

(a) Singapore Kernicterus

Wong in 1966 showed that in Singapore, neonatal jaundice is not due to Rhesus incompatibility but to glucose-six-phosphate dehydrogenase which produces jaundice developing about the 5th day of neonatal life leading to kernicterus. Environmental factors responsible for triggering off haemolysis are herbs taken traditionally by pregnant and nursing mothers and secondly exposure to naphthalene balls in the newborn. An extract of dried roots called Coptis Chinensis is given to infants after boiling it with water and honey. Wong (1966) showed that infants with glucose-six-phosphate dehydrogenase deficiency when given Coptis Chinensis had a significantly higher incidence of severe jaundice than those not given it. The newborn baby in Singapore is often exposed to naphthalene because of the local custom of putting moth-balls in stored clothes. Each moth-ball contains five grams of napthalene which is absorbed via the skin or inhaled and taken to the liver for conjugation. α-naphthol produces haemolysis of normal erythrocytes and glucose-six-phosphate deficient infants develop severe jaundice than those not exposed to it (Wong 1966).

Ninety per cent of Singapore babies are delivered at major government maternity hospitals and all newborns have their blood screened for glucose-six-phosphate dehydrogenase deficiency (Table 3a & 3b). If deficient, all siblings, parents and grandparents are screened for this enzyme. A quarter million of the population and a total of 4540 families are known to be enzyme deficient. The incidence of glucose-six-phosphate dehydrogenase deficiency is 1.4% among all three ethnic groups. Those deficient are kept in the maternity unit for three weeks to prevent exposure to trigger factors. In the event of neonatal jaundice a timely exchange transfusion is done to prevent mental subnormality.

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TABLE I
CLINICAL CLASSIFICATION
INCIDENCE OF MENTALLY SUBNORMAL CHILDREN IN THE VARIOUS CATEGORIES
(1963 to 1968)

	Categories	No. (M)	%	No. (F)	%	No.		%	
1.	Non-Specific Causes	450	(60.7)	324	(31.3)	774		41.8	
2.	Chromosomal Abnormalities								
	(a) Mongolism	159	(58.3)	114	(41.7)	273	308	14.8	16.7
	(b) Others	26	(74.3)	9	(25.7)	35		1.9	
3.	Prenatal and Natal Causes	112	(50.5)	109	(49.4)	221		12.0	
4.	Postnatal Causes	78	(53.4)	58	(46.2)	136		7.5	
5.	Abnormality of Brain e.g. Microcephaly	139	(54.8)	115	(45.2)	254		13.8	
6.	Metabolic and Endocrine Causes	20	(50.4)	17	(49.6)	37		2.0	
7.	Epilepsy and Related Conditions	46	(50.5)	45	(49.5)	91		5.0	
8.	Multiple Defects	14	(60.8)	9	(39.2)	23		1.0	
9.	Miscellaneous	1	(33.3)	3	(66.6)	4		0.2	
	TOTAL	1045	(56.6)	803	(43.5)	1848		100	

Note: 19.5% of children were due to prenatal, natal and postnatal causes.

CLINICAL CATEGORIES OF MENTAL SUBNORMALITY IN SINGAPORE CHILDREN WITH REDUCTION IN PRENATAL, NATAL AND POSTNATAL CAUSES BY PREVENTION

	End of 1963		End of 1971		1978 Only	
	Number	%	Number	%	Number	%
NON-SPECIFIC CAUSES	777	42%	426	45%	108	55%
PRENATAL, NATAL and POSTNATAL CAUSES	357	20%	105	11%	7	4%
DOWN'S ANOMALY	308	16%	157	17%	30	15%
MICROCEPHALY etc.	254	14%	114	12%	9	6%
ENDOCRINE, METABOLIC, EPILEPSY etc.	155	8%	133	15%	41	20%
TOTAL	1848	100%	935	100%	195	100%

NOTE: REDUCTION OF PRENATAL, NATAL AND POSTNATAL CAUSES FROM 20% IN 1963 TO 11% IN 1971 AND 4% IN 1978 ACCOMPLISHED BY PREVENTIVE METHODS.

TABLE 2

With the help of the Ministry of Health, an intensive medical and lay public educational campaign was organised to draw attention to the dangers of herbs and napthalene. As a result of these measures not only has there been a fall in the mortality (Fig. 1) but also the morbidity.

(b) Japanese B encephalitis in Singapore

The second environmental problem that required

SCREENING FOR G-6-P-D ENZYME IN SINGAPORE NEWBORNS OVER A 15 YEAR PERIOD

CHINESE

YEAR	No TESTED	No G6PD Def.	% G6PD Def.
1965	29,013	465	1·6%
1966	28,425	482	1·7%
1967	27,655	456	1·7%
1968	26,064	405	1·6%
1969	24,263	427	1·8%
1970	22,961	329	1·5%
1971	21,665	323	1·5%
1972	22,750	404	1·8%
1973	22,883	434	1·9%
1974	21,651	356	1·6%
1975	19,328	249	1·8%
1976	21,401	413	1·9%
1977	18,356	386	2·1%
1978	18,678	335	1·8%
1979	18,928	345	1·8%
TOTAL	344,021	5,809	1·7%

MALAY

YEAR	No TESTED	No G6PD Def.	% G6PD Def.
1965	4,126	76	1·8%
1966	4,307	93	2·1%
1967	4,624	94	2·0%
1968	4,107	62	1·5%
1969	3,460	56	1·6%
1970	3,250	56	1·7%
1971	2,933	46	1·6%
1972	2,958	61	2·1%
1973	2,790	48	1·7%
1974	2,924	40	1·4%
1975	2,804	31	1·6%
1976	2,766	63	2·3%
1977	2,780	60	2·2%
1978	3,209	60	1·9%
1979	3,443	51	1·8%
TOTAL	50,436	897	1·8%

INDIAN

YEAR	No TESTED	No G6PD Def.	% G6PD Def.
1965	2,289	5	0·1%
1966	1,798	6	0·3%
1967	1,719	4	0·2%
1968	1,420	8	0·5%
1969	1,733	5	0·3%
1970	1,003	2	0·2%
1971	831	4	0·5%
1972	917	3	0·3%
1973	753	7	0·9%
1974	455	3	0·7%
1975	554	4	0·7%
1976	595	3	0·5%
1977	609	7	1·2%
1978	779	2	0·3%
1979	866	4	0·5%
TOTAL	1,953	67	0·34%

Table 3a : Note 1.7% of Chinese and 1.8% of Malays are deficient in glucose-six-phosphate dehydrogenase.

control was Japanese B encephalitis. In common with other parts of South-East Asia, Japanese B encephalitis exists in an endemic form in Singapore. Hale and Lee (1956) have shown that 70% of the population over the age of 12 years in Malaya, Borneo and Singapore have neutralising antibodies to the Japanese B encephalitis virus.

Figure 2 illustrates a typical case of Japanese B encephalitis who was admitted with a history of an acute onset of fever malaise and drowsiness for three days with convulsions on the day of admission.

Seventy per cent of these children were admitted with varying degrees of coma, with neck rigidity, pupillary changes, abnormalities of conjugate eye movements, facial palsies and other motor deficits. Abnormal purposeless movement due to basal ganglia involvement were also seen. The children remained unconscious for eight to nine days with the temperature falling by lysis on the eighth or ninth day. Forty per cent of these children showed some form of sequalae. namely mental retardation and behaviour disorders in the form of temper tantrums, shrill cries, hallucinations and emotional imbalance (Phoon 1963). Seventy-two per cent of the children with Japanese B encephalitis occurred in school-children (Fig. 3).

Both studies (Phoon 1963 and Paul 1977) show that most of the children with Japanese B encephalitis came from the rural areas, probably because of the greater abundance of mosquitoes (Culex tritaenorrhyneus) and the animal reservoir, namely pigs in these areas. Figure 4 shows the postal districts of Singapore and the shaded

SCREENING FOR G-6-P-D ENZYME IN SINGAPORE NEWBORNS OVER A 15 YEAR PEROD

OTHER RACES

YEAR	No TESTED	No G6PD Def.	% G6PD Def.
1965	509	3	0·6%
1966	865	7	0·8%
1967	1,042	7	0·7%
1968	1,017	6	0·6%
1969	404	1	0·2%
1970	771	1	0·1%
1971	715	2	0·3%
1972	492	3	0·6%
1973	582	5	0·9%
1974	862	6	0·7%
1975	559	2	0·7%
1976	629	1	0·16%
1977	509	4	0·6%
1978	364	4	1·1%
1979	320	1	0·6%
TOTAL	9,640	53	0·6%

ALL RACES

YEAR	No TESTED	No G6PD Def.	% G6PD Def.
1965	35,937	549	1·5%
1966	35,393	588	1·6%
1967	35,040	561	1·6%
1968	32,608	481	1·5%
1969	29,860	489	1·6%
1970	27,940	388	1·4%
1971	26,134	375	1·4%
1972	27,117	471	1·7%
1973	27,008	494	1·8%
1974	25,892	405	1·6%
1975	23,245	411	1·8%
1976	25,391	480	1·9%
1977	22,254	455	2·0%
1978	22,930	400	1·7%
1979	23,559	403	1·7%
TOTAL	420,818	6,950	1·7%

APPROXIMATELY 2 OUT OF 100 BABIES TESTED IN SINGAPORE WILL BE G-6-P-D DEFICIENT. ONCE DEFICIENT THEY ARE KEPT IN THE MATERNITY UNIT FOR 3 WEEKS TO PREVENT TRIGGER FACTORS WHICH WILL PRODUCE JAUNDICE. EVEN IF JAUNDICE DEVELOPS, WE PREVENT MENTAL DAMAGE BY A TIMELY EXCHANGE TRANSFUSION.

