

TABLE RD 7 – PREVALENCE OF SCARRING BY AGE: ABORIGINES

AGE	NUMBER EXAMINED	NUMBER WITH BILATERAL SCARRING	%	NUMBER WITH SCARRING IN ONE EAR	%	TOTAL WITH SCARRING IN ONE OR BOTH EARS	%
0 & 1	2,219	51	2.3	119	5.4	170	7.7
2 & 3	3,176	200	6.3	424	13.4	624	19.7
4 & 5	4,811	492	10.2	860	17.9	1,352	28.1
6 & 7	6,086	673	11.1	1,126	18.5	1,799	29.6
8 & 9	5,696	755	13.3	1,058	18.6	1,813	31.8
10 & 11	5,341	714	13.4	999	18.7	1,713	32.1
12 & 13	4,509	666	14.8	829	18.4	1,495	33.2
14 & 15	3,543	528	14.9	604	17.0	1,132	32.0
16 & 17	2,174	268	12.3	410	18.9	678	31.2
18 & 19	1,669	253	15.2	317	19.0	570	34.1
20–29	6,449	944	14.6	1,152	17.9	2,096	32.5
30–39	4,482	633	14.1	778	17.4	1,411	31.5
40–49	3,793	524	13.8	577	15.2	1,101	29.0
50–59	2,607	345	13.2	359	13.8	704	27.0
60 +	3,718	454	12.2	452	12.2	906	24.4
ALL AGES	60,273	7,500	12.4	10,064	16.7	17,564	29.1

It can be seen that the prevalence, comparatively low at 7.7 per cent in children aged 0 and 1, rises sharply among two-year-olds and three-year-olds to 19.7 per cent and again in the next age group to 28.1 per cent. There is a steady climb in overall prevalence, with two peaks being reached: firstly among 12-year-olds and 13-year-olds, with 33.2 per cent affected, then after a four-year age period in which the prevalence is slightly, but not significantly, lower than this, the rate finally peaks among 18-year-olds and 19-year-olds, at 34.1 per cent. From this age there is a steady fall in prevalence, with scarring among persons aged 60 or more (at 24.4 per cent) being lower than that found in any age group except for those

under the age of four.

There were significantly different patterns of scarring among Aborigines in different zones. Table RD 8 shows this.

For Aboriginal children the highest prevalences of tympanic scarring were found in Zone 4, Goldfields WA, and Zone 3, Western Desert, in which more than nine in every 20 children had a scar in at least one eardrum. In these zones also, the prevalence of scarring among adolescents was more than 11 in 20 and in adults the proportion of those seen with at least one scarred eardrum was about one in two. In Zone 4, the trend for adults to have more scarring than adolescents varies from the national trend for scarring to

be lower for adults than adolescents.

In three other zones, Zone 1, the Red Centre, Zone 12, Coastal NSW, and Zone 5, Coastal Missions WA, more than three in every 10 Aboriginal children seen had at least one scarred eardrum. Also the prevalence of scarred eardrums in adolescents was considerably higher than average, ranging from 47.2 per cent in the Red Centre to 37 per cent in Coastal NSW.

Among adults, the prevalence of scarred eardrums ranged from 38.3 per cent in Zone 1, to 27.9 per cent in Zone 5. Only in Coastal NSW was the prevalence of scarring in adults higher than that among adolescents, although the difference was not significant.

Only one of the remaining zones,

TABLE RD 8: SCARRING BY ZONE: ABORIGINES

ZONE	CHILDREN AGE 0–9 Frequency	%	ADOLESCENTS AGE 10–19 Frequency	%	ADULTS AGE 20+ Frequency	%
4: Goldfields WA	295/638	46.2	246/439	56.0	378/641	58.9
3: Western Desert	341/755	45.2	279/494	56.5	469/967	48.5
1: Red Centre	957/2,901	33.0	928/1,965	47.2	1,104/2,886	38.3
12: Coastal NSW	350/1,089	32.1	346/934	37.0	302/803	37.6
5: Coastal Missions	150/483	31.1	141/348	40.5	152/544	27.9
11: Coastal QLD	862/3,504	24.6	961/3,194	30.1	799/2,696	29.6
7: Arid East	931/3,796	24.5	843/2,981	28.3	644/2,786	23.1
6: Coastal Towns WA	312/1,320	23.6	287/1,119	25.6	289/1,027	28.1
2: Cattle Country	401/1,779	22.5	368/1,077	34.2	710/2,483	28.6
13: Southern Mainland	260/1,163	22.4	315/1,053	29.9	344/1,116	30.8
9: Gulf and Cape	274/1,244	22.0	198/897	22.1	222/1,382	16.1
8: Top End NT	518/2,481	20.9	500/1,920	26.0	690/2,745	25.1
10: Torres Strait	106/790	13.4	159/789	20.2	92/871	10.6
ALL ZONES	5,757/21,943	26.2	5,571/17,210	32.4	6,195/20,947	29.6

TABLE RD 9 – PREVALENCE OF SCARRING BY AGE: NON-ABORIGINES

AGE	NUMBER EXAMINED	NUMBER WITH BILATERAL SCARRING	%	NUMBER WITH SCARRING IN ONE EAR	%	TOTAL WITH SCARRING IN ONE OR BOTH EARS	%
0 & 1	297	8	2.7	5	1.7	13	4.4
2 & 3	534	6	1.1	30	5.6	36	6.7
4 & 5	2,765	128	4.6	224	8.1	352	12.7
6 & 7	5,904	259	4.4	537	9.1	796	13.5
8 & 9	5,942	328	5.5	572	9.6	900	15.1
10 & 11	5,633	341	6.0	490	8.7	831	15.2
12 & 13	4,964	302	6.1	423	8.5	725	14.6
14 & 15	3,317	204	6.1	262	7.9	466	14.0
16 & 17	917	37	4.0	66	7.2	103	11.2
18 & 19	226	11	4.9	15	6.6	26	11.5
20–29	2,354	78	3.3	173	7.4	251	10.7
30–39	1,934	65	3.3	132	6.8	197	10.2
40–49	1,220	56	4.6	83	6.8	139	11.4
50–59	836	56	6.7	52	6.2	108	12.9
60 +	870	74	8.5	79	9.0	153	17.7
ALL AGES	37,713	1,953	5.2	3,143	8.3	5,096	13.5

TABLE RD 10 – PREVALENCE OF SCARRING BY ZONE: NON-ABORIGINES

ZONE	CHILDREN AGE 0–9 Frequency	%	ADOLESCENTS AGE 10–19 Frequency	%	ADULTS AGE 20+ Frequency	%
3: Western Desert	66/219	30.1	24/88	27.3	61/213	28.6
5: Coastal Missions	81/284	28.5	55/143	38.5	30/131	22.9
4: Goldfields WA	342/1,308	26.1	169/644	26.2	109/367	29.7
1: Red Centre	45/267	16.9	17/132	12.9	53/435	12.2
11: Coastal QLD	549/3,315	16.6	775/4,385	17.7	174/1,036	16.8
6: Coastal Towns WA	240/1,447	16.6	314/1,570	20.0	41/474	8.7
12: Coastal NSW	56/403	13.9	112/632	17.7	12/138	8.7
10: Torres Strait	11/102	10.8	8/50	16.0	6/177	3.4
7: Arid East	432/4,120	10.5	500/4,514	11.1	167/1,560	10.7
13: Southern Mainland	93/973	9.6	56/753	7.4	43/336	12.8
2: Cattle Country	37/570	6.5	17/246	6.9	53/538	9.8
8: Top End NT	121/1,959	6.2	90/1,543	5.8	84/1,477	5.7
9: Gulf and Cape	24/474	5.1	14/357	3.9	15/329	4.6

Zone 10, Torres Strait Islands, had a prevalence of scarring in children less than 20 per cent, or one in every five. The prevalence was significantly lower, at 13.4 per cent, than that found in any other zone.

Each of the following: Zone 13, Southern Mainland; Zone 11, Coastal Queensland; Zone 7, Arid East; Zone 6, Coastal Towns WA; Zone 2, Cattle Country; Zone 9, Gulf and Cape, and Zone 8, Top End NT, had a prevalence of scarring in children equal to or lower than the overall average. Among adolescents, a similar pattern existed, although the prevalence in Zone 2, Cattle Country, was slightly above the average for adolescents.

In none of these zones was the prevalence found among adults higher than that among adolescents.

Scarring among non-Aborigines is

shown in Table RD 9.

As with Aborigines, the proportion of non-Aboriginal children scarred increased in each successive age group, although at a slower rate and with an earlier peak. See Figure RD 2. By the age of peak prevalence in adolescents, age 10 and 11, 15.2 per cent of children seen had one or both eardrums scarred, compared with 32.1 per cent of Aboriginal children of the same age, about half the rate.

The prevalence tended to remain steady over several age groups and then to fall steadily until the 40–49 age group when it began to rise again. Among non-Aborigines aged 40–49, 11.4 per cent had a scar on one or both drums; in the 50–59 age group, 12.9 per cent did, and among persons aged 60 or more, 17.7 per cent did.

This tendency for the prevalence to

increase, and in fact reach its peak in late adulthood, is the opposite of that found among Aborigines, and, as discussed later, invites speculation about the prevalence of the otitis media which caused scarring among these two groups: Aborigines may have had less otitis media in the past while non-Aborigines may have had more. On average, the non-Aboriginal scarring rate is about half that found in Aborigines of the same age.

As with otitis media, the prevalence of scarred eardrums among non-Aborigines varied from zone to zone. Table RD 10 shows the pattern found.

The highest prevalences of scarring among non-Aboriginal children, adolescents and adults, were found in Zone 3, Western Desert, Zone 5, Coastal Missions WA, and Zone 4, Goldfields WA, in each of which

more than one in every four children seen had a scar in one or both eardrums.

In the next six zones: Zone 1, the Red Centre; Zone 6, Coastal Mission; Zone 11, Coastal Queensland; Zone 12, Coastal NSW; Zone 10, Torres Strait Islands, and Zone 7, Arid East, the prevalence of scarring in non-Aboriginal children seen was higher than 10 per cent. These zones also tended to have the intermediate prevalences for scarring among non-Aboriginal adolescents and adults, although adults were found at only 3.4 per cent prevalence.

In the last four zones: Zone 13, Southern Mainland; Zone 2, Cattle Country; Zone 8, Top End NT, and Zone 9, Gulf and Cape Country, the prevalence of scarring in non-Aboriginal children ranged from 9.6 per cent to 5.1 per cent.

Seven of the zones had higher prevalences of scarring among children than the lowest zone for Aboriginal children. In no zone, however, was the prevalence of scarring among non-Aboriginal children more than the Aboriginal rate, the ratio between the prevalences ranging from 1.1 per cent in Zone 5 to 5.4 per cent in Zone 9. Overall, the prevalence of scarring among non-Aboriginal children was about half that found in Aborigines.

Red Ear Drum

Of 60,273 Aborigines examined for ear disease, 921, or 1.5 per cent were diagnosed as having a red ear drum. (see Figure RD3)

By comparison, 311 non-Aborigines, or 0.8 per cent, had the diagnosis made for one or both ears. The diagnosis was overwhelmingly one found in children. Among Aborigines, as Table RD 11 shows, 75 per cent of the diagnoses were made in children under the age of 10, while among non-Aborigines as Table RD 13 shows, the proportion of the total diagnoses made in children was 72 per cent.

Table RD 11 shows the age prevalence of red ear drum in Aborigines.

In children under the age of four, the prevalence of red ear was 4.9 per cent, with about a quarter of these

having the condition in both ears. The prevalence then began to fall slowly, and bar small variations, continued to do so until age 60+ where the prevalence was 0.2 per cent, the lowest found. The bilateral red ear rate and the unilateral rate followed the overall rate.

There were different prevalences of red ear drums among Aborigines in the zones, as Table RD 12 shows.

Considerably the highest prevalence was found in Zone 12, Coastal NSW, where 15.2 per cent of children seen were said to have red ear drums. Again in Zone 13, Southern Mainland, the prevalence of red ear drum was 6.9 per

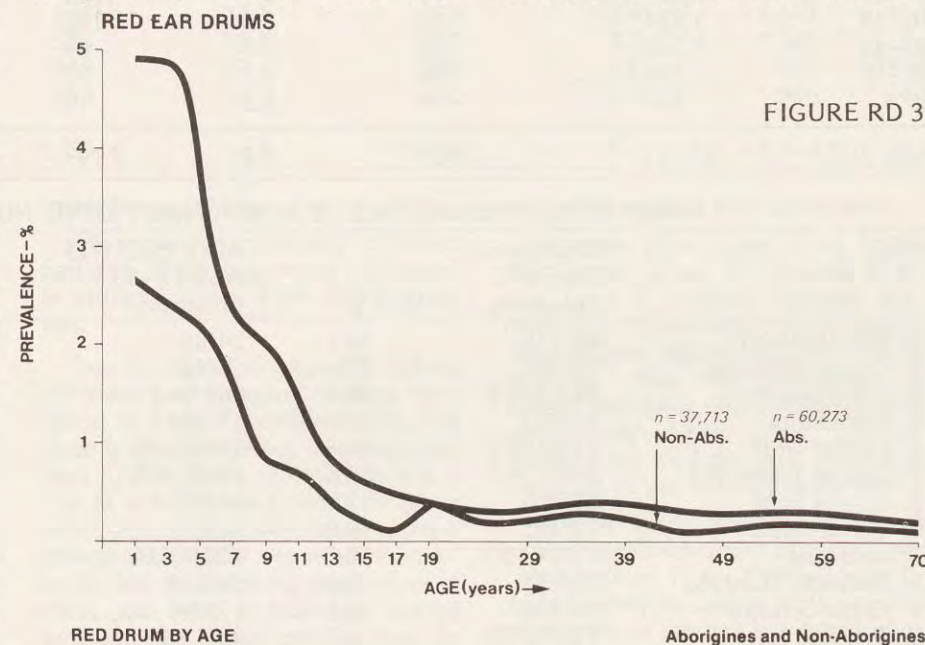


FIGURE RD 3

TABLE RD 11 – PREVALENCE RED EAR DRUM BY AGE: ABORIGINES

AGE	NUMBER EXAMINED	NUMBER WITH BILATERAL RED EAR	%	NUMBER WITH RED EAR IN ONE EAR	%	TOTAL WITH RED EAR IN ONE OR BOTH EARS	%
0 & 1	2,219	29	1.3	80	3.6	109	4.9
2 & 3	3,176	39	1.2	117	3.7	156	4.9
4 & 5	4,811	35	0.7	141	2.9	176	3.7
6 & 7	6,086	33	0.5	107	1.8	140	2.3
8 & 9	5,696	25	0.4	91	1.6	116	2.0
10 & 11	5,341	12	0.2	65	1.2	77	1.4
12 & 13	4,509	8	0.2	28	0.6	36	0.8
14 & 15	3,543	4	0.1	17	0.5	21	0.6
16 & 17	2,174	3	0.1	8	0.4	11	0.5
18 & 19	1,669	1	0.1	6	0.4	7	0.4
20–29	6,449	3	0.0	21	0.3	24	0.3
30–39	4,482	3	0.1	17	0.4	20	0.4
40–49	3,793	4	0.1	9	0.2	13	0.3
50–59	2,607	1	0.0	6	0.2	7	0.3
60 +	3,718	5	0.1	3	0.1	8	0.2
ALL AGES	60,273	205	0.3	716	1.2	921	1.5

cent, twice as high as that found in the next highest zone, Zone 2, with 3.1 per cent. These same high findings for Zone 12 and Zone 13 were also made in the adolescent and adult groups.

Many of the diagnoses were made by one examiner who worked with the program in both zones for a total of about four weeks. Although this person had a special interest in Aboriginal ear disease and may thus

have more accurately reflected a "true" red ear drum rate, there is no doubt that he, by comparison with other observers, overscored red ears. No measure of this was made; it is to be remembered, however, that in both

TABLE RD 12 – PREVALENCE OF RED EAR DRUMS BY ZONE: ABORIGINES

ZONE	CHILDREN AGE 0–9 Frequency	%	ADOLESCENTS AGE 10–19 Frequency	%	ADULTS AGE 20+ Frequency	%
12: Coastal NSW	166/1089	15.2	44/934	4.7	12/803	1.5
13: Southern Mainland	80/1163	6.9	17/1053	1.6	9/1116	0.8
2: Cattle Country	55/1779	3.1	6/2856	0.2	5/2483	0.2
7: Arid East	108/3796	2.8	13/2981	0.4	14/2786	0.5
9: Gulf and Cape	30/1244	2.4	6/897	0.7	5/1382	0.3
6: Coastal Towns WA	32/1320	2.4	3/1119	0.3	6/1027	0.6
5: Coastal Missions WA	11/483	2.3	4/348	1.2	0/544	—
11: Coastal QLD	82/3504	2.3	24/3194	0.8	4/2696	0.1
8: Top End NT	49/2481	2.0	13/1920	0.7	7/2745	0.3
1: Red Centre	56/2901	1.9	12/1965	0.6	5/2886	0.1
3: Western Desert	13/755	1.7	3/494	0.6	2/967	0.2
4: Goldfields WA	10/638	1.6	6/439	1.4	1/641	0.2
10: Torres Strait	5/790	0.6	1/789	0.1	2/871	0.2

TABLE RD 13 – PREVALENCE OF RED EAR DRUM BY AGE: NON-ABORIGINES

AGE	NUMBER EXAMINED	NUMBER WITH BILATERAL RED EAR	%	NUMBER WITH RED EAR IN ONE EAR	%	TOTAL WITH RED EAR IN ONE OR BOTH EARS	%
0 & 1	297	1	0.3	7	2.4	8	2.7
2 & 3	534	2	0.4	11	2.1	13	2.4
4 & 5	2,765	11	0.4	51	1.8	62	2.2
6 & 7	5,904	21	0.4	76	1.3	97	1.6
8 & 9	5,942	8	0.1	39	0.7	47	0.8
10 & 11	5,633	9	0.2	28	0.5	37	0.7
12 & 13	4,964	5	0.1	15	0.3	20	0.4
14 & 15	3,317	2	0	5	0.1	7	0.2
16 & 17	917	0	0	3	0.1	3	0.3
18 & 19	226	0	0	1	0.4	1	0.4
20–29	2,354	1	0	5	0.2	6	0.2
30–39	1,934	3	0.2	4	0.2	7	0.3
40–49	1,220	0	0	2	0.1	2	0.1
50–59	836	0	0	2	0.2	2	0.2
60 +	870	0	0	1	0.1	1	0.1
ALL AGES	37,713	63	0.1	250	0.6	313	0.8

TABLE RD 14 – PREVALENCE OF RED EAR DRUM BY ZONE: NON-ABORIGINES

ZONE	CHILDREN AGE 0–9 Frequency	%	ADOLESCENTS AGE 10–19 Frequency	%	ADULTS AGE 20+ Frequency	%
13: Southern Mainland	39/973	4.0	11/753	1.4	2/336	0.6
3: Western Desert	8/219	3.6	0/88	—	0/213	—
12: Coastal NSW	10/403	2.5	13/632	2.0	0/138	—
10: Torres Strait	2/102	1.9	0/50	—	0/177	—
2: Cattle Country	9/570	1.6	1/246	0.4	1/538	0.2
4: Goldfields	20/1308	1.5	5/644	0.8	0/367	—
7: Arid East	61/4120	1.5	16/4514	0.4	4/1477	0.3
6: Coastal Towns WA	21/1457	1.4	3/1570	0.2	2/474	0.4
5: Coastal Missions WA	4/284	1.4	1/143	0.7	2/131	1.5
11: Coastal QLD	34/3315	1.0	9/4385	0.2	1/1036	0.1
1: Red Centre	2/267	0.7	1/132	0.8	2/415	0.5
8: Top End NT	14/1959	0.7	7/1543	0.4	3/1477	0.2
9: Gulf & Cape	3/474	0.6	1/357	0.2	1/329	0.3

these zones the otitis media rate which does not include red drums, even that found by other observers, was high, and that accordingly the red drum rate might have been expected to be somewhat higher than average. It is of interest, however, that the program's screening team was joined at one centre in these zones by an ear, nose and throat specialist who graded ears with pathology including red drum at a higher rate than program examiners, including the observer referred to.

Among the remainder of the zones there was little difference in prevalence rates, with the range from 3.1 per cent in Zone 2, the Cattle Country, to a low among children of 0.6 per cent in Zone 10, Torres Strait Islands.

As for Aborigines, the diagnosis of red drum for non-Aborigines was uncommon at any age, but particularly from the age of eight. Table RD 13 shows the pattern of prevalence among non-Aborigines according to age.

The peak prevalence was found in children aged 0 and 1. This fell steadily, with a few minor but insignificant rises, through to later age. The same general pattern is seen with the pattern of bilateral red ears, although the prevalence peak, of 0.4 per cent, is the same for three age groups.

Table RD 14 shows the pattern of distribution of red ear drum by zone for non-Aborigines.

The highest prevalence of red ears among non-Aboriginal children was in Zone 13, the Southern Mainland, with 4 per cent affected, while Zone 3, Western Desert, with 3.6 per cent affected and Zone 12, Coastal NSW, with 2.5 per cent affected, were also high. In respect of Zones 12 and 13, the same comments made about observer variation with the Aboriginal prevalence apply. In the other zones the prevalence of red ears range from 1.9 per cent among children in Zone 10, the Torres Strait Islands, to 0.6 per cent in Zone 9, Gulf and Cape Country.