Table 3b : A quarter million of the Singapore population has been screened for glucose-six-phosphate dehydrogenase deficiency.

KERNICTERUS DEATHS IN THE UNIVERSITY DEPARTMENT OF PAEDIATRICS, SINGAPORE OVER A SEVENTEEN YEAR PERIOD (1963 TO 1979)

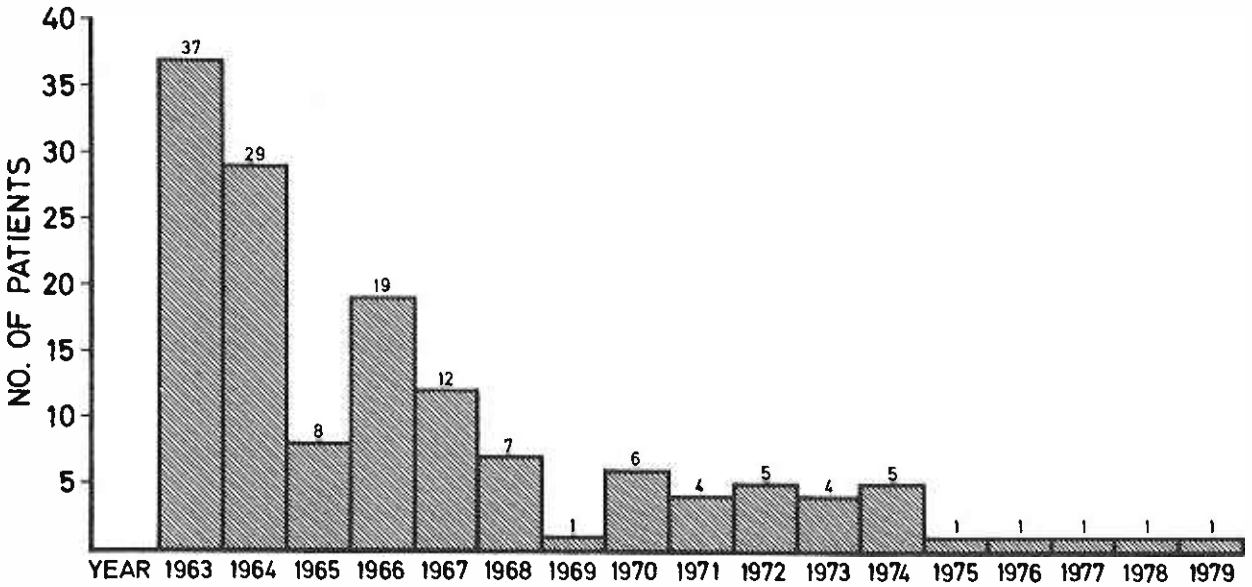

Figure 1 : Note the fall in mortality of neonatal kernicterus in the Department of Paediatrics, Singapore, from 1963 to 1979.

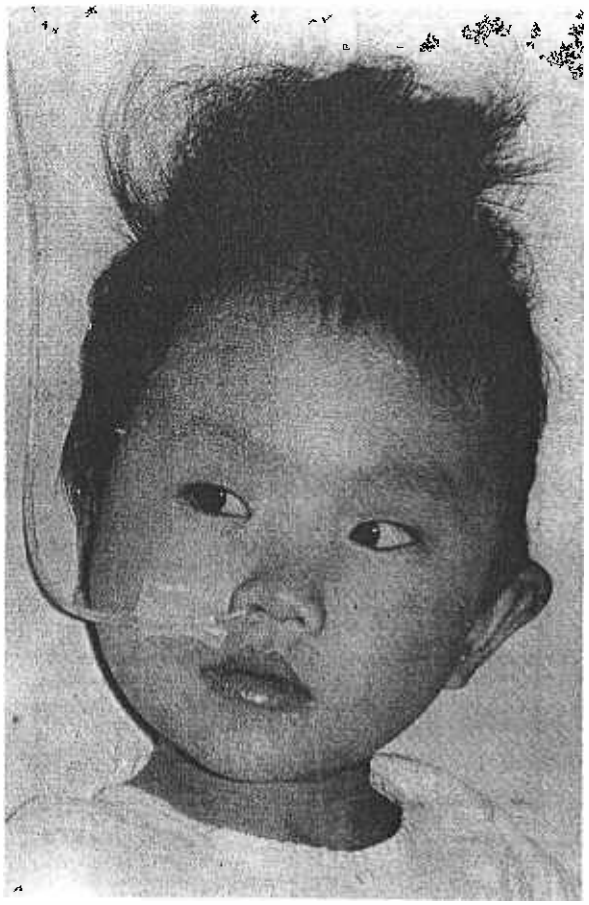

Figure 2 A typical case of Japanese B encephalitis. Note the conjugate deviation of eyes to the right.

areas show where most of the cases come from, namely district 14 and district 19. In countries where Japanese B encephalitis is endemic (eg. Japan) epidemics in human population is preceeded by a peaking of viraemia in pigs. Seasonal peaking is due to seasonal breeding of pigs. In Singapore, there is no viraemia because of the continuous breeding of pigs. A recent serological survey showed that the majority of adult pigs had antibodies to Japanese B encephalitis virus. So obviously mosquito control is the answer here and since 1972 we have had very few cases of Japanese B encephalitis and this is due to the sustained efforts of the public health department of Singapore to control mosquito breeding.

(c) Tuberculous Meningitis

The third environmental problem was childhood tuberculous meningitis causing either death or mental retardation and spasticity of the limbs in survivors.

A review of our cases (Paul 1967) showed that 60% of them were admitted in coma while 35% had a history of illness of more than two weeks prior to admission resulting in high morbidity and mortality rates (60%).

The data from the University Paediatric Unit of the Singapore General Hospital show there has been a progressive decrease in the incidence and mortality from tuberculous meningitis (Table 4).

The factors responsible for the decline are:-

1. The introduction of B.C.G. vaccination
2. Improved nutritional status of the children
3. A good tuberculous case finding system
4. An improvement in the housing conditions
5. A good outpatient medical service

In Singapore, the UNICEF/WHO team started B.C.G. vaccination in June 1961. B.C.G. coverage of newborns in government hospital is at 90% (Table 5) and in addition, Primary I, Primary IV and Secondary IV school children also receive B.C.G. if their Mantoux test is negative. Active detection of adult tuberculosis is also important and this done by massive X-ray campaigns done by the tuberculous control unit. Severe over-crowding existed in the Chinatown area where people live in dense crowded shop-houses, which have all been replaced by high-rise flats. Priority for housing is given to tuberculous patients.

(d) Prenatal Conditions

An interrogation with parents show there was no case of mental subnormality arising from excessive irradiation during pregnancy. Among the three prenatal conditions are congenital syphilis, congenital toxoplasmosis and congenital rubella syndrome.

(1) Congenital Syphilis

Congenital syphilis causes mental subnormality by causing syphilitic meningitis, which has been prevented by doing a Kahn test routinely on all mothers attending antenatal clinics. Table 6 shows the number of children with congenital syphilis for 10 years in Singapore from 1969 to 1978. For the year 1978, 90% of women attending the infant welfare clinics had their blood taken for V.D.R.L. An overall drop of positive V.D.R.L. cases was noted. Eighty-one new cases of congenital syphilis was detected during the year 1978. With early detection, one is able to treat congenital syphilis with Penicillin injections.

(2) Congenital Toxoplasmosis

Toxoplasmosis is a common infection caused by Toxoplasma gonadii. Toxoplasmosis produces chorio-retinitis, cerebral calcification and microcephaly. Studies in Malaysia and Singapore have revealed seropositivity among a number of infants at the time of birth.

However, there were only three reported children with congenital toxoplasmosis (Durfee et al, 1971) and a further three cases were found in this series of mental subnormality (1971).

Figure 5(a) and (6) revealed a severely subnormal child with a very small head with spasticity of the limbs and blindness and radiographs of the skull revealed diffuse patchy calcification of the skull.