Findings for prevalence rates among adolescents and adults were in line, with variations explainable by small sample sizes, with that found among children in the same zone.

Myringotomy Tubes

A total of 70 persons seen by the program had myringotomy tubes in one or both ears. Of these, 36 were Aborigines and 34 non-Aborigines.

Foreign Bodies

If foreign bodies were observed within the ear canal, they were recorded and usually syringed out by program staff. The state of the ear drum was then coded. A record of type of frequency of foreign bodies was not computed but by far the most common were flies. As many as 20 flies were found in as many as 12 children's ears in one day. Flies were found in non-Aboriginal children's ears infrequently. In Walgett, a rather nice opal was syringed from an Aboriginal child's ear canal.

Wax in Ears

Overall, 11.1 per cent of Aboriginal ears examined contained wax sufficient to obscure the drum, compared with 10.1 per cent of non-Aboriginal ears examined.

SUMMARY

These findings confirm that Aborigines suffer from significantly more ear disease than non-Aborigines of the same age. In summary the findings were:

Otitis Media (Perforated ear drum and glue ear): Overall, one in every nine Aborigines had otitis media compared with one in every 90 non-Aborigines. In both groups, the condition was most common in childhood, being less prevalent in adolescence and least in adulthood. In Aborigines, however, a very high prevalence of otitis media was found; the prevalence with increasing age fell but remained high through the teenage years and into adulthood. By contrast, otitis media was uncommon at any age among non-Aborigines, but was especially uncommon among adolescents, and even less common in adults. The highest prevalence of otitis media in children was found among Aboriginal children in the Red Centre, with 32.7 per cent affected. The lowest prevalence among Aboriginal children was found in the Torres Straits, with 7.1 per cent affected. By comparison, the highest prevalence of otitis media found among non-Aboriginal children was 5.7 per cent in Coastal NSW.

Scarring: Overall, the prevalence of scarred eardrums among Aborigines was about twice that found for

non-Aborigines. For all ages, 29.1 per cent of Aborigines had a scar on one or both eardrums, compared with 13.5 per cent of non-Aborigines. In Aborigines, the prevalence of scarring increased markedly with age in children, remained fairly steady, about 33 per cent, in adolescents and adults under the age of 40, and then fell among the old. By comparison, scarring in non-Aborigines shows much the same trend as Aborigines though with smaller prevalences up to age 49, after which prevalence increases. In Aboriginal children, the peak zone for scarring was Zone 4, in which 46.2 per cent of children seen had a scar on one or both drums. That zone also had the peak prevalence for scarring in adults, with 58.9 per cent of Aborigines over the age of 19 having scars in one or both their ears.

In the zone with lowest prevalence of scarring in Aboriginal children, the Torres Strait Islands, 13.4 per cent were affected, while for non-Aborigines the zone with lowest prevalence was the Gulf and Cape zone of Queensland, with 5.1 per cent affected. In no zone was the Aboriginal prevalence lower than the non-Aboriginal prevalence.

Red Ear: Of Aborigines overall, 1.5 per cent had a red drum in one or both ears, compared with 0.8 per cent of non-Aborigines. As with otitis media, red drum was very much a condition of children, with prevalence falling from the lowest age group through to the highest. Considerably more persons were seen with red ear drums in the Coastal NSW and Southern Mainland zones than elsewhere, these believed to be partly associated with observer variation.

Myringotomy Tubes: A very small proportion of persons seen had had surgical operations performed on their ears because of middle-ear disease.

Total Ear Pathology Prevalence

About 38 per cent of Aborigines overall, compared with 15 per cent of non-Aborigines, had pathology (otitis media, scarring or red drum) in one or both ears.

In some areas, particularly the Western Desert zone, the Goldfields

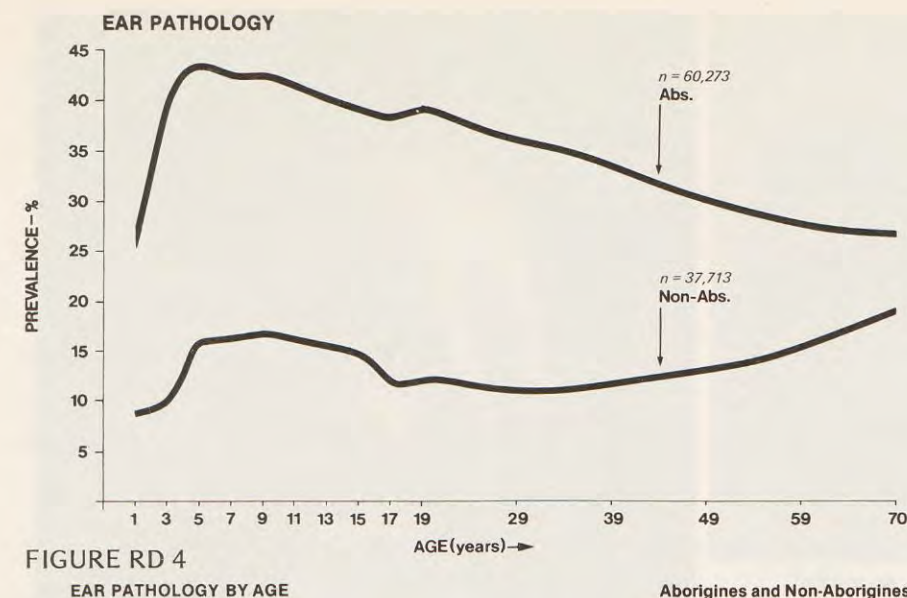


FIGURE RD 4
EAR PATHOLOGY BY AGE
Aborigines and Non-Aborigines

zone, the Red Centre and Coastal NSW, the figure was much worse: 11 in every 20 children had pathology in at least one ear. In the Western Desert zone, the figure was almost two in every three.

The Pattern of Rural Ear Disease and Implications

The relationship between otitis media and hearing loss has been clearly established.¹ With acute otitis media, there might only be temporary loss. With chronic otitis media, such as we have found among Australian Aboriginal children, there can be fairly constant impaired hearing after a perforation has healed and a scar taken its place.

Studies overseas and in Australia have demonstrated that children with hearing loss caused by chronic otitis media are delayed in the acquisition of language skills and suffer educational disadvantage by comparison with their peers who are free of middle-ear disease.^{2 3}

While the prevalence of otitis media in Aboriginal children was nearly 14 times that observed in non-Aboriginal children, the ratio of scarring observed was only about two to one. This suggests a markedly different course of otitis media between Aborigines and non-Aborigines, given that tympanic scarring is a sequel to otitis media. It appears that in non-Aboriginal children, otitis media attacks leading to perforation and eventually to scarring are of short duration and there is thus a low point prevalence of the condition. In

Aboriginal children, by contrast, the epidemiological picture suggests that there are repeated attacks, or chronic infections, or both, leading to a high point prevalence. That there is a markedly different course of the disease is also supported by the significant differences in the prevalence of glue ear in Aborigines and non-Aborigines: with only 8 per cent of otitis media cases in Aboriginal children being glue ear, compared with 44 per cent of the cases of otitis media in non-Aboriginal children.

The size of the sample, particularly among children and adolescents, and the consistency of the prevalence data showing a uniform picture of a disease which reached its peak prevalence at age two and three, with a slow but steady decline in prevalence from then, permits some analysis to be made of the history of otitis media in typical Aboriginal and non-Aboriginal communities.

A study of our data based on a method of analysis devised by Dr. Argye Hillis, of the Johns Hopkins Medical School,⁴ suggests that the average duration of perforated ear drums in Aboriginal children is about four years, compared with an average non-Aboriginal duration of about four months. That is to say that on average it takes about four years before an Aboriginal child's eardrum which has progressed to perforation heals over and becomes scarred, while the same process takes, on average, about four months in non-Aboriginal children. Some account has to be taken of the likelihood of reinfection

in assessing the import of these figures: for Aboriginal children for instance, an eardrum may temporarily heal over but quickly re-perforate because of a fresh attack of disease; the duration might, for instance, average only one year, but the average sufferer may suffer four attacks over a period of four years before his or her eardrum finally scars.

If it is assumed that a person with a perforated ear drum suffers some hearing defect, then it would appear that Aborigines, far more likely in the first place to have ear infections leading to perforations, suffer hearing impairments for 12 times as long as do their non-Aboriginal cohorts.

The Avoidable Overburden of Aboriginal Ear Disease

Considering the overburden among Aboriginal children on an assumption that levels such as those found in their non-Aboriginal counterparts are unavoidable, one must also consider the true significance of the overburden.

Had Aborigines suffered otitis media at the same rate as non-Aboriginal children, the program would have seen only 493 cases of perforations in Aborigines. In fact, the program saw 8,472 cases, 17 times the non-Aboriginal rate. When the suggested duration of perforations is taken into account, it would appear that Aboriginal groups have, in total, hearing loss due to otitis media 200 times that of non-Aboriginal groups. Much of this hearing loss is concentrated in the key developmental years.

The lower scarring rates in young, rather than old, non-Aborigines suggest that for this racial group otitis media is declining. For Aborigines, however, the higher scarring rates in the young suggest that otitis media may be more frequent for this group than it was several decades ago.

It could be expected that when the facilities necessary to overcome this enormous overburden of avoidable ear diseases are made available to and used by Aboriginal Australians, the pattern and duration of disease will also be altered to resemble the non-Aboriginal rate. The necessary facilities and their use is discussed in a later section.

Nasal Discharge

Because the presence or absence

1. Kaplan G.H., Fleshman J.K., and Bender T.R. et al: Long Term Effects of Otitis Media: a ten year cohort study of Alaskan Eskimo Children, *Paediatrics*, Vol. 52 No. 4 October 1973.
2. Stuart J.E., Quayle C.J., Lewis A.N. and Harper J.: Health Hearing and ear disease in Aboriginal schoolchildren *Med. J. Aust* 1972, 1: 855-859.
3. Lewis N.: Otitis media and linguistic incompetence *Arch Otolaryngol* Vol. 102 July 1976.
4. Hillis, Argye: A Mathematical Model for the Epidemiological Study of Infectious Diseases. From the Department of Ophthalmology, Johns Hopkins School of Medicine and Departments of Biostatistics and Pathology, Johns Hopkins School of Hygiene and Public Health, 1975.

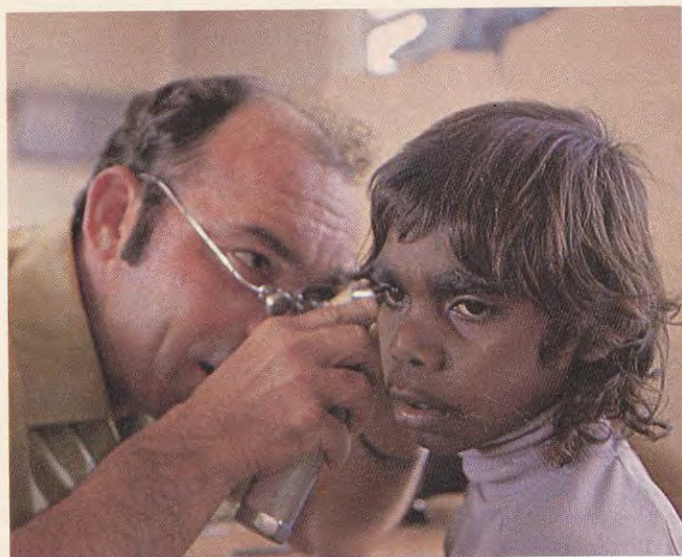


Fig. 5: "Dr. John Ohlrich examining the ear of an Aboriginal child in south-west Queensland."
Fig. 6: "A 'glue ear', one of the signs used by the program for determining the presence of otitis media."

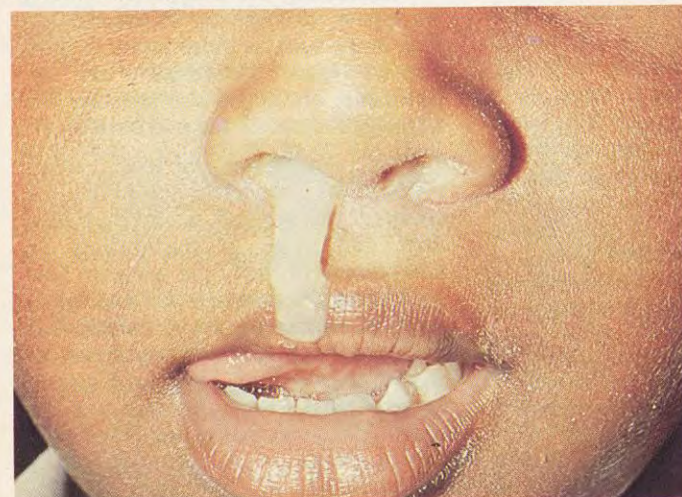


Fig. 7: "A purulent discharge from the nose of an Aboriginal child. Such a discharge had a rating of 2 in the program's grading criteria for nasal discharge."



Fig. 8: "Dr. Paul Torzillo making a respiratory examination at Yandeyarra, Western Australia."

of a nasal discharge is very easily recognised, and so as to gain a national overview of the problems and the conditions it points to, the National Trachoma and Eye Health Program decided to include in its screenings a record of whether or not the condition was observed.

Those screened were graded, after a quick visual inspection, according to the following scale:

- 0 = no nasal discharge observed
- 1 = a clear and watery nasal discharge was observed
- 2 = a purulent nasal discharge was
- 3 = a mucopurulent nasal discharge was observed

In many areas children were presented shortly after the nose had been wiped.

A total of 97,752 people were graded for the condition, 60,030 of whom were Aborigines and 37,722 of

whom were non-Aborigines. The prevalence rates presented are likely to be under-estimated. Altogether, 11,635 people, or 11.9 per cent, of those seen had a nasal discharge of some sort. However, as Table RD 15 shows, there was a very marked dif-

TABLE RD 15 NASAL DISCHARGES BY RACE: ALL AGES

RACE	Clear Discharge	Mucopurulent Discharge	Purulent Discharge	Total Examined
Aboriginal	9,121	2,040	97	60,030
Percentage	15.2	3.4	0.2	
Non-Aboriginal	346	29	2	37,719
Percentage	0.9	0.1	0.0	
TOTAL	9,467	2,069	99	97,749
Percentage	9.7	2.1	0.1	

TABLE RD 16 - NASAL DISCHARGE BY AGE: ABORIGINES

AGE	Number Examined	Number Affected	Percentage Affected
0 & 1	2,223	1,007	45.3
2 & 3	3,179	1,850	58.2
4 & 5	4,809	2,445	50.8
6 & 7	6,072	2,447	40.3
8 & 9	5,683	1,648	29.0
10 & 11	5,301	949	17.9
12 & 13	4,470	393	8.8
14 & 15	3,518	139	4.0
16 & 17	2,167	50	2.3
18 & 19	1,657	39	2.4
20-29	6,422	83	1.3
30-39	4,465	53	1.2
40-49	3,775	30	0.8
50-59	2,592	35	1.4
60 +	3,697	90	2.4
ALL AGES	60,030	11,258	18.8%

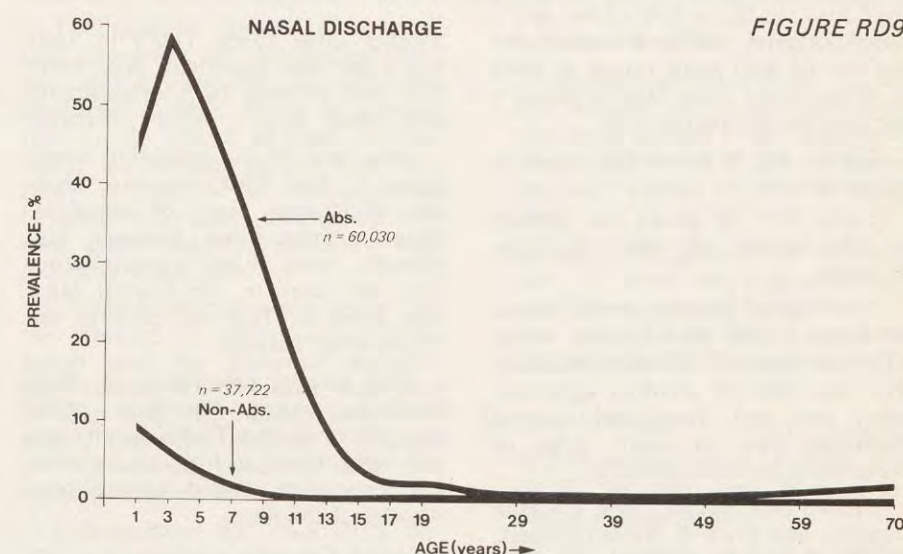
ference in the pattern of nasal discharge seen: nearly one in every five Aborigines seen had a nasal discharge, while only one in every 100 non-Aborigines did.

Table RD 16 shows the pattern of prevalence of the condition, by age, among Aborigines. It can be seen that the condition is primarily one of children, although far from uncommon among adolescents, and occasionally found among adults, particularly the elderly.

With Aboriginal children the peak age prevalence for the condition was among two- and three-year-olds, with 58.2 per cent affected. In the age group below that, 45.3 per cent were affected, while 50.8 per cent of children aged four and five were. Thus more than half the children of pre-school age were affected. Of these, 11.3 per cent had a purulent or mucopurulent discharge.

The proportion of Aboriginal children affected was still very high in the early school-age years: 40.3 per cent of children aged six and seven were affected, and 29 per cent of those aged eight or nine were. Overall, 42.8 per cent of Aboriginal children under the age of 10 had a nasal discharge.

The prevalence was still high among young adolescents, though the prevalence fell through the adolescent years into adulthood. The lowest prevalence was among persons aged between 40 and 49, with 0.8 per cent affected; it rose in persons aged 50-59 and again in persons aged 60 or more.



NASAL DISCHARGE BY AGE Aborigines and Non-Aborigines

TABLE RD 17 - NASAL DISCHARGE BY AGE: NON-ABORIGINES

AGE	Number Examined	Number Affected	Percentage Affected
0 & 1	298	28	9.4
2 & 3	542	33	6.1
4 & 5	2,784	103	3.7
6 & 7	5,927	114	1.9
8 & 9	5,943	56	0.9
10 & 11	5,624	14	0.2
12 & 13	4,967	9	0.2
14 & 15	3,308	3	0.1
16 & 17	918	0	-
18 & 19	226	1	0.4
20-29	2,342	6	0.3
30-39	1,929	2	0.1
40-49	1,220	4	0.3
50-59	835	2	0.2
60 +	859	2	0.2
ALL AGES	37,722	377	1.0

The age prevalence of runny noses among non-Aborigines is shown by Table RD 17. The peak prevalence of nasal discharge was in children under the age of two, with 9.4 per cent affected. Of children aged two and three 6.1 per cent were affected, while 3.7 per cent of children aged between four and five were affected.

Overall, 4.5 per cent of pre-school non-Aboriginal children seen had a nasal discharge, or less than one for every 19 Aboriginal children proportionately.

Over the pre-school age, the condition was very uncommon. Of children aged six and seven, 1.9 per cent were affected and 0.9 per cent of children aged eight or nine were, meaning that 2.2 per cent of all

TABLE RD 18 - NASAL DISCHARGE BY ZONE:
ABORIGINAL CHILDREN

ZONE	Children less than 10 years		
	Number of Children Examined	Per cent with Nasal Discharge*	Per cent with Purulent Nasal Discharge
1. Red Centre	2,885	77.6	25.4
2. Cattle Country	1,790	59.7	10.1
3. Western Desert	704	55.1	15.9
8. Top End	2,525	46.6	9.1
9. Gulf and Cape	1,240	45.7	8.9
4. Goldfields W.A.	543	40.5	6.5
13. Southern Mainland	1,201	38.0	0.7
5. Coastal Mission W.A.	826	37.5	14.8
6. Coastal Towns W.A.	1,117	36.1	4.7
7. Arid East	3,724	33.8	4.1
12. Coastal N.S.W.	973	31.5	4.0
11. Coastal Queensland	3,477	22.7	3.4
10. Torres Strait	708	19.6	2.0

* includes clear and mucopurulent

non-Aboriginal children under the age of 10 seen were found to have a runny nose. This rate is about 5 per cent the Aboriginal rate.

Figure RD 9 shows this trend in graph form.

Table RD 18 shows the pattern of distribution of nasal discharge by zone.

The highest prevalence was found in Zone 1, the Red Centre, where 77.6 per cent of children, including 87.7 per cent of children aged between two and three, had a nasal discharge. One in every three of these had a purulent discharge.

In two other zones, Zone 2, Cattle Country and Zone 3, Western Desert, the prevalence was more than 50 per cent, with peak prevalences among children aged two and three (more than two in three) while in

another three zones, Top End, Gulf and Cape and Goldfields WA, more than four in every 10 Aboriginal children seen had a nasal discharge.

Only one of the remaining zones, Zone 7, Arid East, was not adjacent to coastal areas of Australia. Even in these zones, however, prevalences were high, ranging from 37.5 per cent in the Coastal Missions Zone to 19.6 per cent in the Torres Strait Islands.

The lowest prevalence of nasal discharge among Aboriginal children, found in the Torres Strait, was still eight times as high as the average prevalence found among non-Aboriginal children.

Nasal Discharge and Ear Disease

Otitis media, as discussed earlier,

usually begins after infection by organisms which gain access to the middle ear cavity and its mucous lining through the Eustachian tube, at the rear of the nasal passages. Any inflammatory disease affecting the nose and the nasopharynx can result in the passage of micro-organisms up the Eustachian tube and into the middle ear. The connection between the middle ear and the upper respiratory tract (the Eustachian) provides the link between respiratory and middle ear disease.