(3) Congenital Rubella Syndrome

It is well known that rubella infection of the

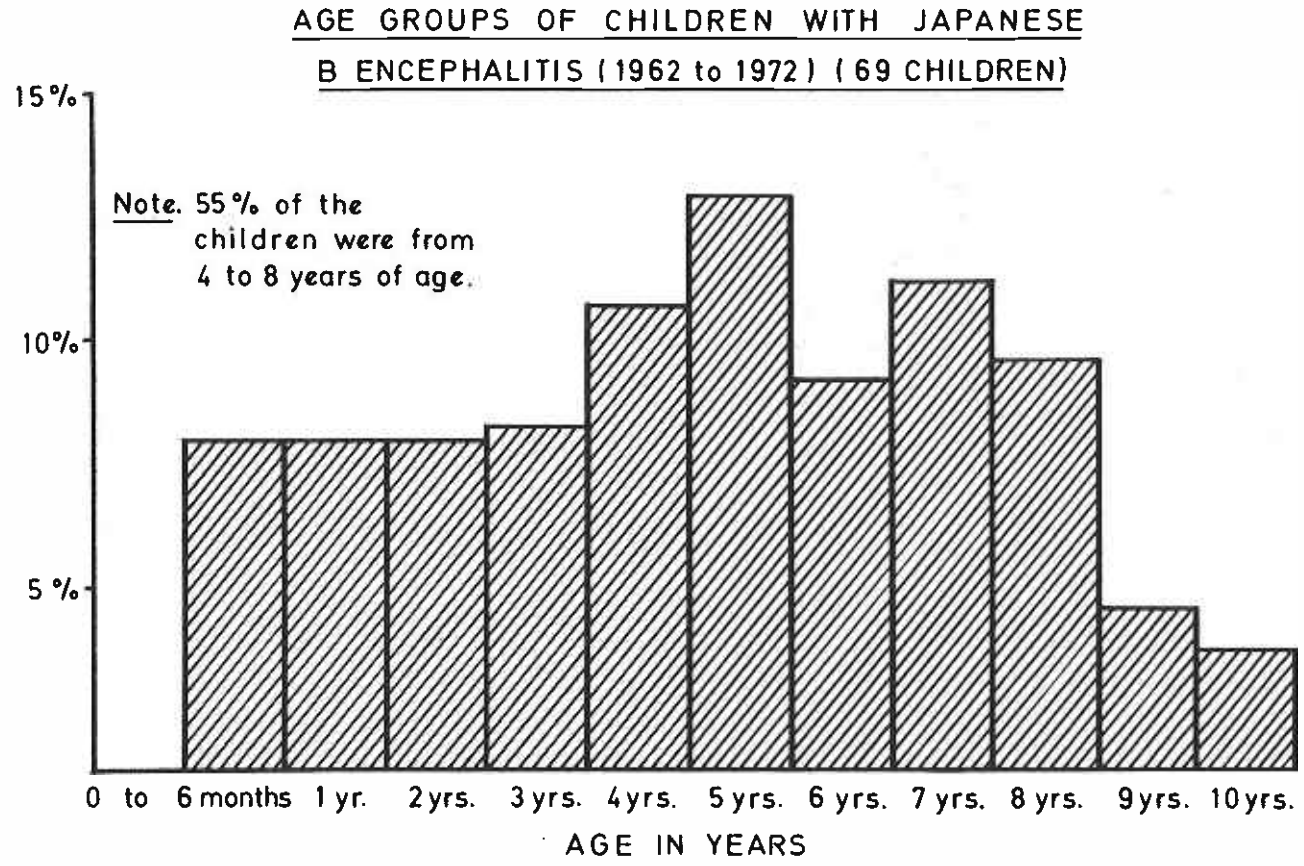

Figure 3 : Note the majority of the cases of Japanese B encephalitis occurred in school-children.

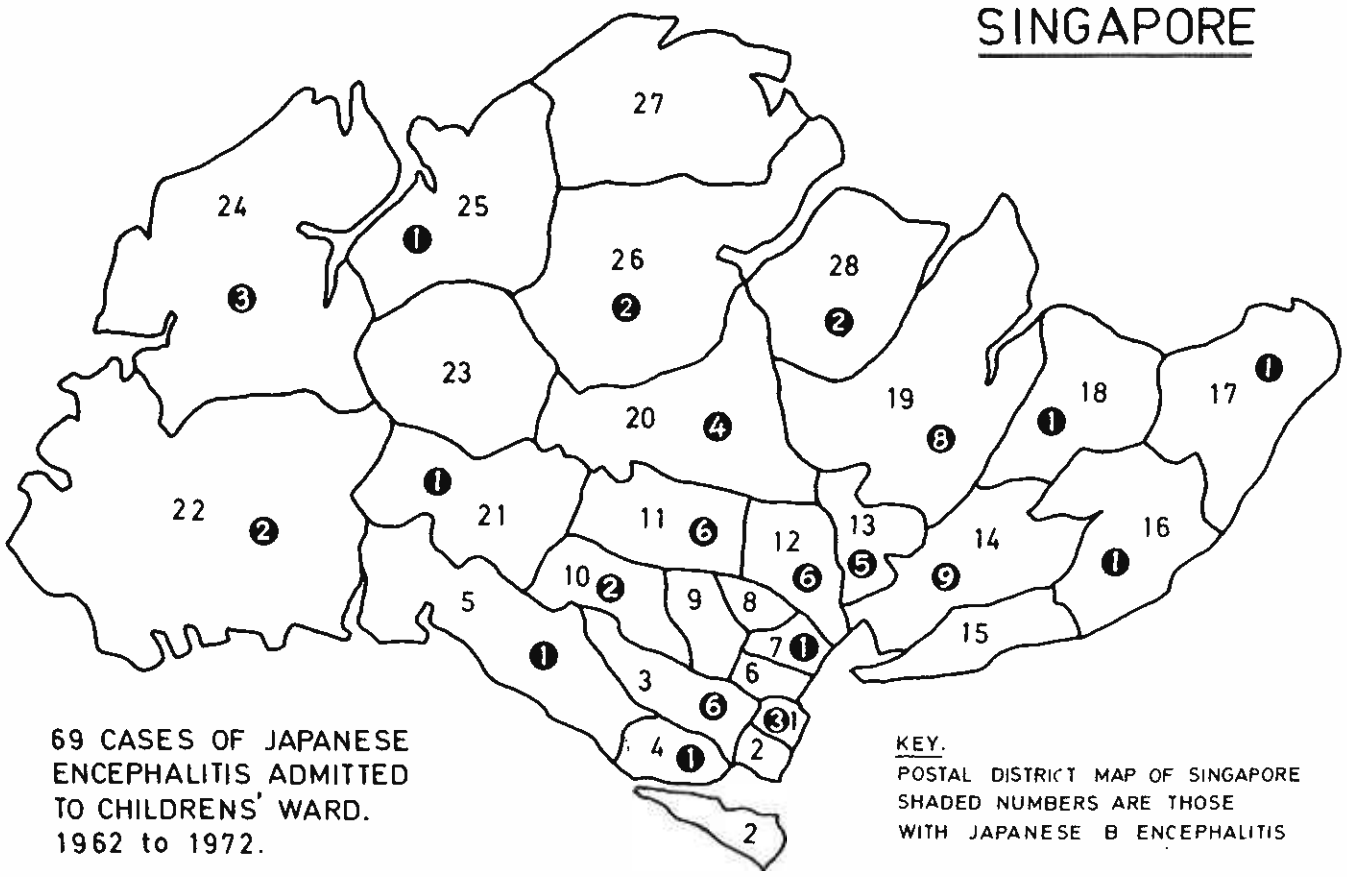

Figure 4 : To show the postal districts in Singapore. The shaded areas represent the areas with Japanese B encephalitis.

TABLE 4
TUBERCULOUS MENINGITIS (1955 to 1979)
PAEDIATRIC UNIT, SINGAPORE GENERAL HOSPITAL

Year	No. TB Meningitis Cases	Fatality of TB Meningitis Cases	Total No. of Admissions
1955	112	60.7%	No. not available
1956	106	46.3%	6,473
1957	60	43.0%	7,217
1958	62	30.7%	9,697
1959	45	28.9%	10,517
1960	46	14.4%	10,712
1961	32	15.6%	10,480
1962	15	15.1%	11,928
*1963	3	0.0%	6,731
1964	8	28.0%	6,249
1965	5	33.3%	6,528
1966	6	16.2%	6,873
1967	5	20.0%	6,586
1968	2	50.0%	6,308
1969	5	0.0%	6,524
1970	5	20.0%	6,356
1971	4	0.0%	6,380
1972	1	0.0%	6,250
1973	3	0.0%	6,637
1974	1	0.0%	4,876
1975	0	0.0%	3,820
1976	2	0.0%	4,787
1977	2	50.0%	4,310
1978	1	0.0%	4,375
1979	1	0.0%	5,484

*1963 onwards reflect the children admitted to the University side of the Paediatric Unit, Singapore General Hospital.

B.C.G. VACCINATION IN SINGAPORE (1969 TO 1975)

	1969	1970	1971	1972	1973	1974	1975
NEW-BORN							
LIFE-BIRTH	44,562	45,934	47,088	49,678	48,269	43,208	39,948
B.C.G. VACCINATION	40,377	41,630	43,001	45,562	44,156	39,251	36,127
% COVERAGE	90.6 %	90.6 %	91.3 %	91.7 %	91.3 %	90.7 %	90.4 %
PRIMARY I (AGE 6)							
ENROLMENT	54,902	55,290	52,808	51,784	51,119	47,113	44,656
B.C.G. VACCINATION	8,895	6,207	4,081	3,062	2,669	1,230	933
% COVERAGE	16.2 %	11.2 %	7.7 %	5.9 %	5.2 %	2.6 %	2.1 %
PRIMARY VI (AGE 11 TO 12)							
ENROLMENT	58,243	56,082	56,626	55,114	52,977	52,196	53,088
B.C.G. VACCINATION	26,465	23,956	16,468	14,886	14,965	26,158	28,036
% COVERAGE	45.4 %	42.7 %	29.1 %	27.0 %	28.3 %	50.1 %	52.8 %
SECONDARY IV (AGE 15 TO 16)							
ENROLMENT	36,889	30,078	31,905	37,135	38,582	33,304	35,406
B.C.G. VACCINATION	8,626	4,858	3,087	4,465	3,749	3,324	2,318
% COVERAGE	23.4 %	16.2 %	9.7 %	12.0 %	9.7 %	10.0 %	6.5 %

Table 5 : Note that 90% of newborns are covered with B.C.G. in the newborn period.