An association between nasal discharge and middle-ear disease can thus be expected, and, as shown by Table RD 19, this was the case.

Otitis media was the condition most strongly associated with nasal discharge. While only 10.5 per cent of children without a nasal discharge had otitis media, 22.3 per cent of those with a clear discharge did, 32.7 per cent of those with a mucopurulent discharge did and 41 per cent of those with a purulent discharge did.

The association between a nasal discharge and tympanic scarring was somewhat less significant than that between otitis media and nasal discharge, though 20.1 per cent had at least one scarred eardrum (though not otitis media in either ear) but 22.1 per cent of children with a nasal discharge had at least one eardrum scarred.

There was a tendency, far less strong, for red ear and nasal discharge to be related ($p = 0.1$) while children with a nasal discharge were very significantly less likely to have bilaterally normal ears than children with no nasal discharge. Although

TABLE RD 19: NASAL DISCHARGE AND EAR DISEASE: ABORIGINAL CHILDREN AGED LESS THAN 10 YEARS

	Otitis Media	CONDITION OF WORSE EAR			Total
		Scarring	Red Drum	Other or Normal	
No nasal discharge	1,310	2,513	324	8,344	12,491
Percentage	10.5	20.1	2.6	66.8	
Clear nasal discharge	1,663	1,590	239	3,951	7,443
Percentage	22.3	21.4	3.2	53.1	
Mucopurulent nasal discharge	596	457	40	727	1,820
Percentage	32.7	25.1	2.2	39.9	
Purulent nasal discharge	34	17	1	31	83
Percentage	41.0	20.5	1.2	37.3	
TOTAL	3,603	4,577	604	13,053	21,837
Percentage	16.5	21.0	2.8	59.8	

TABLE RD 20: NASAL DISCHARGE AND OTITIS MEDIA:
ABORIGINAL CHILDREN AGED LESS THAN 10 YEARS

	Glue ear	CONDITIONS OF WORSE EAR			Total
		Wet Perforation	Dry Perforation	No Otitis Media	
No nasal discharge	174	628	508	11,181	12,491
Percentage	1.4	5.0	5.0	89.5	
Clear discharge	85	1,026	552	5,780	7,443
Percentage	1.1	13.8	7.4	77.6	
Mucopurulent discharge	29	443	158	1,273	1,903
Percentage	1.5	23.2	8.3	66.9	
TOTAL	288	2,097	1,218	18,234	21,837
Percentage	1.3	9.6	5.6	83.5	

66.8 per cent of children with no nasal discharge had bilaterally normal ears, only 50.4 per cent of children with a nasal discharge had bilaterally normal ears.

Of the three diagnoses which made up the definition of otitis media, the condition most significantly associated with nasal discharge was wet perforation, although there was also a very strong association between dry perforations and nasal discharge. There was a negative association, significant only to a $p = 0.1$ level, between glue ear and nasal discharge in Aboriginal children. These associations are found in Table RD 20.

The association between otitis media and nasal discharge was significant to a $p < 0.001$ level for Aboriginal children under the age of 10 in each of the 13 zones.

In five zones: Zone 1, the Red Centre; Zone 2, Cattle Country; Zone 8, the Top End NT; Zone 10, Torres Straits; Zone 12, Coastal NSW, and Zone 13, Southern Mainland, the association was also significant in the adolescent age group.

The association was significant in each zone when all age groups were considered.

Respiratory Disease

The high prevalence of middle-ear disease and nasal discharge in many Aboriginal communities pointed to high levels of respiratory disease in these communities. A number of studies of the spectrum of respiratory disease in Aborigines has shown that otitis media and nasal discharge are but parts of a complex of respiratory disease - an ascend-

ing order of infection and long-term damage to the respiratory system.
1 2 3 4

The program decided to measure the prevalence of respiratory disease against which its ear and nasal discharge findings could be compared. To do this, it engaged, in May 1979, the services of Dr. Paul Torzillo, of the Royal Prince Alfred Hospital in Sydney, to examine persons presenting for rescreening examination in the Pilbara.

Those examined were tested for the presence or absence of a loose cough and for abnormal auscultatory sounds at the base and apex of each lung. His findings were compared with the program's findings for ear disease, nasal discharge and follicular trachoma.

Examinations for respiratory disease can be long and time-consuming while general screening examinations may not be effective in discriminating between those with significant respiratory pathology and those without. However, the testing methods devised provided a reasonable clinical guide to the level of respiratory disease and most importantly can be expected to understate the true prevalence.

Some of Dr. Torzillo's findings, to be published later, are presented here:

Abnormal Auscultatory Sounds

Of 829 children under the age of 15 examined, 113 or 14 per cent had abnormal auscultatory sounds in at least one site, while 59 or 7 per cent had such sounds in two or more sites.

Of 695 persons aged 15 or more, 185 or 27 per cent had abnormal auscultatory sounds in at least one site, while 142 or 20 per cent had such sounds in two or more sites.

Of persons aged 50 or more, 125 of 294 persons, or 43 per cent, had abnormal sounds in at least one site, with 104 or 35 per cent having such sounds in two or more sites.

Overall, 298 persons or 20 per cent of those seen had abnormal auscultatory sounds in at least 1 site, with 201 or 13 per cent having sounds in 2 or more sites.

Loose Cough

of 847 persons under 15 years, 111 or 13 per cent were recorded as having a loose cough.

Of 705 persons aged 15 or more, 130 or 18 per cent had a loose cough.

Overall, 240 of the 1,552 persons tested had a loose cough, an average of 15 per cent.

Where a person was recorded as having abnormal auscultatory sounds and/or a loose cough, he was said to have respiratory disease. Overall, 391 persons or 26 per cent of those seen were found to have respiratory disease by this definition. This included 163 of 829 children, or 20 per cent.

If a slightly different definition was used, requiring the presence of abnormal auscultatory sounds in at least two sites and/or a loose cough, the overall respiratory disease rate was 33.5 or 22 per cent, including 15 per cent of children aged 14 or less.

1. Kamien M: The Physical Health of Aboriginal Children in Bourke NSW Med J Aust Supp April 1976 34
2. Gandevia B: The Prevalence of signs of respiratory infections in Pintipi and Wailpiri Aborigines at Papunya, Central Australia, and Warburton, Western Australia. Med J Aust 2: 237
3. Maxwell et al: Respiratory Infections in Australian Aboriginal Children: A Clinical and Radiological Study. Med J Aust 2: 990
4. Jose et al: A Survey of Children and Adolescents in Queensland Aboriginal Settlements Aust Paediat J 5, 2: 71

Loose cough and abnormal auscultatory sounds were significantly related to all ages ($p < 0.001$).

In children aged 14 or less there was a significant association between the presence of a loose cough and the presence of follicular trachoma and nasal discharge ($p < 0.001$), but only a trend, not significant, for loose cough to be associated with otitis media.

The same association was found with abnormal auscultatory sounds and follicular trachoma and nasal discharge, although in this case there was also a significant association between abnormal auscultatory sounds and otitis media ($p < 0.001$).

THE FINDINGS SHOWED, IN SHORT, A MARKED RELATIONSHIP BETWEEN THE PRESENCE OF RESPIRATORY DISEASE, AS CONSERVATIVELY DEFINED, AND SUCH CONDITIONS AS OTITIS MEDIA AND NASAL DISCHARGE, AS WELL AS FOLLICULAR TRACHOMA.

They suggest a common base for such disease — environmental conditions — as well, of course, as some of the common pathogens involved.

Skin Infections in Rural Australia

To gain a national overview of the prevalence of skin disease, the program decided it would examine each person for skin infection on

the head and other exposed parts of the body. At the same time each person was examined for signs of trachoma, otitis media and ocular pathology.

To this end, the results are likely to be influenced by the amount of clothing usually worn by those examined: in Central and Northern Australia, more of the body was usually exposed for examination than the colder and more settled areas. Thus, a thorough examination was not usually made unless there was reason to suspect the presence of skin disease on covered parts of the body.

Scabies and infected scabies, and impetigo were the most frequently encountered skin infections. Impetigo, often called 'school sores', was a common scourge among Caucasian children several decades ago.

An inflamed blister forms on the skin and becomes filled with pus. The blister may burst and a hard scab forms covering an ulcer containing liquid pus. These lesions can occur anywhere but are most common on the hands, where they become traumatised by normal use, and in the scalp, where they can be felt through the hair which becomes congealed into the pus.

These sores frequently follow scabies bites which cause intense itching. Scratching leads to the infection which may last for days, weeks or months. In some areas, we found children with much of the skin of

their hands ballooned out with impetigo pus.

Apart from the pain, bleeding and inconvenience of impetigo, there are long-term complications. One of the bacteria which infects the sores, a streptococcus, may form an immune-complex which can lead to kidney failure and valvular heart disease. These two problems can cause death and serious illness in young and middle-aged adults.¹ These conditions are much more frequent for Aborigines than for non-Aborigines.

Only infectious skin diseases were recorded by the program and those people found to have them were identified to local health agencies for treatment.

The grading was according to the following scale:

- 0 = no skin infection observed
- 1 = minor skin infection observed
- 2 = moderate patches of skin infection observed
- 3 = many patches of skin infection observed

It is important to emphasise that the results presented here are likely to understate the situation in the communities visited. Apart from the potential for variation arising from the amount of clothing worn, the examination was brief and usually less thorough than the eye and ear examinations.

THE RESULTS

Of the 97,690 persons examined

TABLE SD 1 — SKIN DISEASE AMONG ABORIGINES BY AGE

AGE	Examined	Minor infection observed		Moderate infection observed		Major patches of infection observed		Total with skin infections	
		Freq.	Per Cent	Freq.	Per Cent	Freq.	Per Cent	Freq.	Per Cent
0 & 1	2,218	136	6.1	50	2.3	7	0.1	193	8.7
2 & 3	3,167	217	6.9	61	1.9	19	0.6	297	9.4
4 & 5	4,807	326	6.8	55	1.1	10	0.2	391	8.1
6 & 7	6,050	357	5.9	50	0.8	10	0.2	417	6.9
8 & 9	5,683	258	4.5	41	0.7	8	0.1	307	5.4
10 & 11	5,307	162	3.1	22	0.4	8	0.2	192	3.6
12 & 13	4,474	108	2.4	13	0.3	1	0.0	122	2.7
14 & 15	3,522	64	1.8	7	0.2	2	0.1	73	2.1
16 & 17	2,166	24	1.1	8	0.4	0	—	32	1.5
18 & 19	1,658	27	1.6	5	0.3	2	0.1	34	2.1
20–29	6,417	65	1.0	16	0.2	5	0.1	86	1.3
30–39	4,456	30	0.7	13	0.3	5	0.1	48	1.1
40–49	3,764	27	0.7	2	0.1	1	0.0	30	0.8
50–59	2,585	17	0.7	2	0.1	2	0.1	21	0.8
60+	3,699	21	0.6	7	0.2	1	0.0	29	0.8
ALL AGES	59,973	1,839	3.1	352	0.6	81	0.1	2,272	3.8

1. Audit Report, Community Health Service, Western Australia La Grange, April 1978.

for evidence of skin infection, 2,487 or 2.5 per cent, were recorded as having skin infections. Of these, the greatest proportion were Aborigines; as Table SD 1 shows, 3.8 per cent of Aborigines had skin infections recorded, while as Table SD 2 shows, the rate among non-Aborigines was 0.6 per cent.

It can be seen that among Aborigines skin disease is largely a disease of childhood, with a peak prevalence of 9.4 per cent being found in children aged two and three. From this peak there is a steady fall in prevalence until, in later age groups, the rate settles at about 1 per cent.

Table SD 2 shows the pattern of skin disease among non-Aborigines. Because only 12 persons were seen with moderate or major patches of infection, with the other 203 cases being local infections, the findings are presented for those with any skin infection observed.

TABLE SD 2 — SKIN INFECTIONS AMONG NON-ABORIGINES BY AGE

AGE	EXAMINED	Found to have skin infections:	
		Frequency	Per Cent
0 & 1	298	1	0.3
2 & 3	542	1	0.2
4 & 5	2,786	35	1.3
6 & 7	5,927	49	0.8
8 & 9	5,942	47	0.8
10 & 11	5,623	34	0.6
12 & 13	4,967	21	0.4
14 & 15	3,310	12	0.4
16 & 17	918	0	—
18 & 19	226	0	—
20–29	2,342	7	0.3
30–39	1,949	3	0.2
40–49	1,216	1	0.1
50–59	833	0	—
60+	858	4	0.4
ALL AGES	37,717	215	0.6

With non-Aborigines, the same overall age trend, though on a smaller scale, exists as with Aborigines.

Of those under the age of 10, 0.9 per cent had infections, while 0.5 per cent of those aged 10–19 did and 0.2 per cent of those aged 20 or more did.

A comparison of Tables SD 1 and SD 2 shows quite dramatic differences between skin infection rates in Aborigines and non-Aborigines, especially between the babies and toddlers, with Aboriginal toddlers (aged two and three) having 9.4 per cent infection rate compared with 0.2 per cent in non-Aboriginal tod-

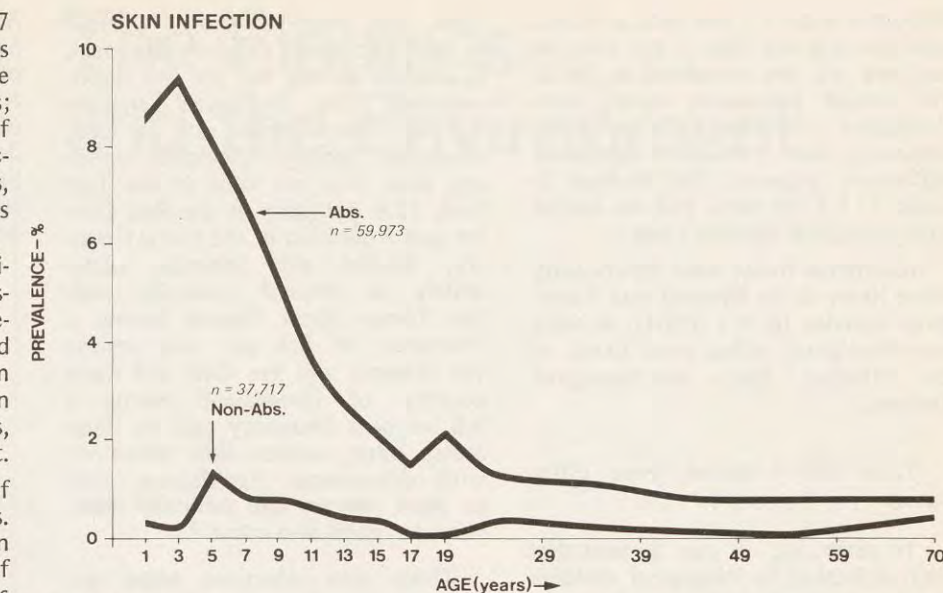


Figure SD 1
SKIN INFECTION BY AGE

Aborigines and Non-Aborigines

Figure SD 1 shows this trend

Table SD 3 shows the pattern of skin infection among Aboriginal children (those under 10) by zone.

The highest prevalence of skin infection was found in Zone 8, the Top End Zone, with 17.6 per cent of children affected. The prevalence was almost as high in the Red Centre Zone, with 15.6 per cent affected.

High prevalences were also found in Zone 2, the Cattle Country, confirming that the Northern Territory is the worst-affected area of Australia for skin infection, and in the Torres Strait Islands, with 9 per cent and 8.3 per cent respectively.

In only three zones, the Goldfields WA, with 1.3 per cent of children affected, Coastal NSW, with 1.9 per cent affected, and the Southern

dlers.

TABLE SD 3 — SKIN INFECTION BY ZONE: ABORIGINAL CHILDREN

ZONE	Examined	Per cent affected
8. Top End NT	2,523	17.6
1. Red Centre	2,870	15.6
2. Cattle Country	1,794	9.0
10. Torres Strait	711	8.3
9. Gulf and Cape	1,240	5.6
7. Arid Eastern	3,708	4.0
6. Coastal Towns WA	1,178	3.9
5. Coastal Missions WA	824	3.3
11. Coastal Qld	3,477	3.1
3. Western Desert	699	3.0
12. Coastal NSW	972	1.9
13. Southern Mainland	1,199	1.7
4. Goldfields	533	1.3

Mainland with 1.7 per cent affected, was the rate less than 3 per cent. In no zone was the prevalence as low as the overall prevalence among non-Aboriginal children, 0.5 per cent, although there was no significant difference between the findings in Zone 4, 1.3 per cent, and the overall non-Aboriginal children's rate.

Aboriginal males were significantly more likely to be affected than Aboriginal females ($p = < 0.001$), as were non-Aboriginal males more likely to be affected than non-Aboriginal females.

Table SD 4 shows these differences.

In summary, it can be seen that skin infection in Aboriginal children reaches its peak at the toddler stage

(two and three-year-olds), whereas in non-Aboriginal children the peak is reached among the six and seven-year-olds. The Northern Territory has the overall worst rate for skin infections among Aboriginal children with 17.6 per cent in the Top End, 15.6 per cent in the Red Centre and 9 per cent in the Cattle Country. Scabies and impetigo occur widely in tropical Australia with the Torres Strait Islands having a frequency of 8.3 per cent among the children and the Gulf and Cape country of Queensland having a 5.6 per cent frequency rate. In these areas, other serious skin infections with skin-contact significance, such as yaws, leprosy and asexually transmitted syphilis also occur.²

These skin infections which are often so nonchalantly tolerated by

Aboriginal communities and their health agents may be a major source of high mortality and illness among Aboriginal adults and some, or all, of the following conditions are needed for all persons in the affected living unit in order to control and eradicate endemic scabies and impetigo.

1. Ability to shower (not bath) with an appropriate antiseptic.
2. Application of local anti-sca-bies substance and anti-bacterial agents.
3. Washing of all clothes and bedding with antiseptics.
4. Fumigation of all non-wash-able bedding materials.
5. The ability to apply insecticide effectively to all sources of scabies in all dwellings.
6. The ability to separate affected individuals and their clothing and bedding contacts.
7. Systemic anti-bacterial substances.

Although the above controls are necessary for the eradication of skin infections, few Aboriginal communities have either the physical or medical amenities needed for this to occur. This will be discussed in greater detail in another chapter.

TABLE SD 4 - SEX DIFFERENCES WITH SKIN INFECTIONS

RACE	SEX	Examined	Affected	
			Frequency	Percentage
ABORIGINES	Males	28,560	1,215	4.3
	Females	31,413	1,057	3.4
NON-ABORIGINES	Males	18,699	135	0.7
	Females	19,018	80	0.4

The Findings and the Environment



Chapter 10:

Previous chapters of this report have shown wide variations in the prevalence of trachoma, ear disease, nasal discharge, skin disease and certain ocular abnormalities, not only between Aborigines and non-Aborigines, but also between the same racial groups in different areas.

With only a few conditions were prevalence rates found among non-Aborigines higher than those found for Aborigines. Each of these conditions, such as refractive disorders, abnormalities of the retina and choroid and strabismus, is known to have a strong hereditary component: the most important predisposing factor to such conditions appears to be the genes a person has inherited. Most of the significant ocular deficiencies known to be related to genetic factors were considerably less commonly seen in Aborigines than non-Aborigines, although there was a tendency, in areas where a substantial proportion of Aborigines had at least some non-Aboriginal ancestors, for rates to be closer to the non-Aboriginal rate.

Most of the diseases encountered, however, are known to be acquired. Many of these conditions were infections, including trachoma, otitis media, skin infections and nasal discharge: whether or not a person acquires such a disease is determined by exposure to the infectious organism and by the extent to which a person's living environment, his immunological status and his social organisation permits him to resist infection once it has presented itself.

Some other conditions, most notably pterygium, cataract and climatic droplet keratopathy (Labrador keratopathy, or Lab.K), appear not to develop as a result of infection, but may be substantially affected by the climate and by the lifestyle a person has adopted.

One of the aims of the program was the elimination of trachomatous blindness in rural Australia. In the spelling out of these aims it was recognised that one of the requirements for this was the achievement of an environmental health status that prevents occurrence and recurrence of the disease.

The organisation of the National Trachoma and Eye Health Program provided an excellent opportunity to look for some of the factors associated with these acquired diseases. There was a large sample drawn from a wide range of areas with different climatic and physical environmental factors, and widely differing social and living conditions.

The program visited and examined people in 461 different sites throughout Australia. For consideration of the associations of the health findings of the program and environment factors, the latter were divided into two groups, climate and hygiene. For both of these factors, a wide variation amongst the communities was seen.