NUMBER OF CHILDREN WITH CONGENITAL SYPHILIS FOR 10 YEARS (1969 to 1978)

Diagnosis	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	Total
Early	1	1	2	5	4	4	9	9	3	5	43
Late	42	56	44	21	34	20	8	10	9	15	269
Total	43	57	46	26	38	24	17	19	12	20	312

Table 6 : To show the number of congenital syphilis over a ten year period.

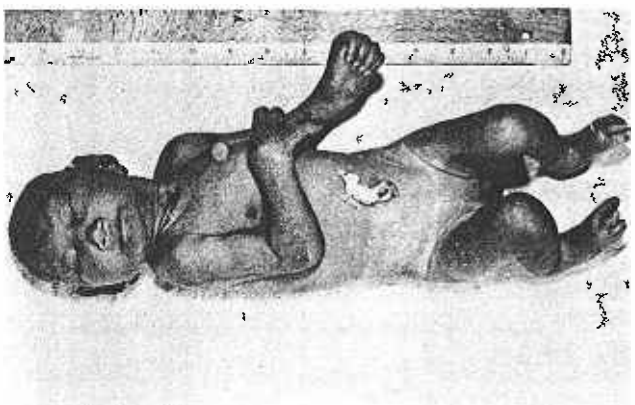

Figure 4a : Note the small head of a child with congenital toxoplasmosis.

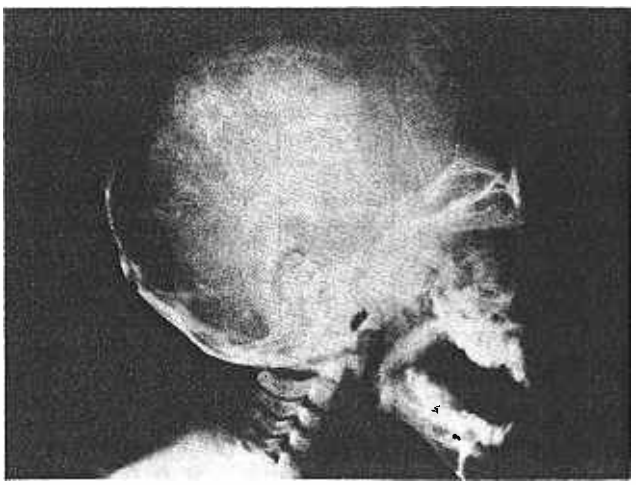

Figure 4b : Note the diffuse patchy calcification of the skull very characteristic of congenital toxoplasmosis.

mother in the early months of pregnancy has resulted in mental deficiency, microcephaly and congenital heart disease. While making the survey of mentally retarded children, the first few cases of rubella syndrome in Singapore are encountered (Paul 1969).

Rubella epidemics continue to exist in Singapore. Although rubella immunisation is offered to young women, people do not make themselves available for this type of immunisation. A widespread epidemic existed in Singapore in 1978. The epidemic started in November 1977 among National Servicemen. However, the infection spread to the civilian population and became amplified in close contact group, e.g. factory workers and school-children.

Out of 3,000 specimens received for rubella serology, 173 persons were found to have active infection and 77 of them were pregnant women. A survey into the immune status showed that out of 497 women tested, 52.5% were found to have no antibody. In spite of widespread epidemics, there still remains a large pool of non-immune women in the reproductive age group. As rubella produces multiple handicaps, it is essential to immunise susceptible groups.

II. Genetical Control of the Causes of Mental Subnormality

We have seen the environmental factors causing mental subnormality and we will now consider genetical inheritance. The latter may be transmitted through many genes of small effect individually but which together, exert a noticeable influence and is called polygenic inheritance. On the other hand, mental subnormality, particularly of severe degree may depend on single genetical factors of major effect. Recognised genetical factors of this kind are rare single genes of major effect.

Single genes of major effect

Single genes of major effect arise in the first place through mutation or a minute molecular change in the D.N.A. (Desoxyribonucleic acid) part of a chromosome. Their presence in families can be detected by the pattern of appearance of affected individuals in the pedigree.

The pattern may be that of Mendelian dominant or recessive inheritance mediated by the autosomes or the pattern may be one of sex-inheritance which is the transmission of the abnormal gene on an X-chromosome.

Recessive gene defects

Recessive traits outnumber both dominant or sex-linked traits. A recessive state must manifest itself in the homozygous condition. The parents who are heterozygous carriers appear normal physically but certain tests exist for the carrier state.

(a) Microcephaly

In a study of 198 children with microcephaly it was found that 51.4% of children were associated with primary microcephaly (Paul 1973) with a high risk of 25% of the offspring being affected genotypically. Familial incidence and a high degree of parenteral consanguinity has been reported in Japan by Komati, Kishimoto and Osaki (1955). There were 13 families in this series giving an incidence of 6% (Fig. 5 & 5a), with a high degree of consanguinity particularly among Indian families. Little can be done for a therapeutic point of view in microcephaly but from a preventive point of view, we hope with the use of ultrasound, the biparietal diameter of the foetal head can be measured and anencephalic babies can be detected in utero.

(b) Mucopolysaccharidosis in multiple members of families

Among the mucopolysaccharidosis were two families with Hurler type of abnormality affecting many members in the same family (Paul 1964). The first family was interesting because there were six gargoyls, one female and five males in a family of eight children (Fig. 6). Both parents were healthy and not consanguionous. All affected siblings had classical features of gargoylism with corneal opacities. The peripheral blood film showed inclusion bodies and the urine was positive for mucopolysaccharides. All the children with corneal opacities had corneal grafts done.

In Singapore, we have not reached the stage in the qualitative analysis of the different mucopolysaccharides of the amniotic fluid, but this is now possible by direct examination for the specific enzyme deficiencies in most individual diseases by the demonstration of an abnormal accumulation of glycosaminoglycans in cultured amniotic fluid cells. Uptake of sulphate by the cells and its retention in the sulphated polysaccharides that accumulated give an easily measured index of that abnormality.

(c) Laurence-Moon-Biedl Syndrome

Laurence-Moon-Biedl Syndrome is characterised by six cardinal features, namely obesity, retinitis pigmentosa, mental retardation, hypogonadism, polydactly and a familial incidence. Two families were reported. The first family reported by Paul (1965) showed an eleven year old boy who was unable to cope with his lessons and examination revealed a classical Laurence-Moon-Biedl Syndrome (Fig. 7). The second family had three affected members (Fig. 7a), and in both families the abnormality had occurred many times before the family sought any form of medical help. Unfortunately, there is no form of biochemical test that will clinch the diagnosis prenatally.

Dominant Gene Effects

Dominant genetical transmission can be recognised in families by the direct handling on of a trait or condition from parent to child. Theoretically, half of the offspring of an affected parent may be expected to inherit the dominant gene in question. Dominant genes tend to have greater variability of expression e.g. the parent of a child with Tuberose sclerosis in its extreme form with epilepsy and severe mental subnormality, may appear normal in every respect, except for a very slight butterfly rash on the face. Figure 8 shows a severe case of Tuberose Sclerosis where only one member was affected. Her adenomatous plaques were obstructing the airway. Although fertility is reduced in severely affected individuals it is difficult to eradicate deleterious dominant genetical influences.

Sex-Linked Defects

In sex-linked inheritance, the female carrier is normal phenotypically but can be detected by special tests eg. in glucose-six-phosphate dehydrogenase deficiency. Figure 9 is an example where the proband patient presented with kernicterus and where glucose-six-phosphate dehydrogenase deficiency was detected over four generations.

Other sex-linked conditions associated with mental retardation include the oculo-cerebral syndrome, Hunter's syndrome and some cases of congenital hydrocephalus. Other sex-linked conditions like pseudohypertrophic muscular dystrophy and nephrogenic diabetes insipidus may be accompanied by some degree of mental retardation.

Polygenic Inheritance

The type of inheritance responsible for the heriditary transmission of most biological variables in man e.g. stature and intelligence is polygenic inheritance.

Chromosomal Disorders

In a survey of mental subnormality in Singapore children, 16.7% of all known causes were associated with chromosomal disorders, 14.8% were due to mongolism and 1.9% were due to other chromosomal abnormalities (Paul, 1974).

Down's Anomaly

The incidence of Down's anomaly based on the total number of live births is 1 in 700 births in Singapore. In spite of active family planning in Singapore which shows a reduction in the live births of Singapore, the number of babies with Down's anomaly at a major maternity hospital has not shown a reduction in the number of mongol babies (Table 7).