Climate

The factors considered for each community were as follows:

NORMAL RELATIVE HUMIDITY — %

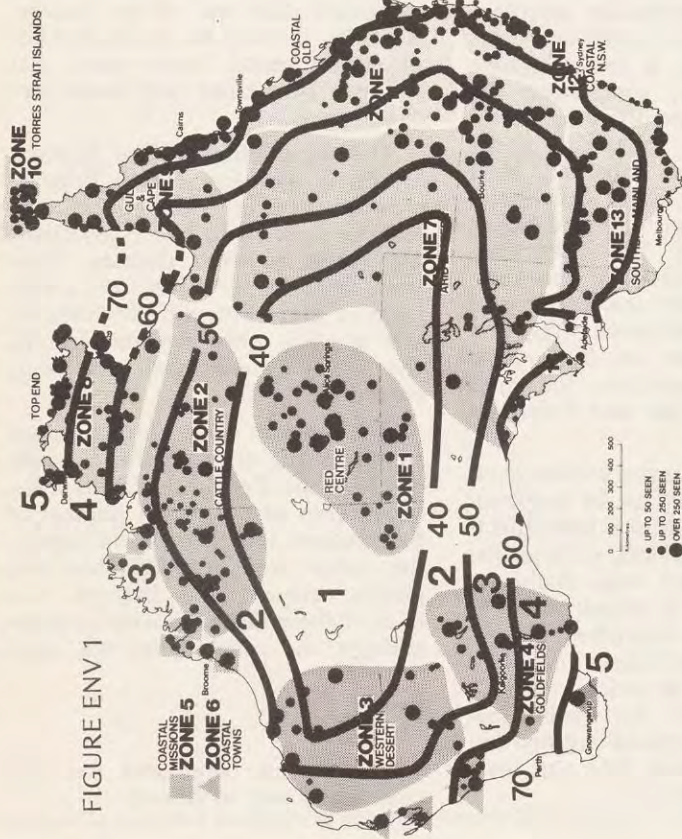


FIGURE ENV 1

ANNUAL RAINFALL — mm

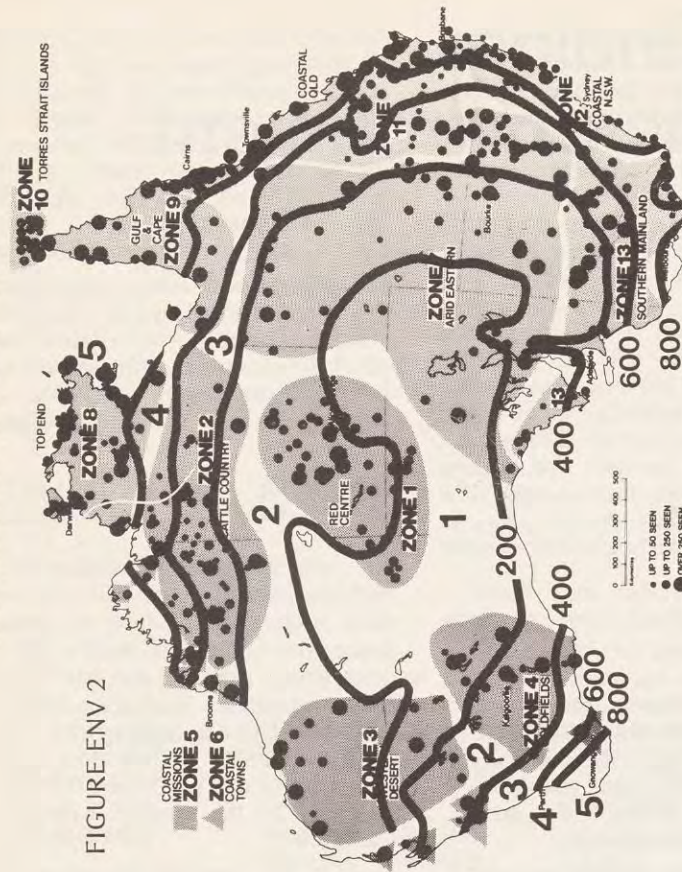


FIGURE ENV 2

LATITUDE SOUTH

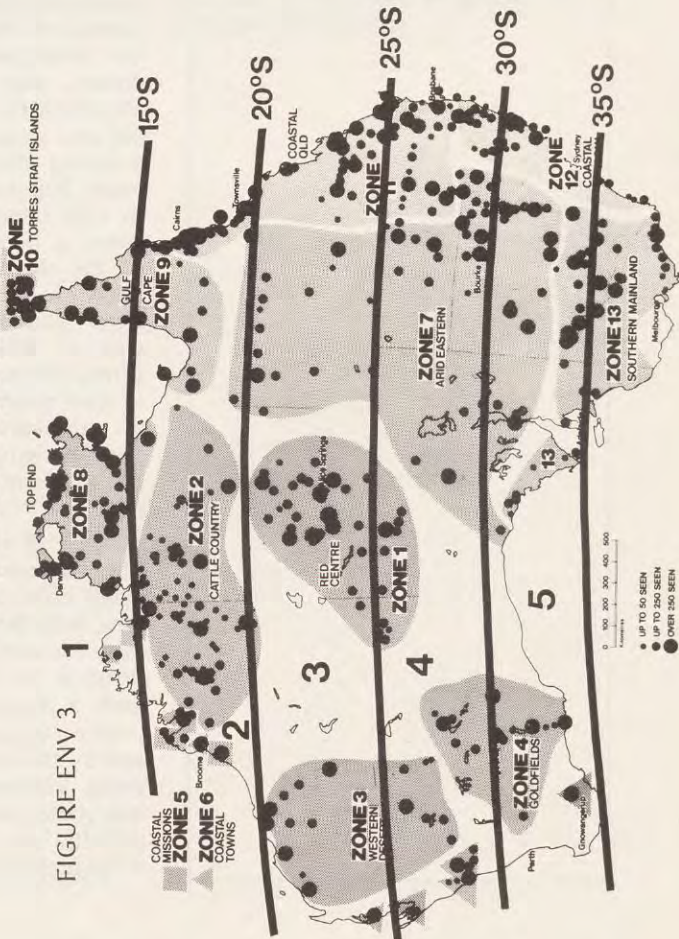


FIGURE ENV 3

ULTRA VIOLET-B RADIATION ERYTHEMAL UNITS



FIGURE ENV 4

FIGURE ENV 5

ANNUAL EVAPORATION — mm

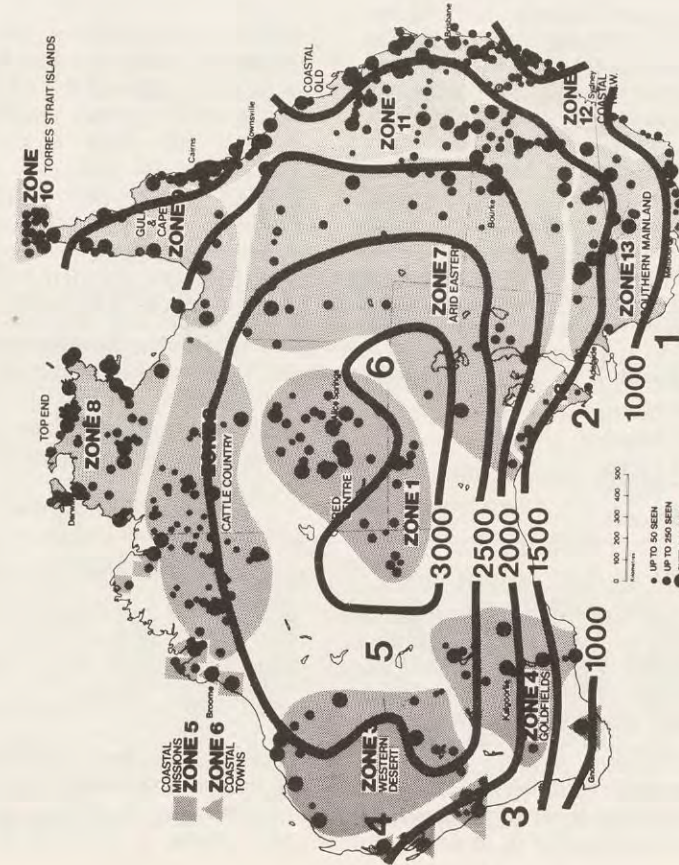


FIGURE ENV 6

BRIGHT SUNSHINE HOURS — AVERAGE DAILY

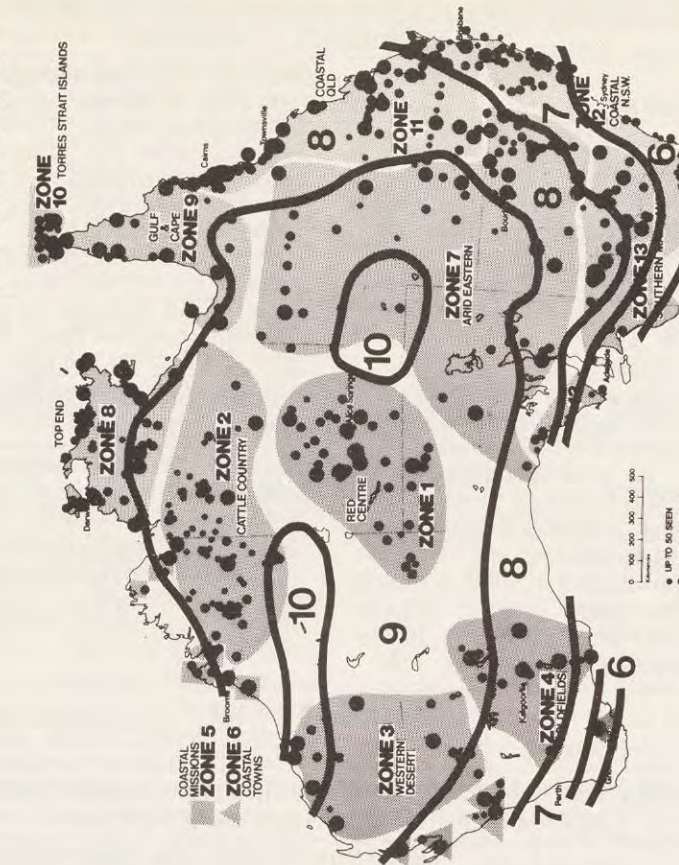


TABLE ENV 1: POPULATION DISTRIBUTION, ABORIGINES & NON-ABORIGINES x AVERAGE HUMIDITY

CATEGORY	No. Aborigines Seen		No. Non-Aborigines Seen	
	0-60 years	0-20 years	0-60 years	0-20 years
1. Less than 40%	11,097	6,938	1,613	1,030
2. 40%-50%	4,593	2,822	4,021	3,349
3. 50%-60%	17,366	11,024	12,509	10,081
4. 60%-70%	18,529	12,365	15,580	12,509
5. More than 70%	10,125	6,885	4,725	4,134
TOTAL	61,710	40,034	38,448	31,103

TABLE ENV 2: POPULATION DISTRIBUTION, ABORIGINES & NON-ABORIGINES x ANNUAL RAINFALL

CATEGORY	No. Aborigines Seen		No. Non-Aborigines Seen	
	0-60 years	0-20 years	0-60 years	0-20 years
1. 200mm or less	10,790	6,711	4,205	3,243
2. between 200-400mm	10,390	6,870	6,802	5,467
3. between 400-600mm	14,147	9,236	12,110	10,137
4. between 600-800mm	4,519	2,765	2,901	2,238
5. more than 800mm	21,864	14,452	12,430	10,019
TOTAL	61,700	40,034	38,448	31,103

All of these are data which, except for Ultraviolet-B data,¹ were obtained from the Australian Bureau of Meteorology. They are already numbered and lend themselves to quantification. Each of the 461 communities was easily categorised for each of these variables. The six climatic variables are illustrated in Figures ENV 1 to ENV 6 and the population of each parameter shown in Tables ENV 1 to Table ENV 6.

Hygiene

Many aspects of hygiene were quantified but for this report data on the following variables are presented:

1. Water access
2. Nutritional status
3. Food storage facilities
4. Waste disposal systems
5. Sewerage systems
6. Housing

These variables posed problems. The first problem — that of obtaining data was readily solved mostly by onsite inspection and by corroboration with D.A.A. information and other sources. The second problem was how to handle the considerable variation of each of these variables within each community. A major Aboriginal settlement might, for instance, have commenced a housing program which had already succeeded in housing a substantial proportion of the community. A town might have Aborigines living in normal housing within the town limits yet have a substantial proportion of the Aboriginal population still living in very poor conditions in fringe camps or reserves on the edge of the town. Even some smaller communities presented problems of range, though usually with less variation.

Additionally, there were difficulties in devising a system of recording hygiene information about communities that provided a step by step progression. Assuming that everybody in a community was uniformly housed, for example, the range of housing which might be contrasted could have been wiltjas, "Stage 1 houses" with floors but little in the way of facilities, poor quality housing (housing that provided facilities inadequate for those living in it, perhaps because of overcrowding) and good quality housing. Yet it could not be assumed that a movement from one step to the next, for example from wiltjas

1. Partridge, G.W. and Barton, I.J., C.S.I.R.O. Division of Atmospheric Technical Paper, 1978.

TABLE ENV 3: POPULATION DISTRIBUTION, ABORIGINES & NON-ABORIGINES x LATITUDE

CATEGORY	No. Aborigines Seen		No. Non-Aborigines Seen	
	0-60 years	0-20 years	0-60 years	0-20 years
1. less than 15°S	11,209	6,913	5,771	4,062
2. between 15°-20°S	15,145	9,459	6,392	5,034
3. between 20°-25°S	12,234	7,908	5,119	4,191
4. between 25°-30°S	13,621	9,238	12,111	10,123
5. between 30°-35°S	6,939	4,874	7,496	6,411
6. between 35°-40°S	2,562	1,642	1,559	1,282
TOTAL	61,710	40,034	38,448	31,103

TABLE ENV 4: POPULATION DISTRIBUTION, ABORIGINES & NON-ABORIGINES x ULTRA-VIOLET RADIATION

CATEGORY	No. Aborigines Seen		No. Non-Aborigines Seen	
	0-60 years	0-20 years	0-60 years	0-20 years
1. Less than 1500	500	288	372	317
2. 1500-2000	4,099	2,776	3,604	3,207
3. 2000-2500	13,862	8,913	13,975	11,666
4. 2500-3000	12,410	8,388	8,744	7,629
5. Greater than 3000 Erythral units	30,839	18,681	11,753	8,284
TOTAL	61,710	39,046	38,448	30,542

TABLE ENV 5: POPULATION DISTRIBUTION, ABORIGINES & NON-ABORIGINES x ANNUAL EVAPORATION

CATEGORY	No. Aborigines Seen		No. Non-Aborigines Seen	
	0-60 years	0-20 years	0-60 years	0-20 years
1. Less than 1000mm	2,006	1,340	857	758
2. 1000-1500mm	14,580	9,783	8,489	7,251
3. 1500-2000mm	13,368	8,573	11,651	9,407
4. 2000-2500mm	18,748	11,463	14,144	10,898
5. 2500-3000mm	11,691	7,146	3,098	2,141
6. Greater than 3000mm	1,317	741	209	87
TOTAL	61,710	39,046	38,448	30,542

TABLE ENV 6: POPULATION DISTRIBUTION, ABORIGINES & NON-ABORIGINES x AVERAGE DAILY HOURS OF BRIGHT SUNSHINE

CATEGORY	No. Aborigines Seen		No. Non-Aborigines Seen	
	0-60 years	0-20 years	0-60 years	0-20 years
1. 10 hours	2,623	1,567	1,198	927
2. 9 hours	28,781	18,100	16,404	12,985
3. 8 hours	15,936	9,731	12,710	9,641
4. 7 hours	13,049	8,797	7,691	6,623
5. 6 hours	1,321	851	445	366
TOTAL	61,710	39,046	38,448	30,542

to "stage one housing" amounted to a step of the same magnitude as, for example, a movement from "stage 1 housing" to poor quality housing or from poor quality housing to good housing.

Jack Waterford devised a method of quantifying these hygiene variables for each community so as to take into

account the intra-community variability. This method (the Waterford Index) is based on a "worse half" "better-half" system.

Each of the hygiene variables is graded into three or four grades of ascending quality as set out below with some explanatory information.

Grades for Hygiene Variables

1. Water Access GRADE 1

Water was only available well removed from dwellings. Although in the scoring of this characteristic the quantity of water available was not directly considered, such a grading inevitably implied that only a very small quantity of water was available for personal use, with all water, whether for washing, cooking or drinking, having to be taken in small containers from its source, perhaps a soak, a well, or from a central tap in a settlement community.

GRADE 2

Water for washing, cooking and drinking could only be obtained from outside dwellings, though not necessarily far removed from it. Included in this category were areas where dwellings had only a single tap, perhaps from a rain-water tank or water storage outside the dwelling, and those in which no taps were present inside houses, with cooking and drinking water being taken from an outside source, but where some "communal ablution facilities" were available for washing and perhaps for laundry.

GRADE 3

Water was available for a partial range of purposes inside dwellings, but not for a full range. Included in this category were houses where there was a single tap, perhaps over a sink, but no satisfactory facilities for bathing or showering or for ordinary domestic laundry.

GRADE 4

Water was available within the houses for the full range of its uses; for drinking, cooking for bathing or showering, and for the washing of clothes. In most, but not all, such houses, water was also available for a sewerage system.

Grades for Nutritional Status.

GRADE 1

The range of food available being used is very poor. For example, fruit, vegetables and fresh meat were only occasionally, if at all, available and being used. The major features of the diet being flour, sugar and tinned meat products. If a substantial aspect of the diet involved hunting and gathering, a sector of the comm-

unity was not graded one. Many very remote communities, especially cattle stations were graded one for nutrition.

GRADE 2

The range of foods available and being used did not meet the nutritional needs of the community. In such communities, vegetables, fruit and fresh meat might be occasionally available although mostly not, but other factors, perhaps most notably income, prevented best use of food available. In such communities staples still tended to be flour, sugar and tinned foods. If a sector of the community was supplementing some of its food with "bush tucker" but still relying on these staples for most of its diet, it was regarded as two. Many people living in communities where such gradings were made had only a limited range of food available within shops, usually at high prices in situations where average income was very low.

GRADE 3

A good range of foods was usually available but some factors, including income, meant that the foods being most commonly used did not fully meet the community's nutritional needs. Fruit and vegetables, for instance, might be usually available but very expensive, particularly in relation to income, with the result that they did not form a substantial part of the diet. Sections of communities relying primarily on "bush tucker" were graded as three.

GRADE 4

The food available and being used met the population's nutritional needs. Fresh fruit and vegetables were available and being used.

Grades for Food Storage (note: three grades only).

GRADE 1

Food storage facilities were virtually non-existent: family groups within this section not having refrigeration or cold storage facilities, and not having cupboards or other secure areas in which perishable foods could be stored. Such conditions predisposed to poor diet and to the necessity of purchasing tinned food.

GRADE 2

Some facilities for storage of food existed, but ones inadequate to meet the needs of the community. Some such communities had dwellings lacking refrigeration but had some cupboard space; included also in this category were some small communities, which had communal facilities for food storage, usually in a community-owned and controlled store.

GRADE 3

Facilities where food could be easily and appropriately stored within dwellings. Such dwellings possessed refrigeration and adequate cupboard space.

Grades for Waste Disposal Systems. (three grades only)

GRADE 1

No system operating for removal of waste from the living environment.

GRADE 2

Only insufficient waste removal systems operating.

GRADE 3

Waste removal system operating efficiently.

Grades for Sewerage Systems.

GRADE 1

No systems which removed body wastes from the living environment. Even if toilet functions were carried away from the immediate living environment, body wastes were quickly re-introduced into it by the movement of dogs and other vectors.

GRADE 2

Some systems operating to remove body wastes from the living environment, but these were not sufficient to prevent some of it being re-introduced into the living environment.

GRADE 3

Either water-based sewerage systems close to dwellings, generally "communal ablution facilities", or other appropriate systems for effectively removing sewerage from the living environment.

GRADE 4

There were efficient water-based sewerage systems located inside dwellings.

An attempt was made in scoring for each community to take account of what was appropriate for the sort of conditions being faced by the community. Thus, in a small community in arid Australia, excrement deposited a considerable distance from dwellings was quickly dessicated by the sun and would not be as quickly re-introduced, if at all, into the living environment as in larger settlements. Thus, similar facilities in one area might be graded two, while in a large settlement might be graded one.

Grades for Housing GRADE 1

Wiltjas, tents or improvised dwellings only.

GRADE 2

"Stage one housing" — generally iron huts, sometimes with and sometimes without a floor, and with little facilities available within.

GRADE 3

European-style housing which was however seriously inadequate in meeting the hygiene needs of those living within it. The relative shabbiness, or lack of repair of dwellings, was not a factor in considering the adequacy of housing: what was significant was whether the contained facilities such as water, sewerage disposal and space were sufficient to meet the needs of persons living in the dwelling. Thus, a modern-style house of three bedrooms in which 13 people were living would be considered unsatisfactory, as would a construction which lacked water outlets for showering and washing clothes.

GRADE 4

Housing with facilities suitable for the health needs of all those living in the dwelling.

For each hygiene variable each community is given a number that best fits the situation for those persons in the "worse-half" of the community. Then for each hygiene variable each community is given a grade number that best fits the situation in the "better-half" of the community.

A composite score for each variable for each community was obtained by adding the worse-half grade number to the better-half grade number. This gave a range from 2 to 6 or 2 to 8 for each community for each of the six hygiene variables.