In a series of Down's anomaly children studied from 1963 to 1968 in Singapore (Paul 1974) it was shown that the children were born to mothers in the

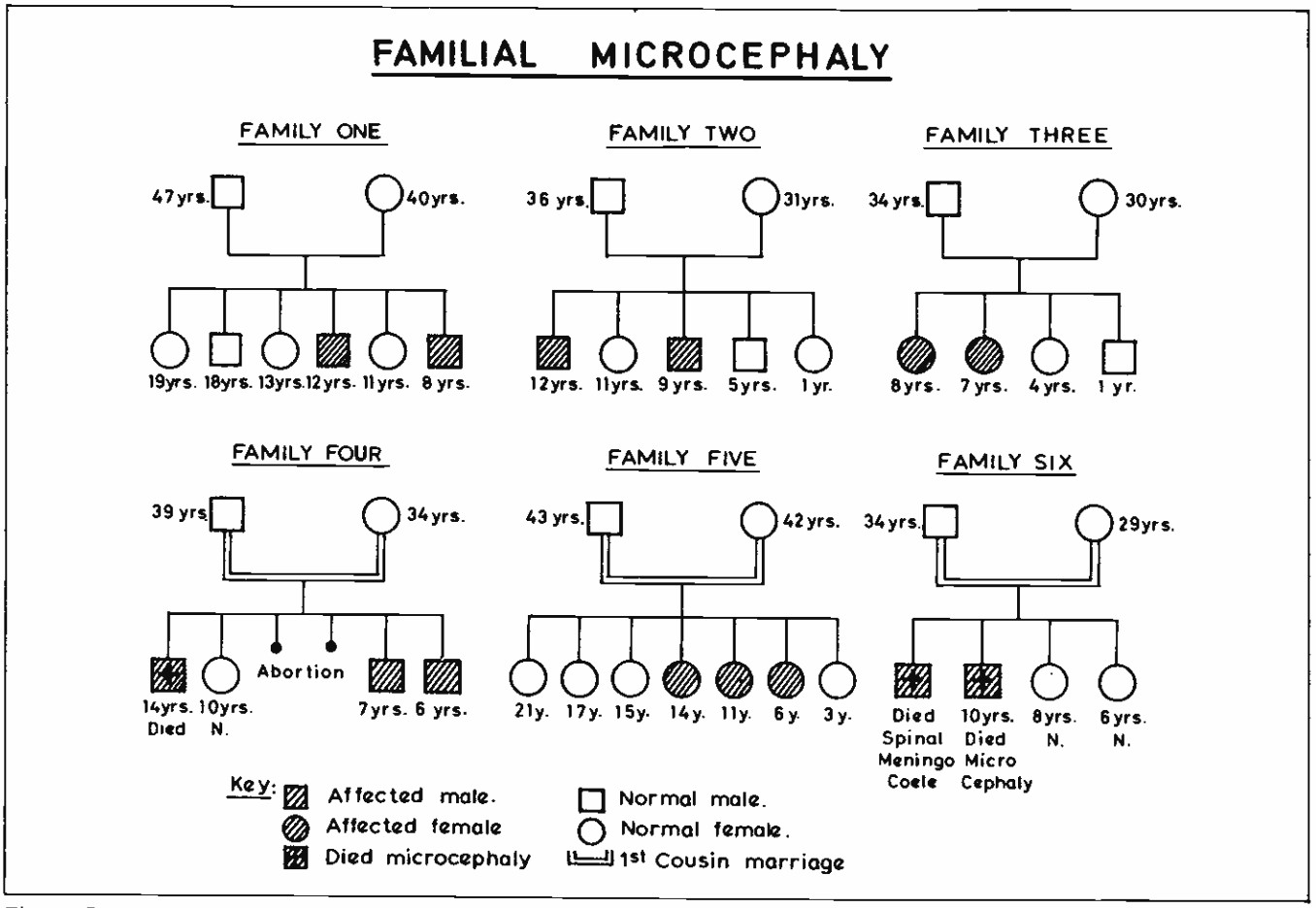

Figure 5

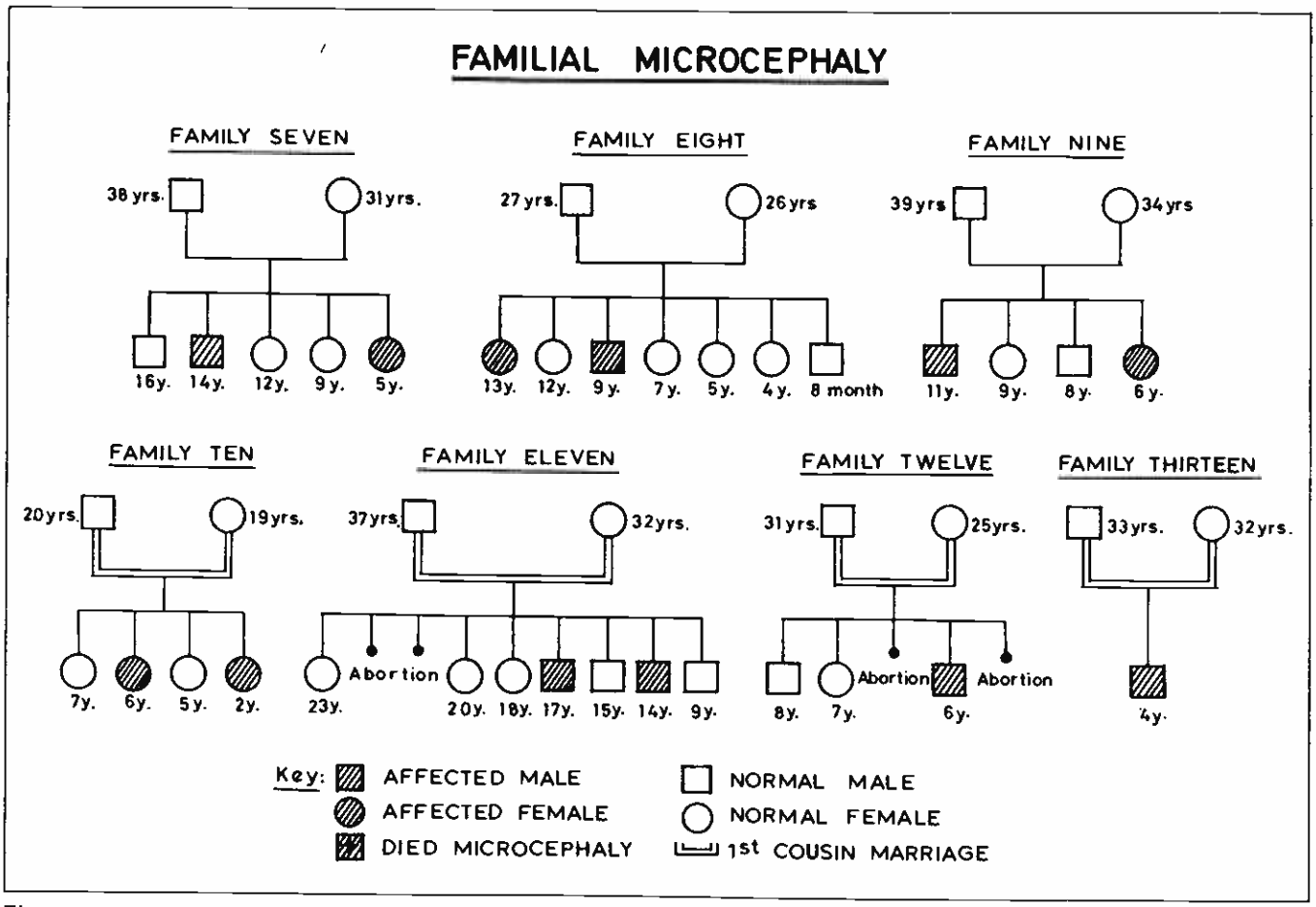

Figure 5a

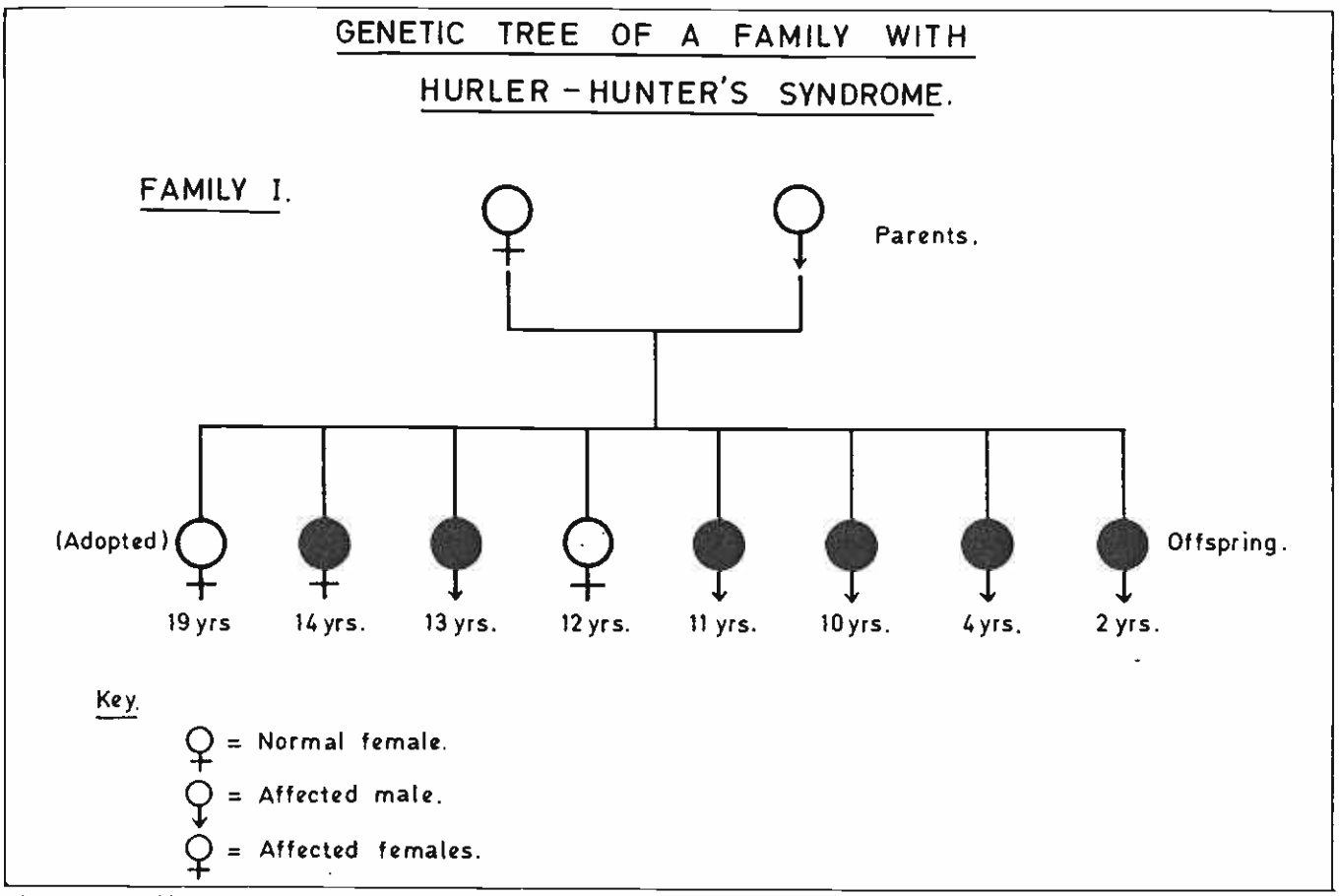