For each of the six hygiene var-

TABLE ENV 7 — WATER ACCESS CATEGORIES:
ABORIGINAL POPULATION

COMPOSITE SCORE	NUMBER OF ABORIGINES IN EACH CATEGORY	
2	1,866	3.1%
3	6,961	11.5%
4	12,235	20.2%
5	15,040	24.8%
6	4,038	6.7%
7	8,770	14.5%
8	11,619	19.2%
ALL CATEGORIES	60,529	100.0%

TABLE ENV 8 — NUTRITION CATEGORIES:
ABORIGINAL POPULATION

COMPOSITE SCORE	NUMBER OF ABORIGINES IN EACH CATEGORY	
2	1,786	3.0%
3	7,652	12.6%
4	13,052	21.6%
5	14,269	23.6%
6	5,343	8.8%
7	10,577	17.4%
8	7,867	13.0%
ALL CATEGORIES	60,546	100.0%

TABLE ENV 9 — FOOD STORAGE CATEGORIES:
ABORIGINAL POPULATION

COMPOSITE SCORE	NUMBER OF ABORIGINES IN EACH CATEGORY	
2	3,569	6.1%
3	10,241	17.4%
4	15,759	26.8%
5	12,827	21.8%
6	16,346	27.8%
ALL CATEGORIES	58,742	

TABLE ENV 10 — WASTE DISPOSAL CATEGORIES:
ABORIGINAL POPULATION

COMPOSITE SCORE	NUMBER OF ABORIGINES IN EACH CATEGORY	
2	1,330	2.2%
3	11,791	19.5%
4	13,356	22.1%
5	15,716	26.0%
6	18,353	30.3%
ALL CATEGORIES	60,546	

TABLE ENV 11 — SEWERAGE SYSTEM CATEGORIES:
ABORIGINAL POPULATION

COMPOSITE SCORE	NUMBER OF ABORIGINES IN EACH CATEGORY	
2	3,509	5.8%
3	4,216	7.0%
4	15,343	25.4%
5	4,173	6.9%
6	15,299	25.4%
7	12,415	20.6%
8	5,345	8.9%
ALL CATEGORIES	60,300	100.0%

TABLE ENV 12 — HOUSING CATEGORIES:
ABORIGINAL POPULATION

COMPOSITE SCORE	NUMBER OF ABORIGINES IN EACH CATEGORY	
2	2,895	4.8%
3	5,325	8.8%
4	18,233	30.0%
5	11,852	19.5%
6	5,021	8.3%
7	12,908	21.2%
8	4,552	7.5%
ALL CATEGORIES	60,786	



Station manager's residence at Gordon Downs, Western Australia.



Aboriginal housing at Gordon Downs, Western Australia, a few hundred yards from the manager's residence.

tables, the number of Aboriginal persons living in communities of similar composite scores are given in Tables ENV 7 to ENV 12 inclusive.

It can be seen that for each of the six hygiene variables a reasonable number of persons fell into every composite score category. The smallest number was for Waste Disposal, composite score 2—1,330 persons, and the highest was 18,353 persons also in the Waste Disposal composite score 6 (see Table ENV 10).

NON-ABORIGINES The program saw few if any non-Aborigines whose hygiene variables could have been coded other than at the highest composite score for each variable. In the remotest and most difficult areas of Australia even quite small groups of non-Aborigines almost always had with them and were using health hardware and systems. Thus they have been given the highest composite score for hygiene variables.

Testing for Associations

Having allocated to each community a composite score for each hygiene variable and having allocated a number for each climate variable and having derived prevalence rates for several disease entities and visual function categories it became possible to test the strength of the association of health variables with hygiene and climate variables. There were literally thousands of possible associations to test and some hundreds were tested.

The health variables that will be considered here are follicular trachoma in persons under the age of 20 years; cicatricial trachoma all ages; the two vision categories, blindness and poor vision; nasal discharge; skin infection and otitis media. The health variables, cataract, pterygium, corneal scars, Labrador keratopathy, (Lab. K), will also be considered.

It quite rapidly became apparent that some of the climate variables were highly dependent on each other and were to a considerable extent measuring the same things. For example, comparison of Figure ENV 1, Average Humidity, Figure ENV 2, Average Rainfall, and Figure ENV 5, Average Evaporation, show a marked similarity of categorisation of areas of Australia.

The same occurred for some of the hygiene variables. For example, a community that has a high grade of food storage will almost always have a high grade, or certainly not a very low grade, of housing.

To illustrate the Waterford Index, the association between nasal discharge prevalence and housing grades composite score is as follows.

Table ENV 13 shows the prevalence of nasal discharge for Aborigines aged 0-20 years according to the housing grades of the "worse-half" of the community in which they lived.

Table ENV 14 shows the nasal discharge prevalence for Aborigines of the same age according to the housing grades of the "better-half" of the communities in which they lived.

Thus in communities where the "worse half" housing was grade 1, the prevalence of nasal discharge was 40.3%. This gives no precise indication of the state of the housing of the "better-half". Where housing for the "better-half" was grade 1, the nasal discharge prevalence was 57.3%. Clearly, if the "better-half" live in grade 1 housing so too does the other half so this category sets the lower level of poor housing. Similarly, the rate of 14% from Table ENV 13 for those from communities where the "worse-half" live in good housing sets the rate for the highest housing category.

Similarly Table ENV 15 shows the composite housing score against the prevalence rate for nasal discharge.

As a means of ranking nasal discharge, the Waterford Index composite score for housing gives a very high correlation ($r_s = +.98$, $p = < .05$). Table ENV 16 provides the population figures for the composite housing score tabulation.

HOUSING COMPOSITE SCORE	Number of Aborigines under the age of 20 living in that range	
Two	1,398	3.6%
Three	2,862	7.4%
Four	11,482	29.8%
Five	7,272	18.9%
Six	3,400	8.8%
Seven	8,934	23.2%
Eight	3,157	8.2%
TOTAL	38,505	100.0%

HOUSING GRADE	PREVALENCE NASAL DISCHARGE
1	40.3%
2	21.2%
3	18.1%
4	14.0%

HOUSING GRADE	PREVALENCE OF NASAL DISCHARGE
1	57.3%
2	42.8%
3	31.9%
4	17.6%

COMPOSITE SCORE	Range of Housing	PREVALENCE OF NASAL DISCHARGE
Two	All in improvised dwellings	57.3%
Three	Half in improvised dwellings, half in "stage one housing"	45.8%
Four	Either all in stage one housing or half in improvised dwellings and half in poor housing	37.2%
Five	Either half in improvised dwelling and half in good housing, or, half in stage one housing and half in poor housing	25.9%
Six:	Either all in poor housing or half in stage one housing and half in good housing.	17.0%
Seven	Half in poor housing, half in good housing	17.2%
Eight	All in good housing	14.0%

In this example, the substantial numbers in each composite score group and the high rank correlation show a very strong association between housing grade and nasal discharge for Aborigines under 20 years. For non-Aborigines of the same age all in, at least, grade 8 housing, the nasal discharge prevalence rate was 1.2%.

The Association of Climate Factors and The Prevalence of Certain Health Variables

1. FOLLICULAR TRACHOMA. This condition is considered only for

persons aged less than 20 years.

A. Humidity has a clear association with the prevalence rates for follicular trachoma for Aborigines, see Figure ENV 7 and Table ENV 17.

The relative change in prevalence rates for Aborigines from 38.7% to 5.9% (6.5 times) is of the same order as that for non-Aborigines, 2.3% to 0.3% (7.6 times). But clearly the severity and duration and the absolute differences in prevalence rates make this climatic effect of greater significance for the young Aborigines.

This almost equal ranking of follicular trachoma prevalence and decreasing humidity is shown for non-Aborigines. See Figure ENV 8 and Table ENV 18.

Fig. 1

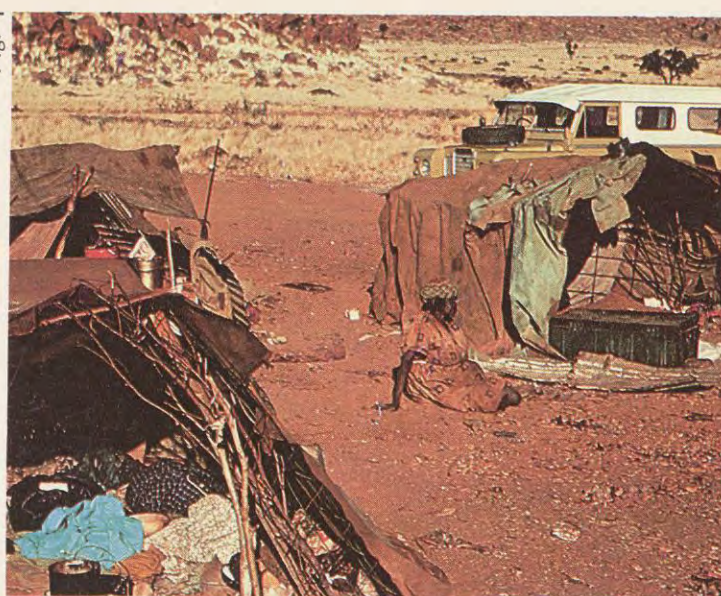


Fig. 3

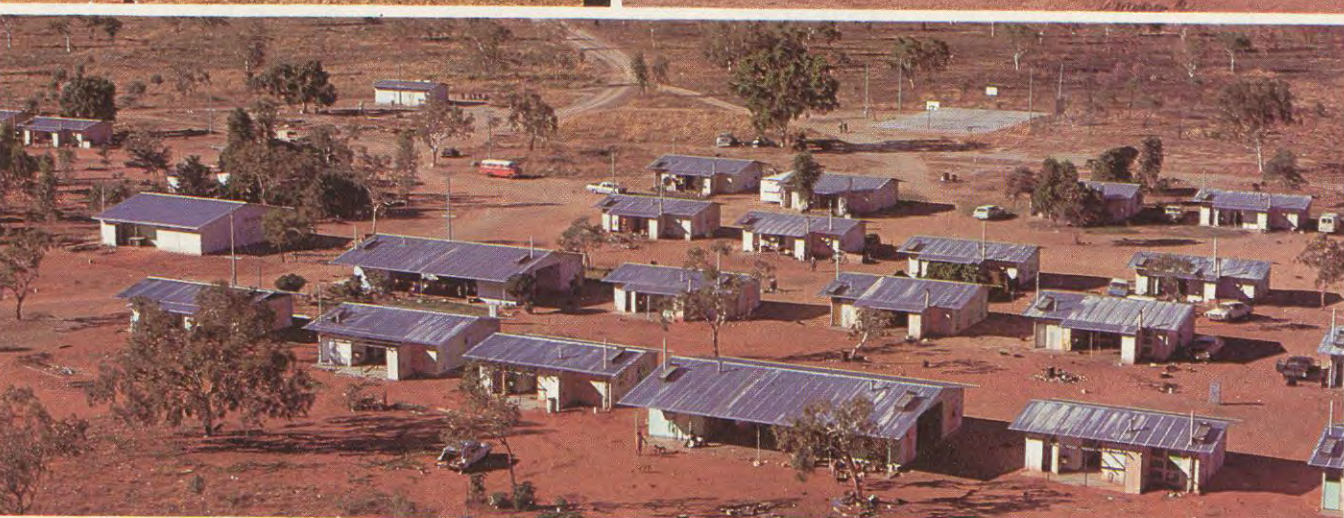
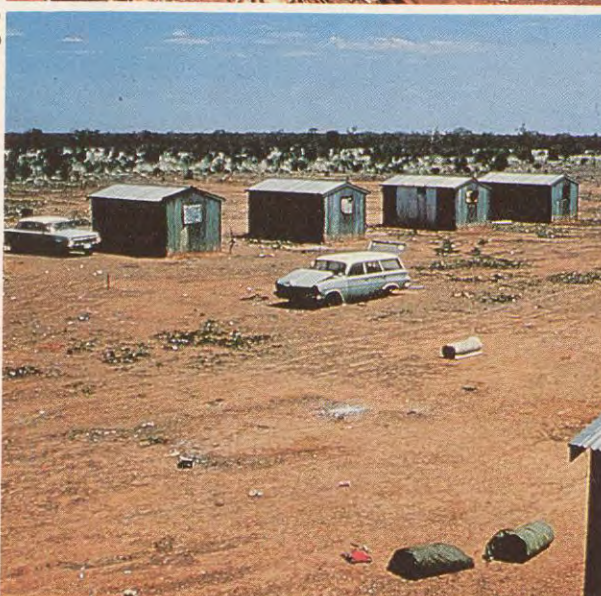


Fig. 5

Fig. 2

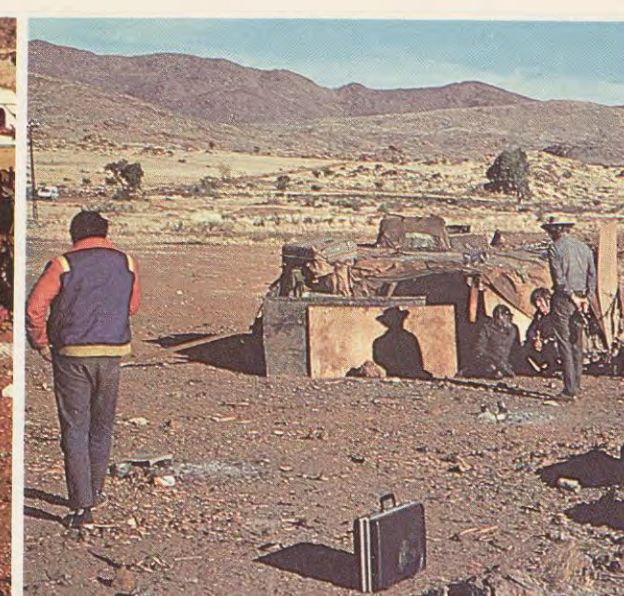


Fig. 4



Figures 1-5: Some examples of Aboriginal housing seen by the program: 1. Grade 1 housing. 2. Grade 1 housing. 3. Grade 2 housing. 4. Grade 3 housing. 5. Grade 4 housing.

Figure ENV 7

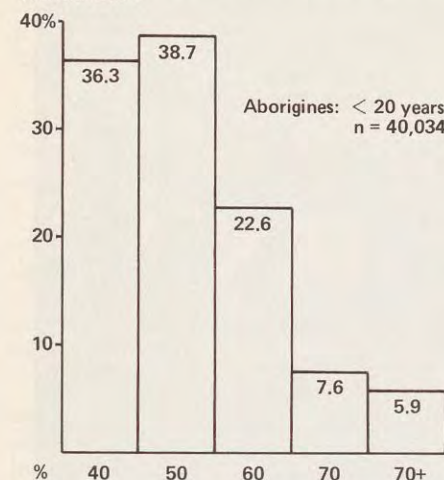
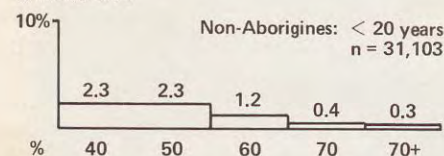
PREVALENCE OF FOLLICULAR TRACHOMA
X HUMIDITYPREVALENCE OF FOLLICULAR TRACHOMA
X HUMIDITY

Figure ENV 8

Figure ENV 9

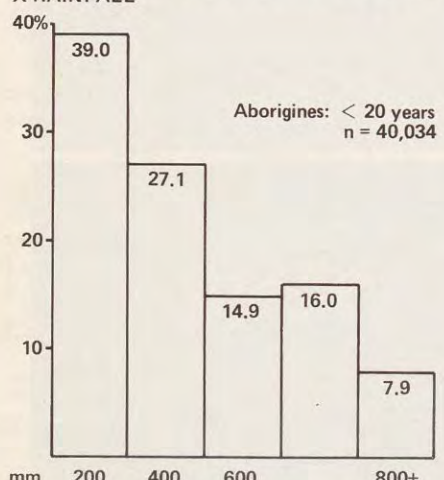
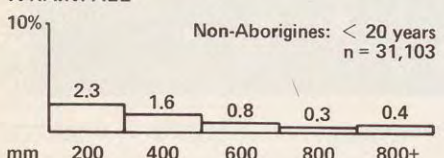
PREVALENCE OF FOLLICULAR TRACHOMA
X RAINFALL

Figure ENV 10

PREVALENCE OF FOLLICULAR TRACHOMA
X RAINFALLTABLE ENV 17: PREVALENCE OF FOLLICULAR TRACHOMA,
ABORIGINES LESS THAN 20 YEARS BY HUMIDITY

CATEGORY	No. Seen	No. with F.T.	%
1. Less than 40%	6,938	2,519	36.3
2. 40-50%	2,822	1,092	38.7
3. 50-60%	11,024	2,489	22.6
4. 60-70%	12,365	944	7.6
5. More than 70%	6,885	408	5.9
TOTAL	40,034	7,452	18.6

TABLE ENV 18: PREVALENCE OF FOLLICULAR TRACHOMA,
NON-ABORIGINES LESS THAN 20 YEARS BY HUMIDITY

CATEGORY	No. Seen	No. with F.T.	%
1. Less than 40%	1,030	23	2.3
2. 40-50%	3,349	76	2.3
3. 50-60%	10,081	117	1.2
4. 60-70%	12,509	51	0.4
5. More than 70%	4,134	13	0.3
TOTAL	31,103	280	0.9

B. Rainfall was also associated with follicular trachoma prevalence; less rainfall occurred with more trachoma. For the ranking for Aborigines see Figure ENV 9 and Table ENV 19.

The rank order was not perfect

but statistically significant, with $p = < .05$. The same relationship was seen for non-Aborigines. See Figure ENV 10 and Table ENV 20. The range of the prevalence rate changes with rainfall differences was substantial.

TABLE ENV 19: PREVALENCE OF FOLLICULAR TRACHOMA,
ABORIGINES LESS THAN 20 YEARS BY AVERAGE
ANNUAL RAINFALL

CATEGORY	No. Seen	No. with F.T.	%
1. 0-200mm	6,711	2,616	39.0
2. 200-400mm	6,870	1,863	27.1
3. 400-600mm	9,236	1,373	14.9
4. 600-800mm	2,765	443	16.0
5. More than 800mm	14,452	1,157	7.9
TOTAL	40,034	7,452	18.6

TABLE ENV 20: PREVALENCE OF FOLLICULAR TRACHOMA,
NON-ABORIGINES LESS THAN 20 YEARS BY AVERAGE RAINFALL

CATEGORY	No. Seen	No. with F.T.	%
1. 0-200mm	3,243	73	2.3
2. 200-400mm	5,467	86	1.6
3. 400-600mm	10,136	73	0.8
4. 600-800mm	2,238	6	0.3
5. More than 800mm	10,019	42	0.4
TOTAL	31,103	280	0.9

Figure ENV 11

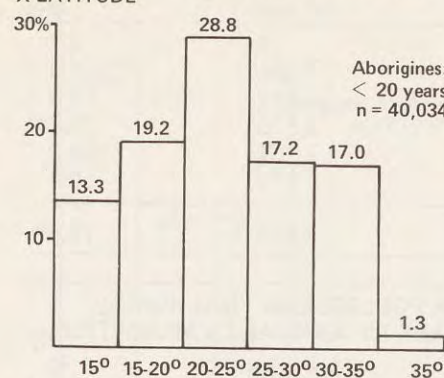
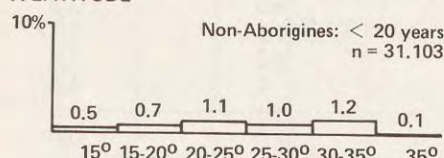
PREVALENCE OF FOLLICULAR TRACHOMA
X LATITUDE

Figure ENV 12

PREVALENCE OF FOLLICULAR TRACHOMA
X LATITUDE

C. Latitude. This climate variable distributed prevalence rates for follicular trachoma as seen in Figure ENV 11 and Table ENV 21 for Aborigines and Figure ENV 12 and Table ENV 22 for non-Aborigines.

The trend is for prevalence rates to

TABLE ENV 21: PREVALENCE OF FOLLICULAR TRACHOMA,
ABORIGINES LESS THAN 20 YEARS BY LATITUDE

CATEGORY	No. Seen	No. with F.T.	%
1. 0-15°S	6,913	923	13.3
2. 15°-20°S	9,459	1,813	19.2
3. 20°-25°S	7,908	2,282	28.8
4. 25°-30°S	9,238	1,583	17.2
5. 30°-35°S	4,874	831	17.0
6. 35°-40°S	1,642	20	1.3
TOTAL	40,034	7,452	18.6

TABLE ENV 22: PREVALENCE OF FOLLICULAR TRACHOMA,
NON-ABORIGINES LESS THAN 20 YEARS BY LATITUDE

CATEGORY	No. Seen	No. with F.T.	%
1. 0-15°S	4,062	19	0.5
2. 15°-20°S	5,034	35	0.7
3. 20°-25°S	4,191	47	1.1
4. 25°-30°S	10,123	102	1.0
5. 30°-35°S	6,411	76	1.2
6. 35°-40°S	1,282	1	0.1
TOTAL	31,103	280	0.9

be higher in those parts of Australia that can be considered as central in terms of latitude, generally dry, arid regions.

D. Ultra Violet Exposure year round. For Aborigines the follicular trachoma prevalence rates were

higher with increasing U.V. exposure. See Figure ENV 13 and Table ENV 23.

For non-Aborigines the association was weak. See Figure ENV 14 and Table ENV 24.

Figure ENV 13

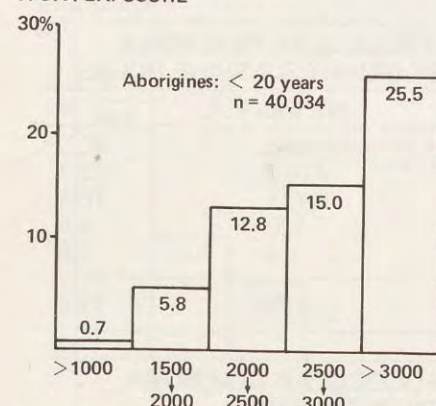
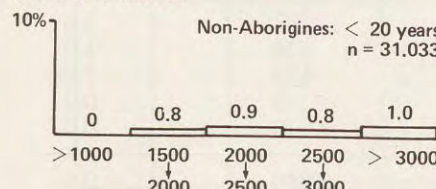
PREVALENCE OF FOLLICULAR TRACHOMA
X U.V. EXPOSURE

Figure ENV 14

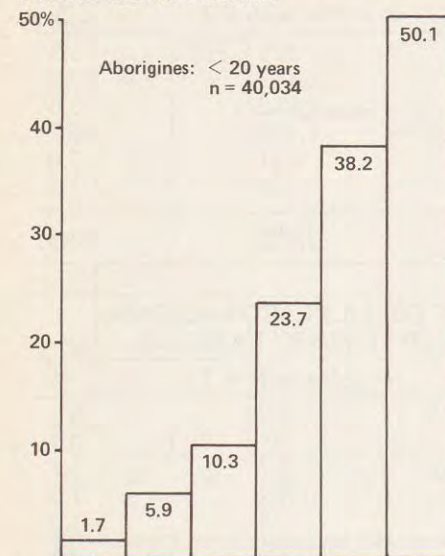
PREVALENCE OF FOLLICULAR TRACHOMA
X U.V. EXPOSURETABLE ENV 23: PREVALENCE OF FOLLICULAR TRACHOMA,
ABORIGINES LESS THAN 20 YEARS BY ULTRA-VIOLET EXPOSURE

CATEGORY	No. Seen	No. with F.T.	%
1. 1000-1500	283	2	0.7
2. 1500-2000	2,778	161	5.8
3. 2000-2500	9,696	1,241	12.8
4. 2500-3000	8,502	1,271	15.0
5. More than 3000	18,775	4,777	25.5
TOTAL Erythmal units	40,034	7,452	18.6

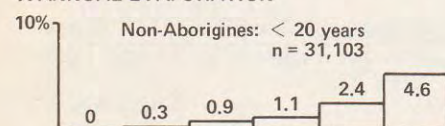
TABLE ENV 24: PREVALENCE OF FOLLICULAR TRACHOMA,
NON-ABORIGINES LESS THAN 20 YEARS BY
ULTRA-VIOLET EXPOSURE

CATEGORY	No. Seen	No. with F.T.	%
1. 1000-1500	317	0	0.0
2. 1500-2000	3,207	27	0.8
3. 2000-2500	11,666	106	0.9
4. 2500-3000	7,629	60	0.8
5. More than 3000	8,284	87	1.0
TOTAL Erythmal units	31,103	280	0.9

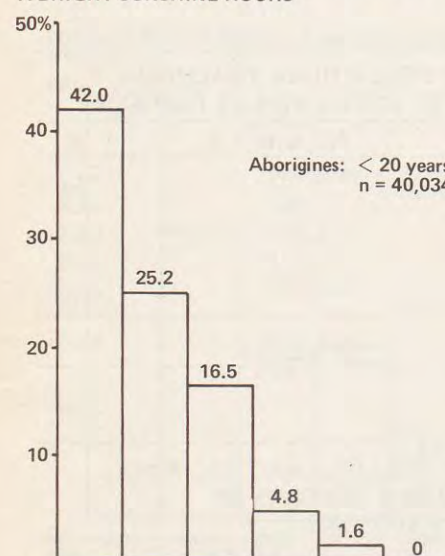
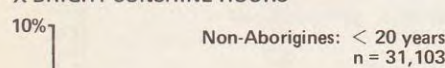
Figure ENV 15

PREVALENCE OF FOLLICULAR TRACHOMA
X ANNUAL EVAPORATION

mm < 1000 < 1500 < 2000 < 2500 < 3000 > 3000

Figure ENV 16
PREVALENCE OF FOLLICULAR TRACHOMA
X ANNUAL EVAPORATION

mm < 1000 < 1500 < 2000 < 2500 < 3000 > 3000

Figure ENV 17
PREVALENCE OF FOLLICULAR TRACHOMA
X BRIGHT SUNSHINE HOURSPREVALENCE OF FOLLICULAR TRACHOMA
X BRIGHT SUNSHINE HOURS

HRS. 10 9 8 7 6 5

HRS. 10 9 8 7 6 5

Figure ENV 18

TABLE ENV 25: PREVALENCE OF FOLLICULAR TRACHOMA,
ABORIGINES LESS THAN 20 YEARS BY ANNUAL EVAPORATION

CATEGORY	No. Seen	No. with F.T.	%
1. Less than 1000mm	1,325	22	1.7
2. 1000-1500mm	9,960	588	5.9
3. 1500-2000mm	9,129	932	10.3
4. 2000-2500mm	11,642	2,770	23.7
5. 2500-3000mm	7,227	2,764	38.2
6. More than 3000mm	751	376	50.1
TOTAL	40,034	7,452	18.6

TABLE ENV 26: PREVALENCE OF FOLLICULAR TRACHOMA,
NON-ABORIGINES LESS THAN 20 YEARS BY ANNUAL EVAPORATION

CATEGORY	No. Seen	No. with F.T.	%
1. Less than 1000mm	756	0	0.0
2. 1000-1500mm	7,272	25	0.3
3. 1500-2000mm	9,807	80	0.9
4. 2000-2500mm	11,081	119	1.1
5. 2500-3000mm	2,163	52	2.4
6. More than 3000mm	87	4	4.6
TOTAL	31,103	280	0.9

E. Annual Evaporation Rate. This variable shows a clear relationship with follicular trachoma prevalence for Aborigines see Figure ENV 15 and Table ENV 25.

A very strong trend, consistent over the whole range, for increasing evaporation rate to be associated with increased prevalence of follicular trachoma is demonstrated. The same trend is shown for non-Aborigines, see Figure ENV 16

and Table ENV 26, but the baseline and the levels of prevalence achieved are much lower.

F. Bright Sunshine Hours. For Aborigines there was an orderly ranking of prevalence rates for follicular trachoma with decreasing bright sunshine hours, see Figure ENV 17 and Table ENV 27.

A similar but less regular trend was seen for non-Aborigines. See Figure ENV 18 and Table ENV 28.

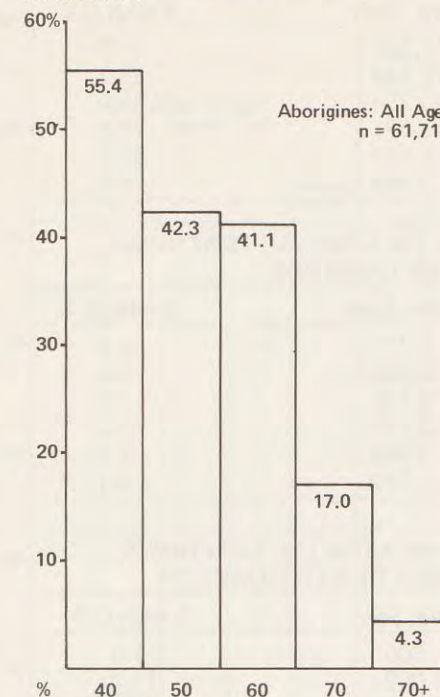
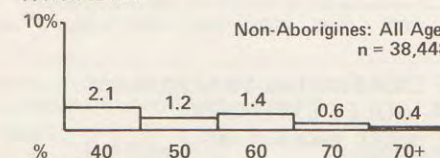
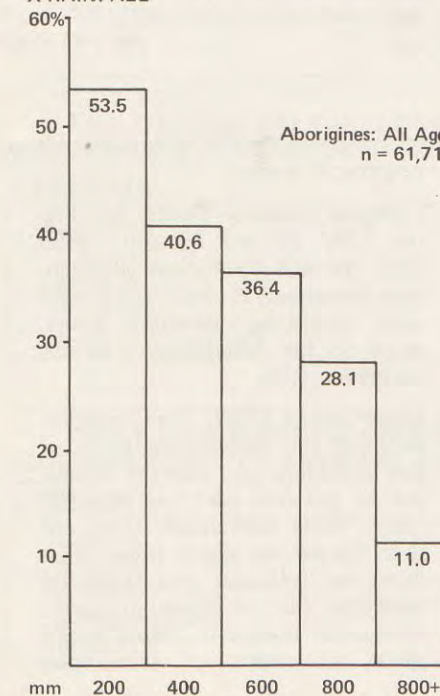
TABLE ENV 27: PREVALENCE OF FOLLICULAR TRACHOMA,
ABORIGINES LESS THAN 20 YEARS BY BRIGHT SUNSHINE HOURS

CATEGORY	No. Seen	No. with F.T.	%
1. 10 hours	1,586	666	42.0
2. 9 hours	18,297	4,617	25.2
3. 8 hours	10,492	1,735	16.5
4. 7 hours	8,812	420	4.8
5. 6 hours	847	14	1.6
TOTAL	40,034	7,452	18.6

TABLE ENV 28: PREVALENCE OF FOLLICULAR TRACHOMA,
NON-ABORIGINES LESS THAN 20 YEARS
BY BRIGHT SUNSHINE HOURS

CATEGORY	No. Seen	No. with F.T.	%
1. 10 hours	933	17	1.8
2. 9 hours	13,079	128	1.0
3. 8 hours	10,105	126	1.3
4. 7 hours	6,620	9	0.2
5. 6 hours	366	0	0.0
TOTAL	31,103	280	0.9

Figure ENV 19

PREVALENCE OF CICATRICAL TRACHOMA
X HUMIDITYFigure ENV 20
PREVALENCE OF CICATRICAL TRACHOMA
X HUMIDITYFigure ENV 21
PREVALENCE OF CICATRICAL TRACHOMA
X RAINFALLTABLE ENV 29: PREVALENCE OF CICATRICAL TRACHOMA,
ABORIGINES BY AVERAGE HUMIDITY

CATEGORY	No. Seen	% with C.T.
1. Less than 40%	11,097	55.4
2. Less than 50%	4,593	42.3
3. Less than 60%	17,366	41.1
4. Less than 70%	18,529	17.0
5. More than 70%	10,125	4.3

TABLE ENV 30: PREVALENCE OF CICATRICAL TRACHOMA,
NON-ABORIGINES BY AVERAGE HUMIDITY

CATEGORY	No. Seen	% with C.T.
1. Less than 40%	1,613	2.1
2. Less than 50%	4,021	1.2
3. Less than 60%	12,509	1.4
4. Less than 70%	15,580	0.6
5. More than 70%	4,725	0.4

SUMMARY

Follicular Trachoma prevalence rates are strongly related to humidity, evaporation rate and bright sunshine hours and somewhat less strongly related to rainfall, U.V. exposure and latitude. The relationship is present for both racial groups but the extent of the change to higher prevalence rates is much greater for Aborigines.

2. CICATRICAL TRACHOMA. This condition, that may accompany

severe and/or follicular trachoma of long duration, occurs later in life than follicular trachoma and is ranked against the six climatic variables as follows. Prevalences are for all age groups.

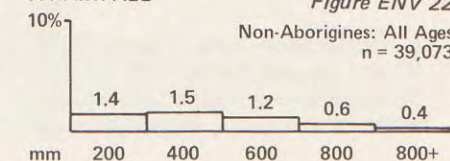
A. Humidity. See Figures ENV 19 and ENV 20 and Tables ENV 29 and 30. A definite association of lower humidity and higher prevalence rates is seen for both racial groups. The trend is stronger for Aborigines.

TABLE ENV 31: PREVALENCE OF CICATRICAL TRACHOMA,
ABORIGINES BY AVERAGE ANNUAL RAINFALL

CATEGORY	No. Seen	% with C.T.
1. Less than 200mm	10,790	53.5
2. 200-400	10,390	40.6
3. 400-600	14,147	36.4
4. 600-800	4,519	28.1
5. More than 800mm	21,864	11.0

TABLE ENV 32: PREVALENCE OF CICATRICAL TRACHOMA,
NON-ABORIGINES BY AVERAGE ANNUAL RAINFALL

CATEGORY	No. Seen	% with C.T.
1. Less than 200mm	4,205	1.4
2. 200-400	6,802	1.5
3. 400-600	12,110	1.2
4. 600-800	2,901	0.6
5. More than 800mm	12,430	0.4

PREVALENCE OF CICATRICAL TRACHOMA
X RAINFALL

B. Rainfall A strong association of increasing prevalence with decreasing rainfall was seen for Aborigines. A less strong trend was seen for non-Aborigines. See Figures ENV 21 and 22, and Tables ENV 31 and 32.

Figure ENV 23

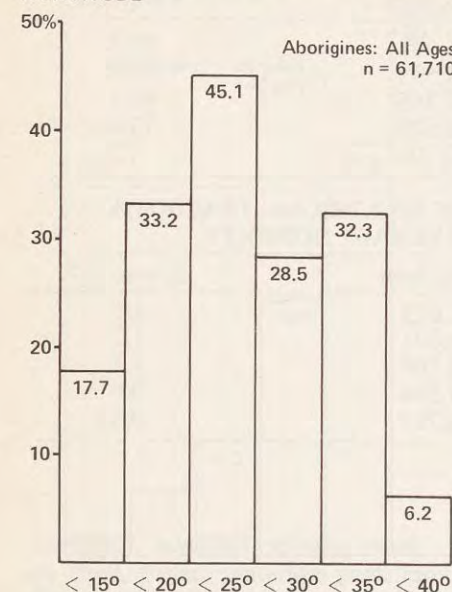
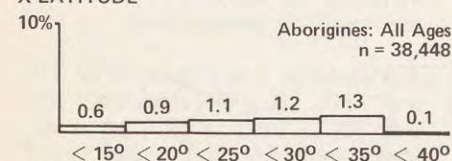
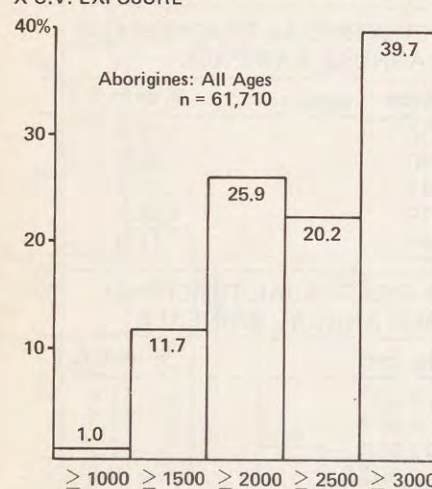
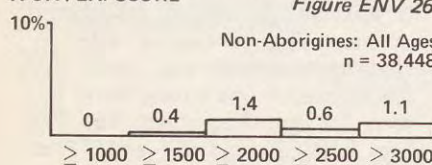
PREVALENCE OF CICATRICAL TRACHOMA
X LATITUDEPREVALENCE OF CICATRICAL TRACHOMA
X LATITUDE

Figure ENV 24

Figure ENV 25

PREVALENCE OF CICATRICAL TRACHOMA
X U.V. EXPOSUREPREVALENCE OF CICATRICAL TRACHOMA
X U.V. EXPOSURETABLE ENV 33: PREVALENCE OF CICATRICAL TRACHOMA,
ABORIGINES BY LATITUDE

CATEGORY	No. Seen	% with C.T.
1. Less than 15°S	11,209	17.7
2. 15°-20°S	15,145	33.2
3. 20°-25°S	12,234	45.1
4. 25°-30°S	13,621	28.5
5. 30°-35°S	6,939	32.3
6. More than 35°S	2,562	6.2

TABLE ENV 34: PREVALENCE OF CICATRICAL TRACHOMA,
NON-ABORIGINES BY LATITUDE

CATEGORY	No. Seen	% with C.T.
1. Less than 15°S	5,771	0.6
2. 15°-20°S	6,392	0.9
3. 20°-25°S	5,119	1.1
4. 25°-30°S	12,111	1.2
5. 30°-35°S	7,496	1.3
6. More than 35°S	1,559	0.1

TABLE ENV 35: PREVALENCE OF CICATRICAL TRACHOMA,
ABORIGINES BY ULTRA-VIOLET EXPOSURE

CATEGORY	No. Seen	% with C.T.
1. 1000-1500	500	1.0
2. 1500-2000	4,099	11.7
3. 2000-2500	13,862	25.9
4. 2500-3000	12,410	20.2
5. More than 3000	30,839	39.7

TABLE ENV 36: PREVALENCE OF CICATRICAL TRACHOMA,
NON-ABORIGINES BY ULTRA-VIOLET EXPOSURE

CATEGORY	No. Seen	% with C.T.
1. 1000-1500	372	0.0
2. 1500-2000	3,604	0.4
3. 2000-2500	13,975	1.4
4. 2500-3000	8,744	0.6
5. More than 3000	11,753	1.1

C. Latitude. The same trend of association is seen (see Figures ENV 23 and 24 and Tables ENV 33 and 34) as for latitude and follicular trachoma prevalence.

D. Ultra Violet Exposure and cicatricial trachoma prevalence associations are seen in Figures ENV 25 and 26 and Tables ENV 35 and 36. There is an association for both races, it is significant but not perfect. The greater the U.V. exposure, the greater the prevalence of cicatricial trachoma.

E. Evaporation Rate. Figures ENV 27 and 28 and Tables ENV 37 and 38 show strong regular associations between increasing evaporation ra-

tes and cicatricial trachoma for both racial groups.

F. Bright Sunshine Hours. See Figure ENV 29 and 30 and Tables ENV 39 and 40. Cicatricial trachoma prevalence is clearly associated with increasing sunshine hours, more so for Aborigines than for non-Aborigines.

3. SKIN INFECTION. The consideration of the associations between this condition and climate is limited to persons aged less than 20 years. Most prevalence rates for skin disease are much lower than those for follicular and cicatricial trachoma but in most situations substantial numbers in each group allow assessment of association

Figure ENV 27

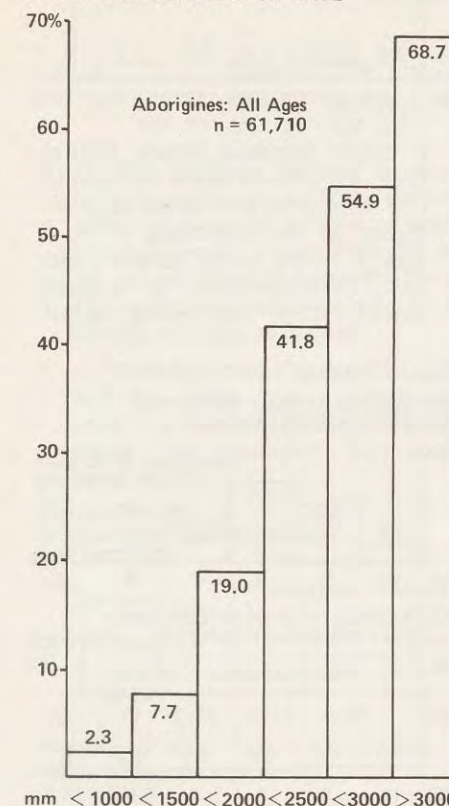
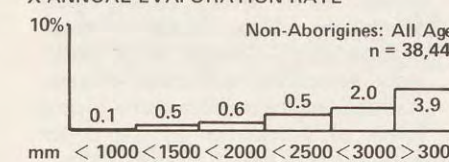
PREVALENCE OF CICATRICAL TRACHOMA
X ANNUAL EVAPORATION RATEPREVALENCE OF CICATRICAL TRACHOMA
X ANNUAL EVAPORATION RATE

Figure ENV 28

TABLE ENV 39: PREVALENCE OF CICATRICAL TRACHOMA,
ABORIGINES BY AVERAGE DAILY HOURS OF BRIGHT SUNSHINE

CATEGORY	No. Seen	% with C.T.
1. 10 hours	2,623	56.4
2. 9 hours	28,781	41.4
3. 8 hours	15,936	28.9
4. 7 hours	13,049	5.8
5. 6 hours	1,321	4.8

TABLE ENV 40: PREVALENCE OF CICATRICAL TRACHOMA,
NON-ABORIGINES BY AVERAGE DAILY HOURS OF BRIGHT SUNSHINE

CATEGORY	No. Seen	% with C.T.
1. 10 hours	1,198	1.4
2. 9 hours	16,404	1.2
3. 8 hours	12,710	1.2
4. 7 hours	7,691	0.4
5. 6 hours	445	0.0

TABLE ENV 37: PREVALENCE OF CICATRICAL TRACHOMA,
ABORIGINES BY ANNUAL EVAPORATION

CATEGORY	No. Seen	% with C.T.
1. Less than 1000mm	2,006	2.3
2. 1000-1500	14,580	7.7
3. 1500-2000	13,368	19.0
4. 2000-2500	18,748	41.8
5. 2500-3000	11,691	54.9
6. More than 3000mm	1,317	30.4

TOTAL 61,710 30.4

TABLE ENV 38: PREVALENCE OF CICATRICAL TRACHOMA,
NON-ABORIGINES BY ANNUAL EVAPORATION

CATEGORY	No. Seen	% with C.T.
1. Less than 1000mm	857	0.1
2. 1000-1500	8,489	0.5
3. 1500-2000	11,651	0.6
4. 2000-2500	14,144	1.5
5. 2500-3000	3,098	2.0
6. More than 3000mm	209	3.9

TOTAL 38,448 1.1

trends. Results are presented graphically, though relevant Tables ENV 41 to 54 can be found in Appendix (4A).

A. Humidity. For Aborigines (see Figure ENV 31) the trend is for skin disease to be more prevalent in the lowest humidity category and in the higher humidity categories less prevalent in the mid-range of humidity grades.