Figure 6 : Shows 6 affected members with Hurler type of mucopolysaccharidosis.

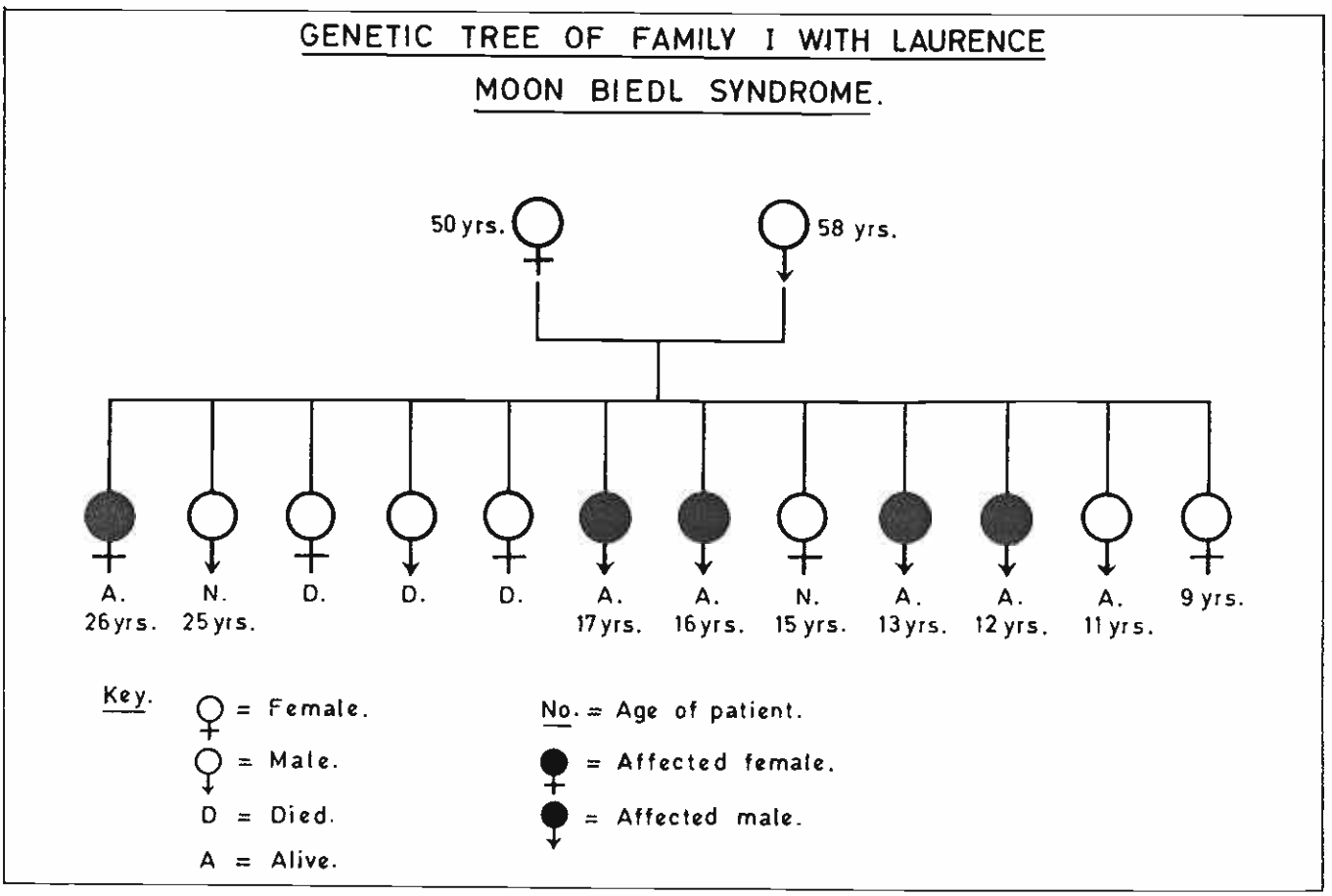

Figure 7 : Note the 5 members affected with Laurence-Moon-Biedl Syndrome.

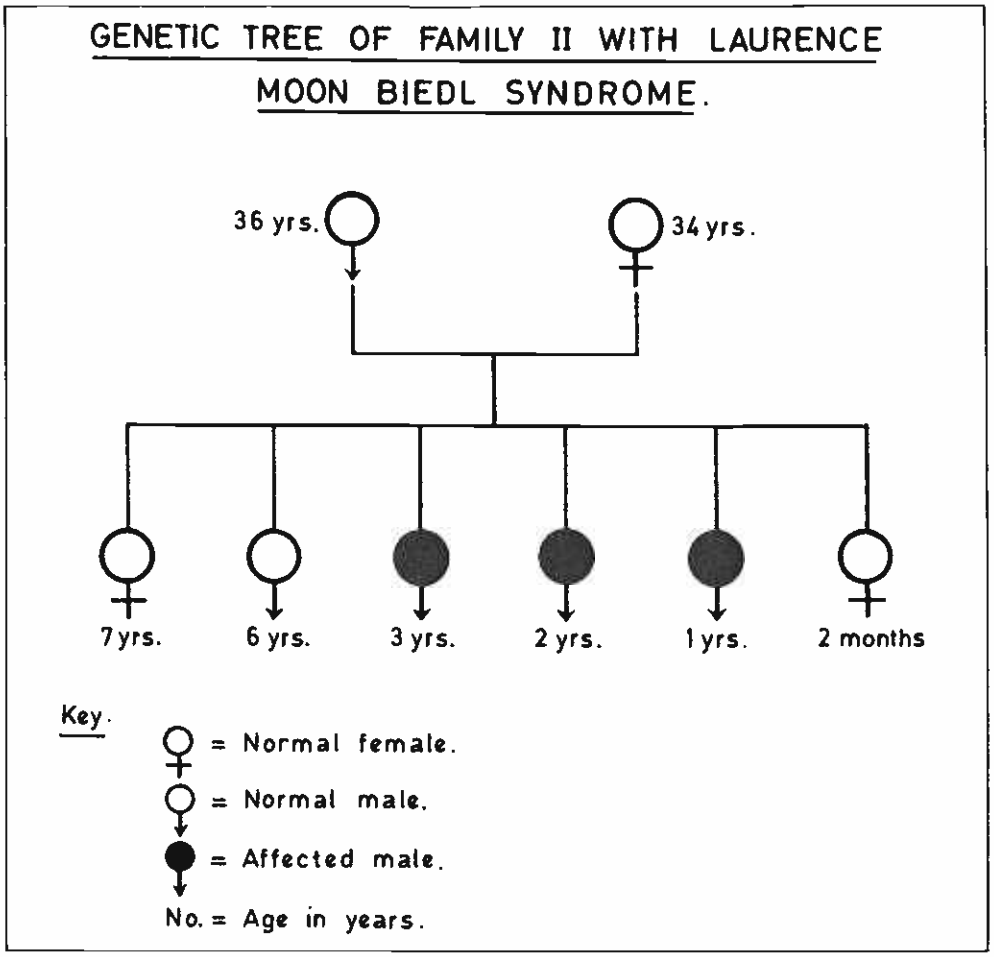

Figure 7a : Note 3 members with Laurence-Moon-Biedl Syndrome.

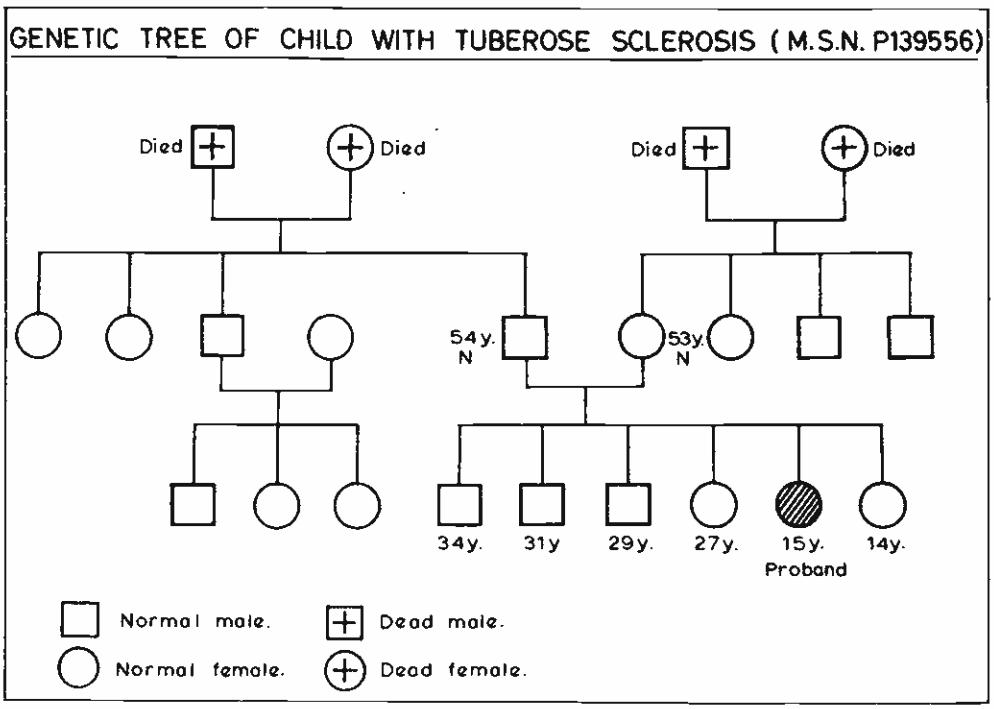

Figure 8 : The family tree of a severe case of Tuberose Sclerosis due to mutation of the gene.

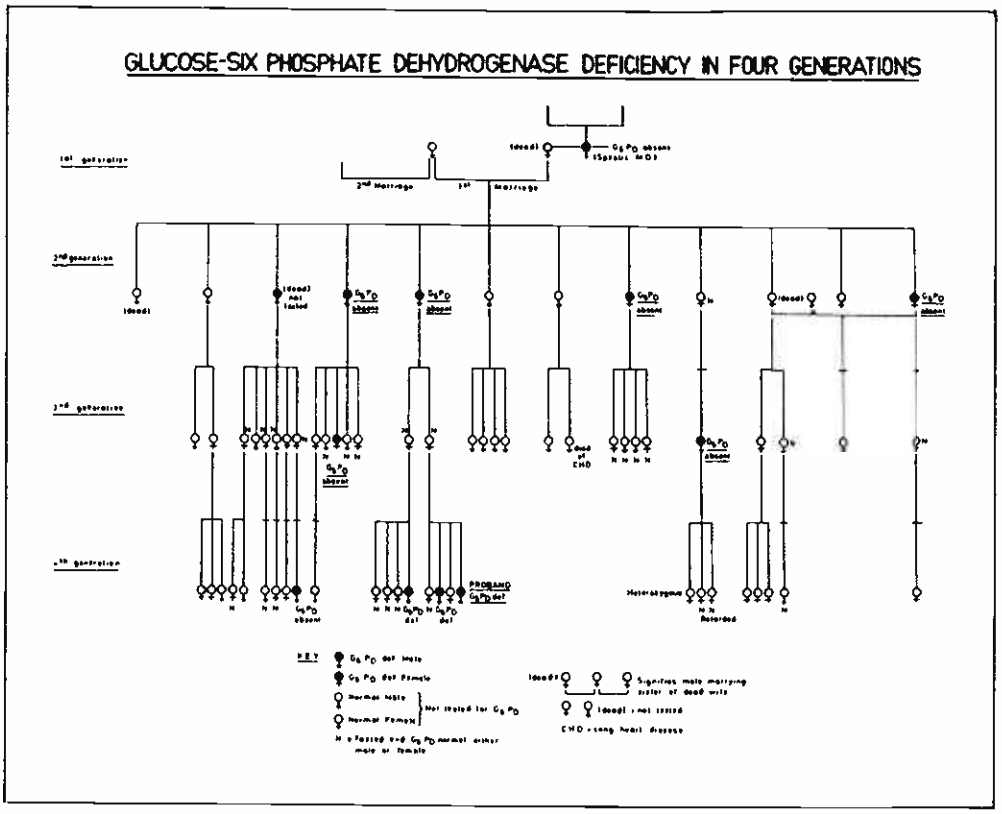

Figure 9 : This figure shows glucose-six-phosphate dehydrogenase deficiency present in four generations.

TABLE 7
INCIDENCE OF DOWN'S ANOMALY IN SINGAPORE CHILDREN BASED ON LIVE BIRTHS IN KANDANG KERBAU MATERNITY HOSPITAL

Year	Live-Births in S'pore	Newborn Mongols	Incidence %
1965	39,287	54	0.11
1966	39,085	55	0.14
1967	38,456	34	0.09
1968	39,816	52	0.13
1969	31,174	37	0.11
1970	29,387	27	0.09
1971	29,956	40	0.14
1972	30,245	47	0.15
1973	28,913	34	0.12
1974	25,901	24	0.09
1975	23,006	25	0.11
1976	24,865	28	0.11
1977	22,183	34	0.15
1978	22,924	18	0.08

Note: There is no noticeable reduction in the incidence of Down's anomaly at the maternity hospital.

age groups from 40 to 44 years, while the maximum child bearing age of Singapore mothers was from 25 to 29 years. Among 146 Down's anomaly studied from 1969 to 1973, 67% of the mongols were from 40 to 44 years, while the maximum child bearing age of Singapore mothers has dropped from 20 to 24 years. In a more recent study (1978) it was shown that the maximum child bearing age of Singapore mothers remains at 20 to 24 years, but the mothers producing the Down's anomaly are still in the older age-group (Fig. 10). This would probably explain why there has been no drop in the incidence of Down's anomaly.

In a study of 324 Down's anomaly children in Singapore (Paul 1974) showed there were seven families with familial mongolism. Although the incidence of dual mongolism in the same family is rare, the risk of a mother having a second mongol child is high. Figure 11 shows seven pedigrees in Singapore with familial mongolism.

Translocation Down's Anomaly

Down's anomaly can be inherited from parents who themselves are balanced translocation, D/G or G/G being the commonest. In such situations the chance of a mother producing a second baby with Down's syndrome is as high as 30%. Figure 12 shows a 13-15/21 translocation Down's anomaly where the father and grandfathers were carriers, balanced with a modal number of 45. The father's sister was also Down's anomaly.

Prenatal Diagnosis of Down's Anomaly

While the chance of bearing a baby with Down's syndrome is less than 1 in a 1,000 for a woman under the age of 30 years, the risk increases sharply to about 1 in 100 by the age of 40. To reduce the incidence of Down's anomaly it is recommended that we do an amniocentesis and chromosome culture not only if the first child is a Down's anomaly or if there is a family history of Down's syndrome but in every mother above the age of 30 years.

Other Chromosomal Disorders of Genetic Significance

(a) Cri-du-chat syndrome in Singapore

Out of 9 children with cri-du-chat syndrome seen in Singapore, there were five patients seen in two Chinese families (Wong and Chua 1968). The parents were phenotypically normal but genotypically the father revealed a partial deletion of the short arms of chromosome No. 5, and there was an abnormality long chromosome belonging to Group 3 believed to be a translocation of chromosome No. 5 on to the chromosome No. 3 i.e. a 3-5 translocation so that the father was chromosomally balanced and he was normal.

(b) Edward's 17-18 Trisomy Syndrome

There was yet another family with two members affected with Edward's 17-18 trisomy syndrome one of whom died as a baby while the other is alive and is a mosaic Edward's trisomy syndrome.

All these chromosomal abnormalities point to the importance of amniocentesis in women above the age of 30 years and to those who have produced one child with a chromosomal abnormality.

Conclusions drawn from the genetical control of mental subnormality

Singapore is a densely populated island with a rapidly falling birth rate and a rapidly falling infant mortality rate. With intensive family planning policies of the government so that each family will have the ideal number of two children, families will want the best quality of babies free of genetic disease.

Japanese style families have been genetically beneficial because they reduce the frequency of Down's syndrome by one third and the other miscellaneous genetic defect by about one tenth (Matsunaga). In some cases, genetic disease would express themselves in a favourable environment and manipulation of the environment would prevent the diseased condition e.g. glucose-six-phosphate deficiency states. Genetic counselling before embarking on pregnancy or amniocentesis after pregnancy has solved the problem in some of our cases in Singapore.