Figure ENV 29

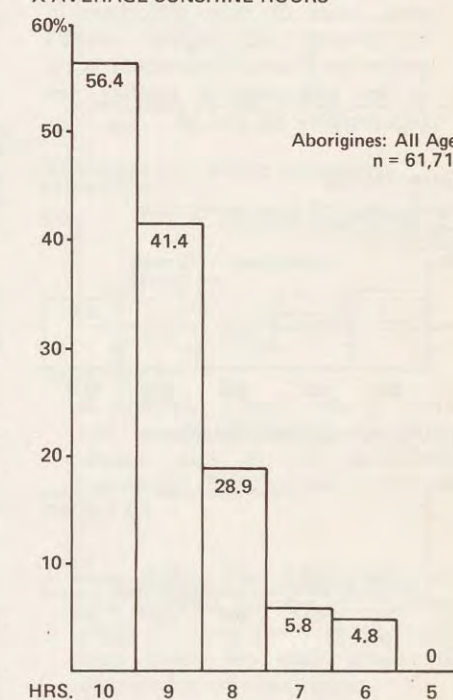
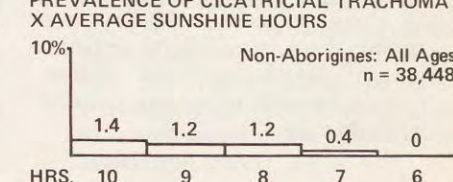
PREVALENCE OF CICATRICAL TRACHOMA
X AVERAGE SUNSHINE HOURSPREVALENCE OF CICATRICAL TRACHOMA
X AVERAGE SUNSHINE HOURS

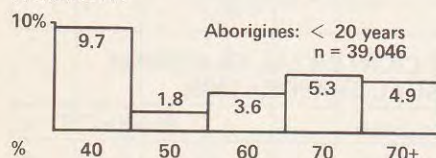
Figure ENV 30

The same trend is seen for non-Aborigines in Figure ENV 32.

Aboriginal rates are all higher but the highest non-Aboriginal prevalence rate, found in humidity category 40 per cent and more than 70 per cent, approaches the lowest Aboriginal prevalence rate, found in the 50 per cent humidity category.

Figure ENV 31

PREVALENCE OF SKIN INFECTION
X HUMIDITY



PREVALENCE OF SKIN INFECTION
X HUMIDITY

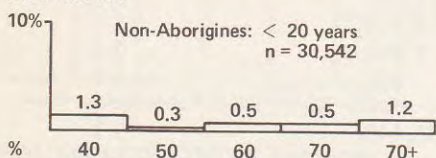
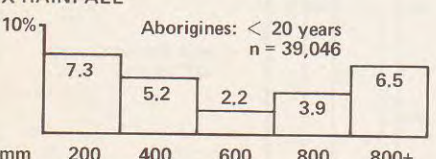


Figure ENV 32

B. Rainfall. This climate factor repeats the trend for humidity for both races to show higher prevalence rates of skin infections in the lowest and highest rainfall groups and lesser prevalence rates in the mid-range of rainfall. See Figures ENV 33 and 34.

Figure ENV 33

PREVALENCE OF SKIN INFECTION
X RAINFALL



PREVALENCE OF SKIN INFECTION
X RAINFALL

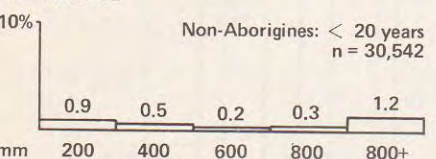
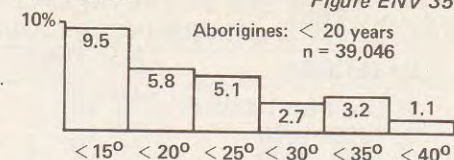


Figure ENV 34

C. Latitude. Figures ENV 35 and 36 show the trend. Although not regular there is a definite association of decreasing skin disease prevalence with increasing latitude for both races.

PREVALENCE OF SKIN INFECTION
X LATITUDE



PREVALENCE OF SKIN INFECTION
X LATITUDE

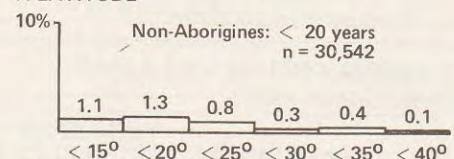
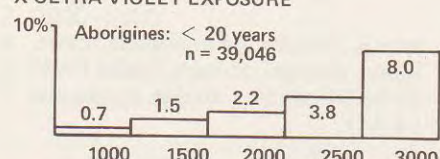


Figure ENV 36

D. Ultra Violet Exposure. See Figures ENV 37 and 38. These figures show a strong association of increased prevalence of skin disease and increasing exposure to U.V. irradiation for Aborigines and a less strong association for non-Aborigines.

Figure ENV 37

PREVALENCE OF SKIN INFECTION
X ULTRA VIOLET EXPOSURE



PREVALENCE OF SKIN INFECTION
X ULTRA VIOLET EXPOSURE

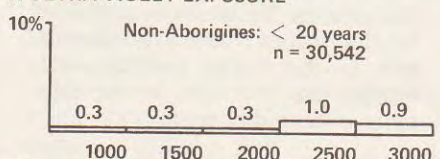
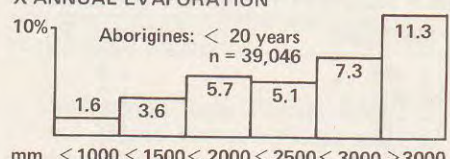


Figure ENV 38

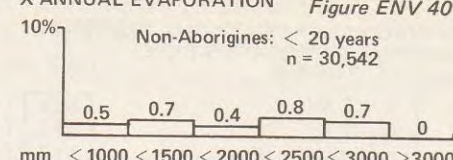
E. Annual Evaporation. There is a trend (see Figure ENV 39) for skin infection prevalence to increase as the evaporation rate increases. The trend is a strong one but the ranking is not perfect. For non-Aborigines, see Figure 40, there does not appear to be a significant trend.

Figure ENV 39

PREVALENCE OF SKIN INFECTION
X ANNUAL EVAPORATION



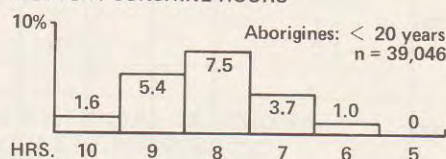
PREVALENCE OF SKIN INFECTION
X ANNUAL EVAPORATION



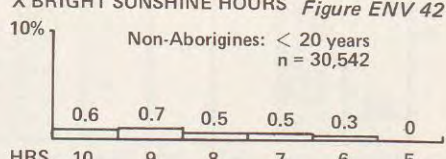
F. Bright Sunshine Hours. Figures ENV 41 and 42 show the trends. For Aborigines prevalence rates are higher in the mid-zones of 9, 8 and 7 hours bright sunshine per day. Non-Aborigines to a lesser extent show the same trend.

Figure ENV 41

PREVALENCE OF SKIN INFECTION
X BRIGHT SUNSHINE HOURS



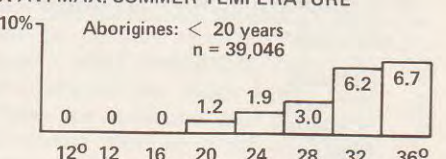
PREVALENCE OF SKIN INFECTION
X BRIGHT SUNSHINE HOURS



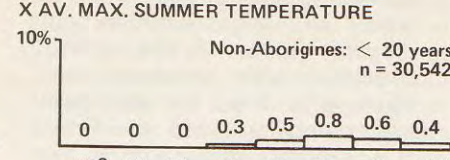
Summary — For skin disease and these climatic variables there appears to be several factors operating: an aridity factor — evaporation rate — seems to be positively associated with skin disease. Rainfall and humidity show higher levels of prevalence at the upper and lower limits. There appears to be a "tropical effect" in skin diseases and Figures ENV 43 and 44 show a temperature association for skin disease. Latitude shows a clear trend — the further south the less skin disease. Notably it can be seen that for this climate variable the worst non-Aboriginal group 15° — 20° has a higher prevalence of skin disease, 1.3 per cent, than the best Aboriginal group, less than 40°S, at 1.1 per cent. See Figures ENV 35 and ENV 36.

Figure ENV 43

PREVALENCE OF SKIN INFECTION
X AV. MAX. SUMMER TEMPERATURE



PREVALENCE OF SKIN INFECTION
X AV. MAX. SUMMER TEMPERATURE



4. OTITIS MEDIA (Defined as presence of wet or dry eardrum, perforation or glue ear in one or both ears.) Relevant Tables ENV 55 to 66 can be found in Appendix (5A). This condition was associated with climate variables as follows:

A. Humidity. See Figures ENV 45 and 46. There was a significant trend for the association of otitis media and humidity for both racial groups.

Figure ENV 45

PREVALENCE OF OTITIS MEDIA
X HUMIDITY

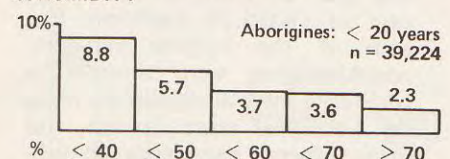
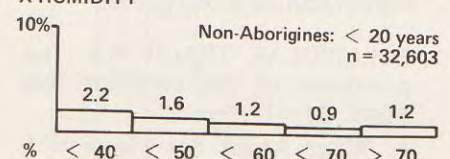


Figure ENV 46

PREVALENCE OF OTITIS MEDIA
X HUMIDITY



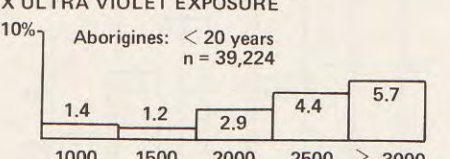
B. Rainfall. There was an association but not a strong one for increasing rainfall to be associated with lesser rates of otitis media.

C. Latitude. Mid latitudes tended to have higher rates of otitis media for both racial groups. This trend was not a strong one.

D. Ultra Violet Exposure. See Figure ENV 47. For Aborigines there was a trend for prevalence rates to fall then rise steadily as

Figure ENV 47

PREVALENCE OF OTITIS MEDIA
X ULTRA VIOLET EXPOSURE



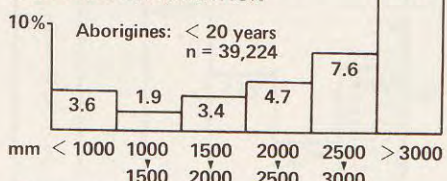
ERYTHEMAL UNITS

U.V. exposure increased ($r_s = +.9$). This trend is significant at the $p = < .05$ level. The same trend was not obvious for non-Aborigines.

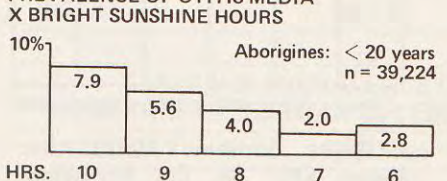
E. Evaporation Rate. See Figure ENV 48. For Aborigines, the same trend of association is seen as for U.V. exposure, that is, an initial fall then a rise with increasing U.V. exposure grades. This association occurs for Aborigines but no such trend exists for non-Aborigines.

Figure ENV 48

PREVALENCE OF OTITIS MEDIA
X ANNUAL EVAPORATION



PREVALENCE OF OTITIS MEDIA
X BRIGHT SUNSHINE HOURS



F. Bright Sunshine Hours. See Figure ENV 49. For Aborigines, the otitis media rates diminished with lessening sunshine hours only to increase in the lowest sunshine group. The same trend was not evident for non-Aborigines.

Summary It appears that for Aborigines less than 20 years, otitis media prevalence rates are higher, the more arid the climate, the higher the evaporation, the lower the humidity, the lower the rainfall, the more bright sunshine hours and the more U.V. exposure. There is, however, a trend for the lowest groups for annual evaporation, bright sunshine hours and U.V. irradiation to be higher than the next group. It is interesting to speculate whether or not this is a "cold", in the sense of the common affliction, effect. The trend is supported by sufficient numbers in the various groups so as not to be a spurious statistical effect.

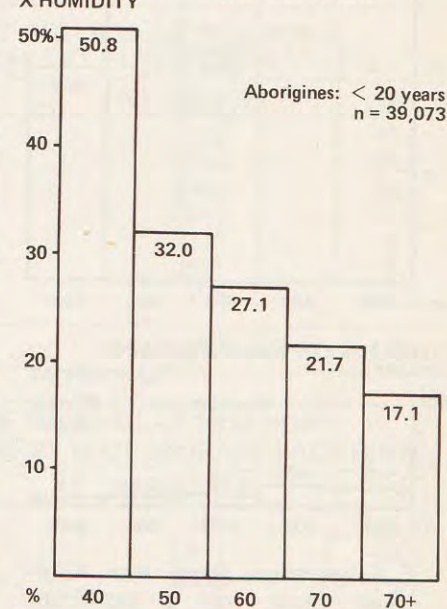
5. NASAL DISCHARGE. This clinical finding is only considered in so far as it affected those under 20 years and no account is taken of the severity of the discharge. Relevant

tables ENV 67 to 78 may be found in Appendix 4A.

A. Humidity. See Figures ENV 50 and 51. The prevalence rates for nasal discharge were clearly ranked with humidity. The lower the humidity the higher the rate for discharge. Although the prevalence rate for non-Aborigines was much less, they also showed the trend.

Figure ENV 50

PREVALENCE OF NASAL DISCHARGE
X HUMIDITY



PREVALENCE OF NASAL DISCHARGE
X HUMIDITY

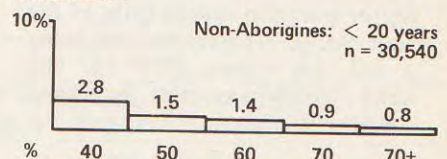


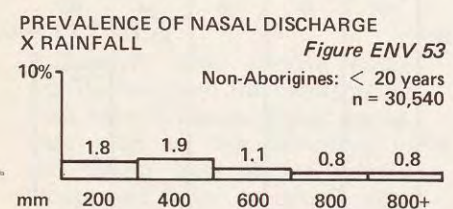
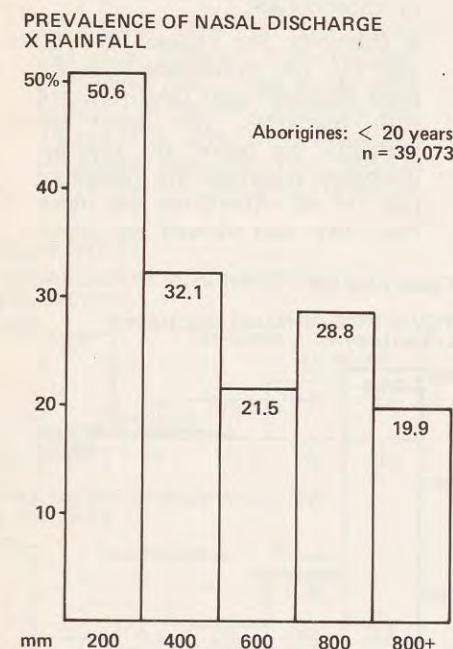
Figure ENV 51

B. Rainfall. There was a trend not wholly consistent for prevalence rates to fall as rainfall increased. See Figures ENV 52 and 53.

C. Latitude. For Aborigines there was a trend for the mid-latitude zones to have the highest prevalence rates. No such trend was obvious for non-Aborigines.

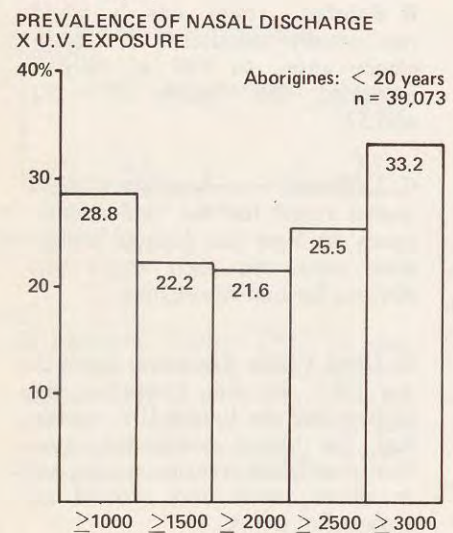
D. Ultra Violet Exposure. See Figure ENV 54. For Aborigines the highest and the lowest U.V. groups had the higher prevalence rates. Non-Aboriginal prevalence rates were much lower and showed no association trend.

Figure ENV 52



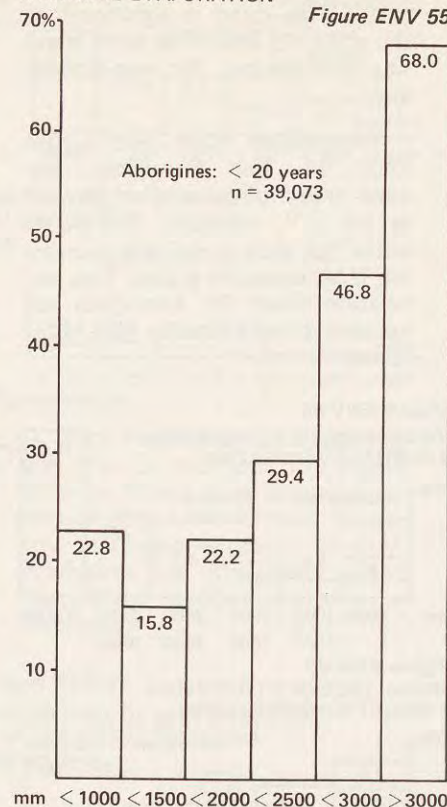
E. Evaporation Rate. For Aborigines there was a significant trend ($p < .05$) for nasal discharge prevalence to increase with increasing evaporation rate in spite of the first change in prevalence rate being a fall. See Figure ENV 55. The same trend was not as strong for non-Aborigines.

Figure ENV 54

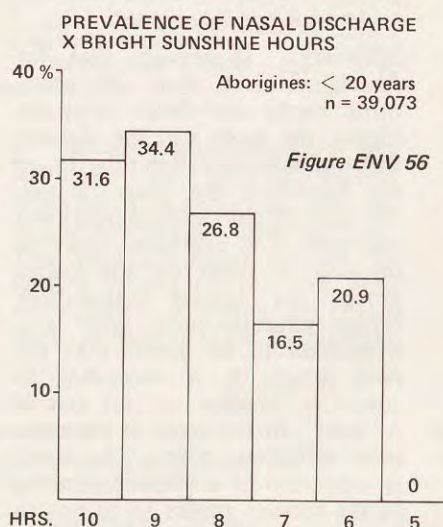


PREVALENCE OF NASAL DISCHARGE X ANNUAL EVAPORATION

Figure ENV 55



F. Bright Sunshine Hours. See Figure ENV 56. For Aborigines more bright sunshine hours were associated with higher prevalence rates for nasal discharge. The association was not a strong one. The same trend was not evident for non-Aborigines.



Summary. Nasal discharge rates for Aborigines aged less than 20 years were always many times the non-Aboriginal rate and appeared to be higher with high evaporation, low humidity and low

rainfall. Latitude and U.V. exposure and bright sunshine hours did not appear to be strongly correlated with prevalence rates. There is a trend for the lowest evaporation rate and the lowest U.V. exposure rate groups to have higher rates of prevalence than the next highest groups.

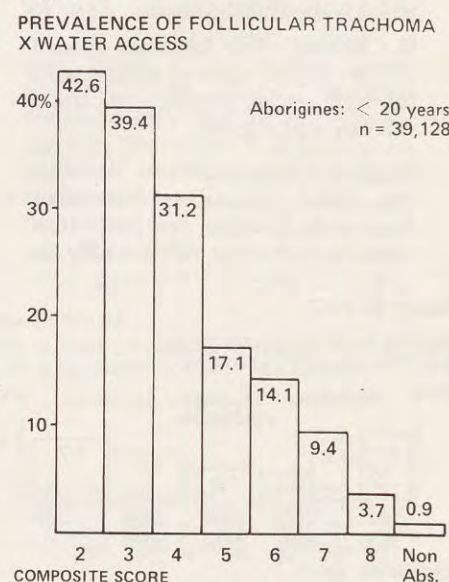
Hygiene

For this section six hygiene variables are tested for their association with several health parameters. The Waterford Index composite scores are used to quantify progressively each of the hygiene variables. For all the health variables, prevalence rates used are for those persons aged less than 20 years, except in the case of cicatricial trachoma. For each of the hygiene variables, non-Aborigines were allocated a composite score along-side the highest Aboriginal score. In our, and many others', experience no substantial numbers of non-Aborigines experience other than the very highest standards of hygiene.

1. FOLLICULAR TRACHOMA. The prevalence of this condition was tested against:

A. Water Access See Figure H 1 and Table H 1. With increase in composite score for water access there was a step wise fall in the prevalence rate for FT.

Figure H 1



The size of the fall between scores is not constant but the direction of change is striking. There was a reduction of prevalence rate from 42 times the non-Aboriginal rate of 0.9% in those whose composite score was further from the non-Aboriginal water access position to 4 times the non-Aboriginal rate in those whose water access position most closely resembled the non-Aboriginal situation.

B Nutritional Status. See Figure H2 and Table H2. The fall in prevalence rate as composite nutrition scores increased to approach the non-Aboriginal situation was marked and followed the same significant trend as for water access.