Amniocentesis followed by therapeutic abortion of abnormal foetuses will increase the prenatal selection of good phenotypes. The trend to small families is also eugenic in that it minimises the level of mutation, especially chromosomal. Hence, a reduction in population size and with improved health conditions, the genetic aspects of population structuring becomes an important problems in Singapore.

CONCLUSION

Thus we see that prevention of mental subnormality is as important as early diagnosis and long-term treatment. Prevention of mental subnormality has to some extent been accomplished in Singapore by:-

(a) Judicious family planning, amniocentesis and chromosome culture of amniotic cells e.g. in Down's anomaly.
(b) Genetic counselling, particularly in heriditary conditions like microcephaly.
(c) Screening for conditions like glucose-six-phosphate dehydrogenase and thereby reducing kernicterus.
(d) Active immunisation against conditions like tuberculous meningitis.

Further preventive measures were necessary, particularly with regard to rubella immunisation.

In all countries, neonatology was important particularly with regard to correction of biochemical abnormalities that are likely to damage the brain and with the prevention of conditions like cerebral anoxia.

In all tropical countries, proper nutrition and feeding in the first five years are important, particularly at a time when the brain is rapidly developing.

Early diagnosis is essential and the use of developing screening tests at infant welfare clinics is necessary to detect handicapping conditions.

Although progress has occurred in the therapy of biochemical conditions of mental retardation and drugs are essential in the field of epilepsy and

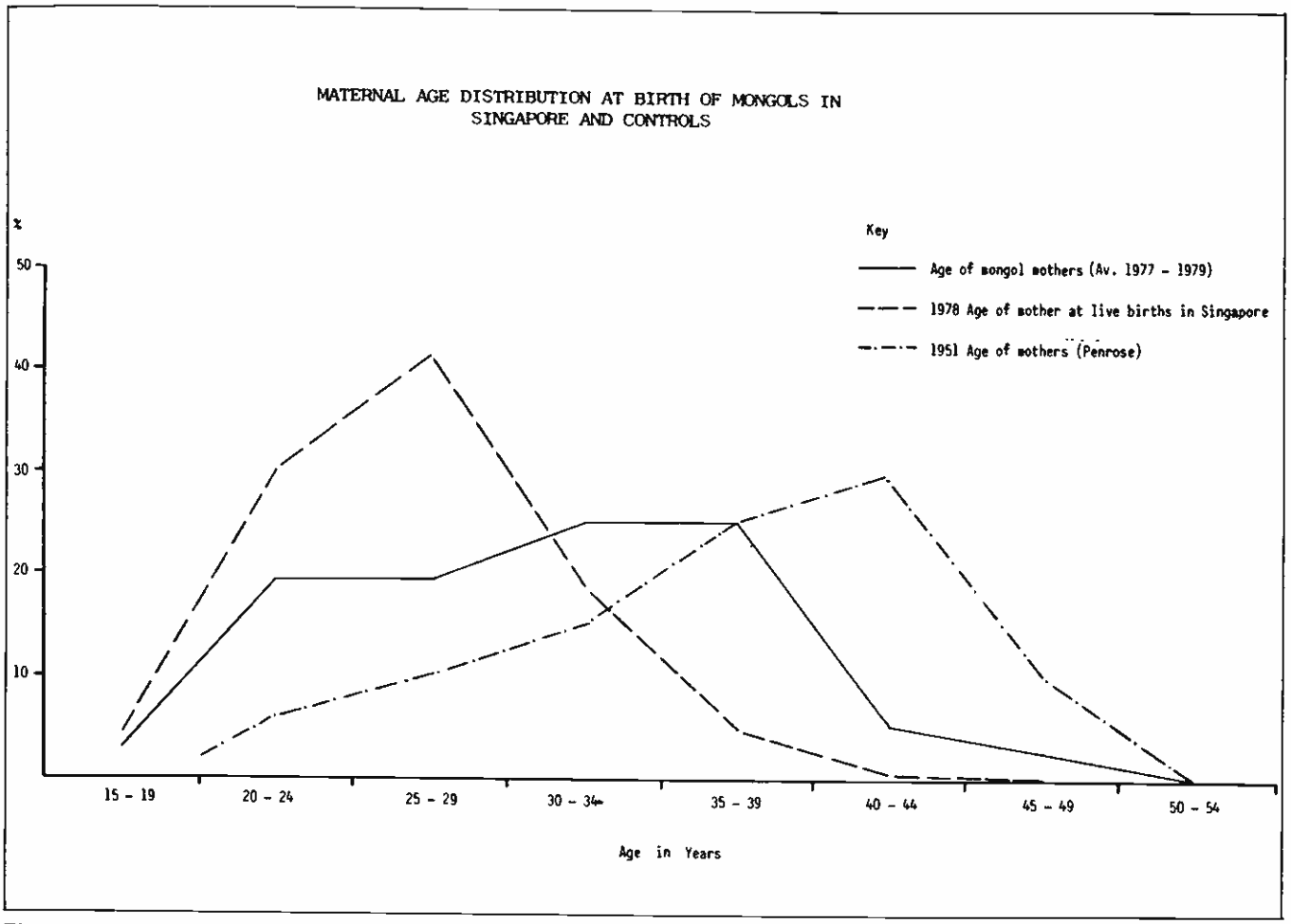

Figure 10 : Note for the year 1978, the mothers of the mongols are still above the age of 30 years.

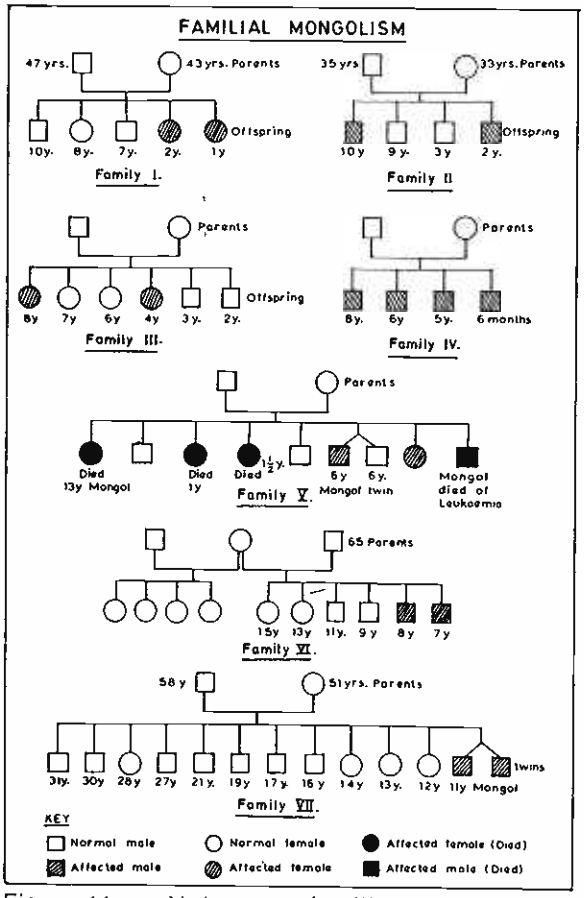

Figure 11 : Note seven families with familial mongolism.

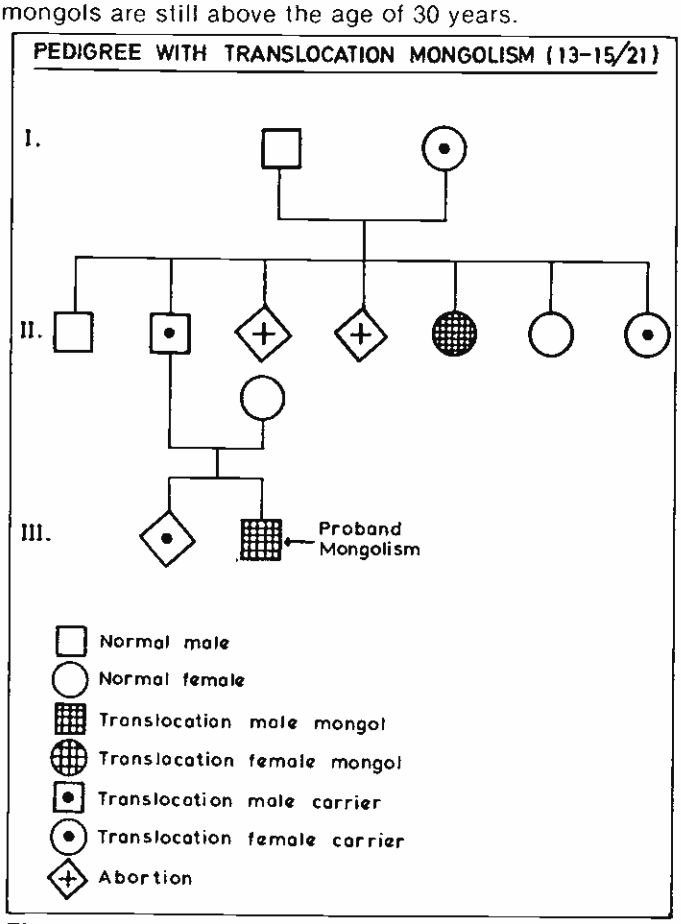

Figure 12 : Shows a pedigree of a 13-15/21 Down's Anomaly where the father and grandfather were carriers

endocrine causes, in most cases there is no wonder drug for the cure of mental retardation.

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