Figure H 2

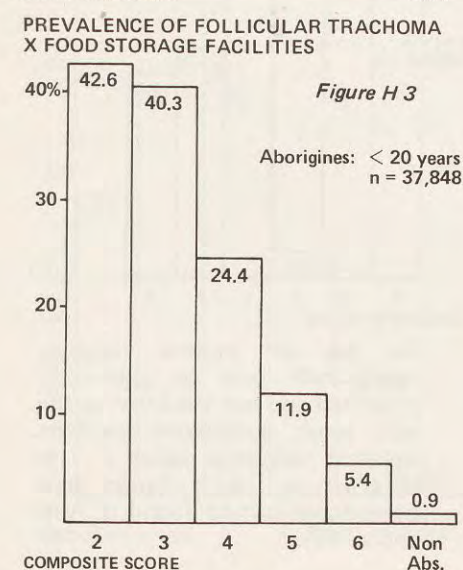
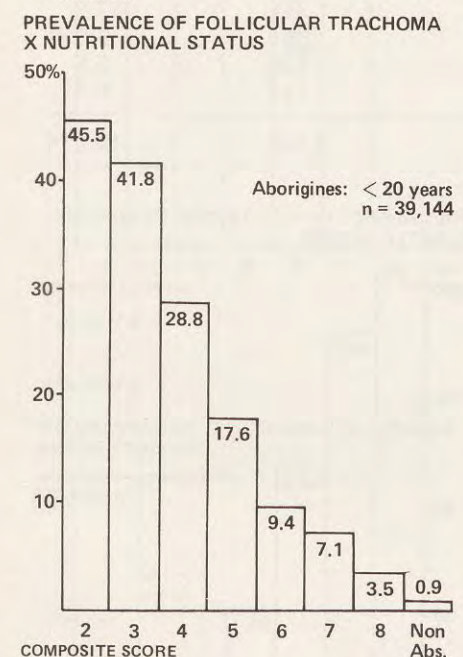


TABLE H 1: PREVALENCE OF FOLLICULAR TRACHOMA, ABORIGINES LESS THAN 20 YEARS BY WATER ACCESS

CATEGORY	No. Seen	No. with F.T.	%
2.	912	389	42.6
3.	4,202	1,656	39.4
4.	7,495	2,338	31.2
5.	9,704	1,654	17.1
6.	2,700	380	14.1
7.	6,004	563	9.4
8.	8,111	306	3.7
TOTAL	39,128	7,286	18.6

TABLE H 2: PREVALENCE OF FOLLICULAR TRACHOMA, ABORIGINES LESS THAN 20 YEARS BY NUTRITIONAL STATUS

CATEGORY	No. Seen	No. with F.T.	%
2.	950	432	45.5
3.	4,311	1,804	41.8
4.	8,336	2,394	28.8
5.	9,144	1,611	17.6
6.	3,530	330	9.4
7.	7,310	521	7.1
8.	5,563	195	3.5
TOTAL	39,144	7,287	18.6

TABLE H 3: PREVALENCE OF FOLLICULAR TRACHOMA, ABORIGINES LESS THAN 20 YEARS BY FOOD STORAGE FACILITIES

CATEGORY	No. Seen	No. with F.T.	%
2.	1,786	761	42.6
3.	6,098	2,451	40.3
4.	9,985	2,430	24.4
5.	8,507	1,019	11.9
6.	11,472	612	5.4
TOTAL	37,848	7,273	19.2

TABLE H 4: PREVALENCE OF FOLLICULAR TRACHOMA, ABORIGINES LESS THAN 20 YEARS BY WASTE DISPOSAL SYSTEMS

CATEGORY	No. Seen	No. with F.T.	%
2.	647	260	40.1
3.	6,826	2,625	38.5
4.	8,177	1,910	23.3
5.	10,589	1,885	17.8
6.	12,903	607	4.7
TOTAL	39,144	7,287	18.6

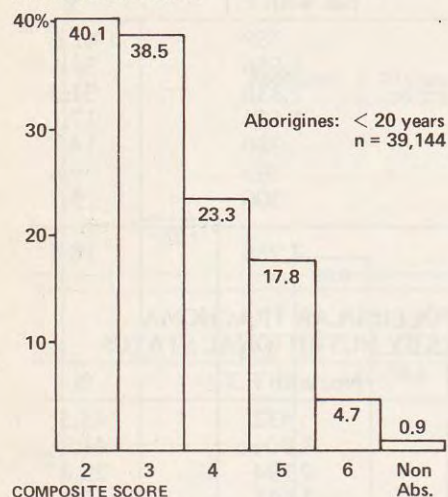
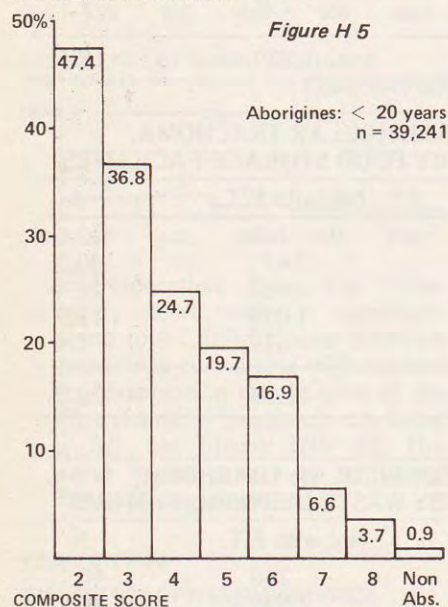
C. Food Storage Facilities. See Figure H3 and Table H3. The increase in quality of food storage facilities was closely associated ($p = .05$) with falling prevalence of follicular trachoma.

D. Waste Disposal Systems showed a similar trend to A, B and C above. See Figure H 4 and Table H 4.

E. Sewerage Systems. See Figure H 5 and Table H 5. The composite scores repeat the pattern of A, B, C and D above.

F. Housing. See Figure H6 and Table H 6. This showed a constant strong trend of falling prevalence with increasing housing composite score.

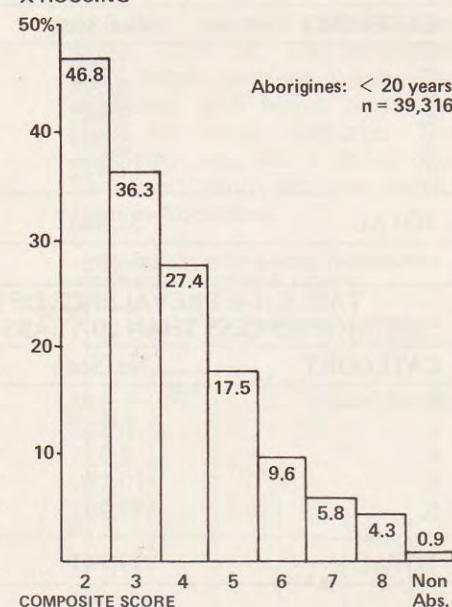
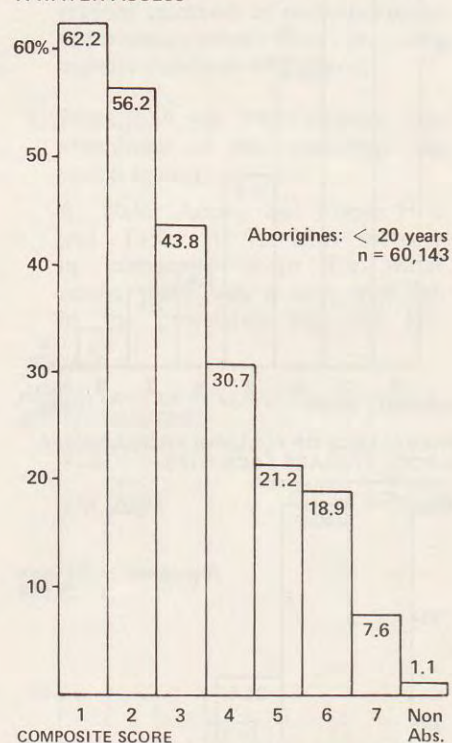
Figure H 4

PREVALENCE OF FOLLICULAR TRACHOMA
X WASTE DISPOSALPREVALENCE OF FOLLICULAR TRACHOMA
X SEWERAGE SYSTEMSTABLE H 5: PREVALENCE OF FOLLICULAR TRACHOMA,
ABORIGINES LESS THAN 20 YEARS BY SEWERAGE SYSTEM

CATEGORY	No. Seen	No. with F.T.	%
2.	1,737	823	47.4
3.	2,443	899	36.8
4.	9,634	2,386	24.7
5.	10,220	2,011	19.7
6.	2,703	456	16.9
7.	8,697	583	6.6
8.	3,807	142	3.7
TOTAL	39,241	7,300	18.6

TABLE H 6: PREVALENCE OF FOLLICULAR TRACHOMA,
ABORIGINES LESS THAN 20 YEARS BY HOUSING

CATEGORY	No. Seen	No. with F.T.	%
2.	1,399	656	46.8
3.	3,000	1,091	36.3
4.	11,596	3,178	27.4
5.	7,733	1,351	17.5
6.	3,398	362	9.6
7.	8,987	528	5.8
8.	3,203	137	4.3
TOTAL	39,316	7,303	18.6

Figure H 6
PREVALENCE OF FOLLICULAR TRACHOMA
X HOUSINGFigure H 7
PREVALENCE OF CICATRICAL TRACHOMA
X WATER ACCESS

for the six hygiene variables, results will only be graphically presented and not tabulated in this and some subsequent sections. Relevant statistical tables H 7 to H 60 from which figures have been drawn can be found in Appendix (4B).

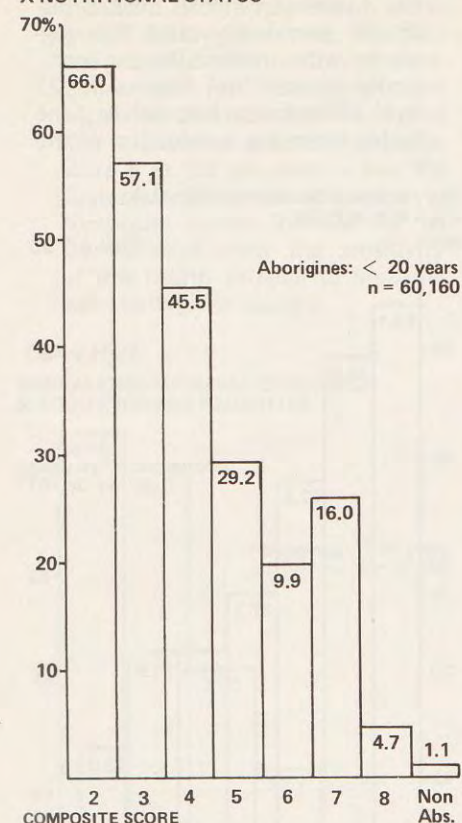
PREVALENCE OF CICATRICAL TRACHOMA
X NUTRITIONAL STATUS

Figure H 8

Figure H 9

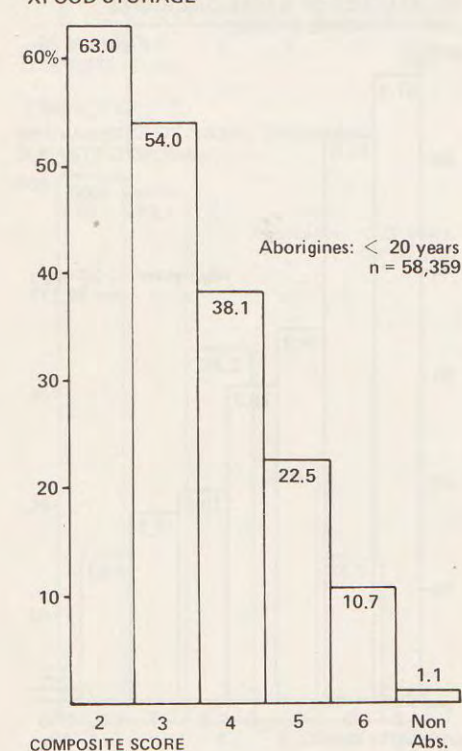
PREVALENCE OF CICATRICAL TRACHOMA
X FOOD STORAGE

Figure H 10

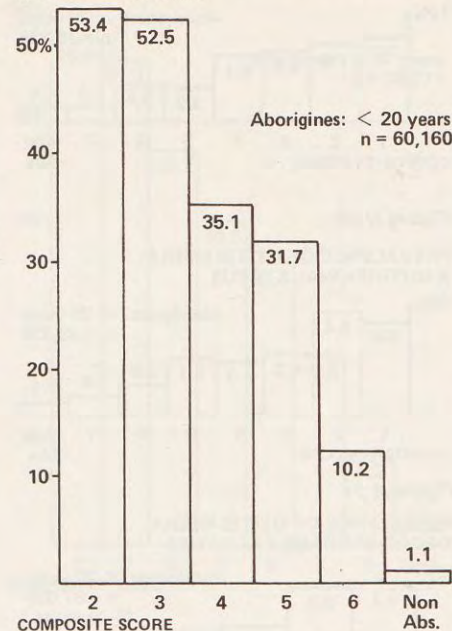
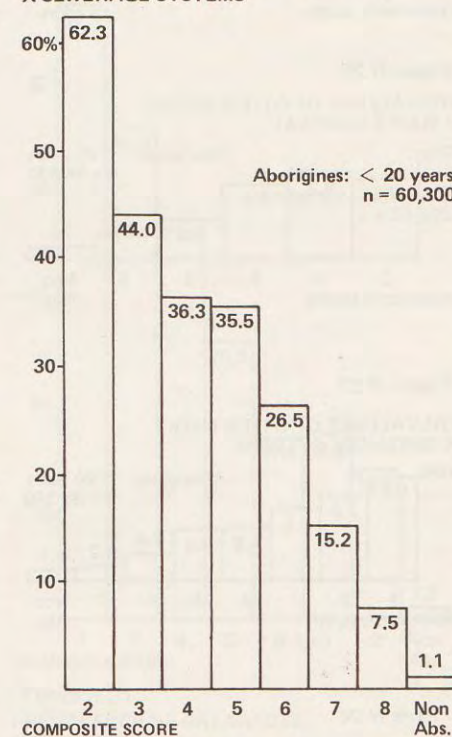
PREVALENCE OF CICATRICAL TRACHOMA
X WASTE DISPOSALFigure H 11
PREVALENCE OF CICATRICAL TRACHOMA
X SEWERAGE SYSTEMS

Figure H 12

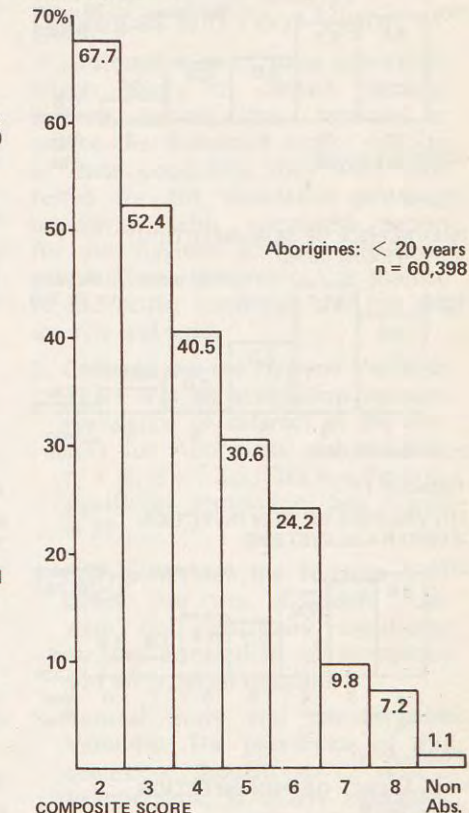
PREVALENCE OF CICATRICAL TRACHOMA
X HOUSING

Figure H 13

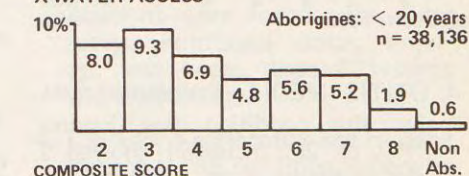
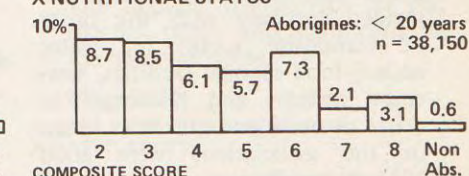
PREVALENCE OF SKIN INFECTION
X WATER ACCESS

Figure H 14

PREVALENCE OF SKIN INFECTION
X NUTRITIONAL STATUS

3. SKIN INFECTION. Figures H 13-H 18 inclusive show the associations between the prevalence of skin infections and each of the six hygiene variables. The associations of improved hygiene score and lower prevalence rates are significant for all variables but the

association is less marked than that for the two forms of trachoma. As the hygiene variable approaches that for the non-Aboriginal groups so too does the prevalence rate. The trend is most clear for food storage and sewerage systems.

Summary. For follicular trachoma, prevalence rates were clearly related to all six hygiene variables tested. The association was consistent throughout the range of all the variables, more so for housing. It appears that to an extent for follicular trachoma prevalence any of the six variables is a good indicator of level of the rate. For the best Aboriginal hygiene composite scores, Aboriginal prevalence rates approach but do not attain the low level of the non-Aboriginal group.

2. CICATRICAL TRACHOMA. Prevalence rates for this condition were those for all ages. For all six hygiene variables there was

strong association of lesser prevalence rate and higher composite score. See Figure H 7 to H 12, inclusive. Only for nutritional status and CT prevalence is there other than a perfectly step-wise association. Cicatricial trachoma prevalence, like that for follicular trachoma, appears to be sensitive to all the hygiene variables tested. In view of the common trend

Figure H 15

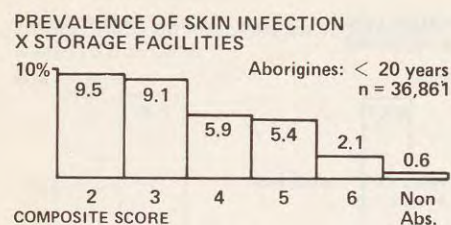


Figure H 16

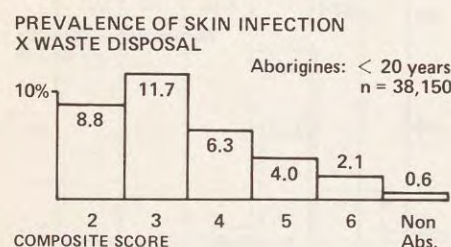


Figure H 17

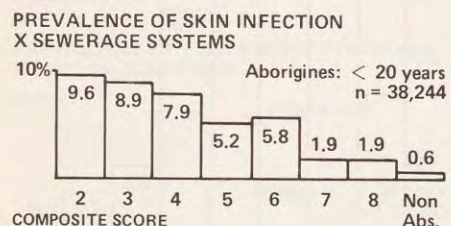
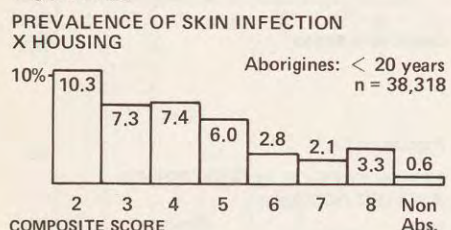


Figure H 18



4. OTITIS MEDIA. Prevalence rates for this condition (see Figures H19 to 24, inclusive) showed a strong tendency to lessen as the composite score for each hygiene variable approached the non-Aboriginal level. The rank order of prevalence for otitis media coincided precisely with the order of composite scores for water access, food storage facilities, sewerage systems and housing. For waste disposal and nutritional status the associations were good but not complete.

It is to be noted that with better quality hygiene facilities, or at the higher composite score for these variables, the Aboriginal otitis media rate comes very close to the non-Aboriginal rate.

Figure H 19

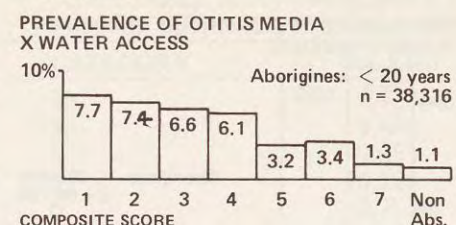


Figure H 20

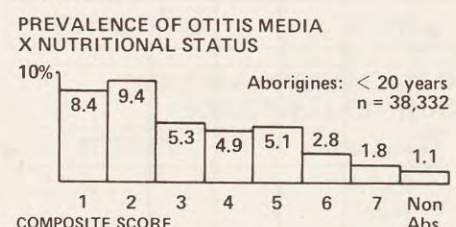


Figure H 21

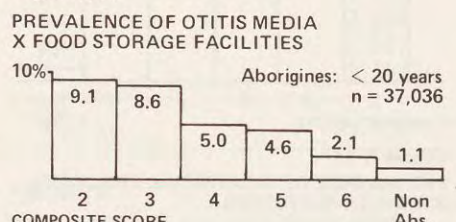


Figure H 22

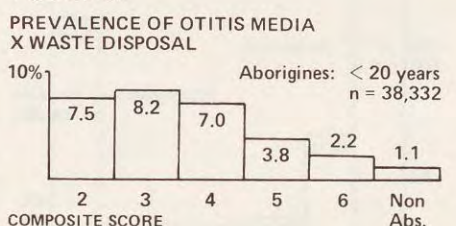


Figure H 23

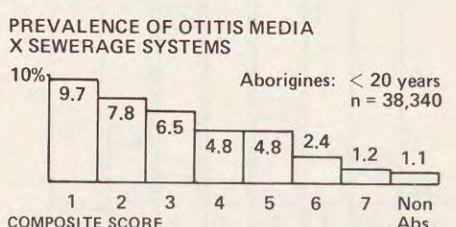
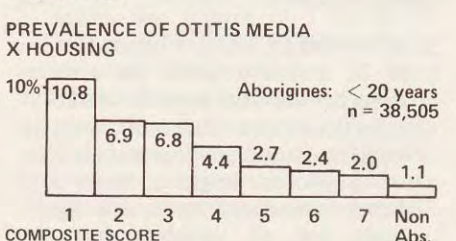
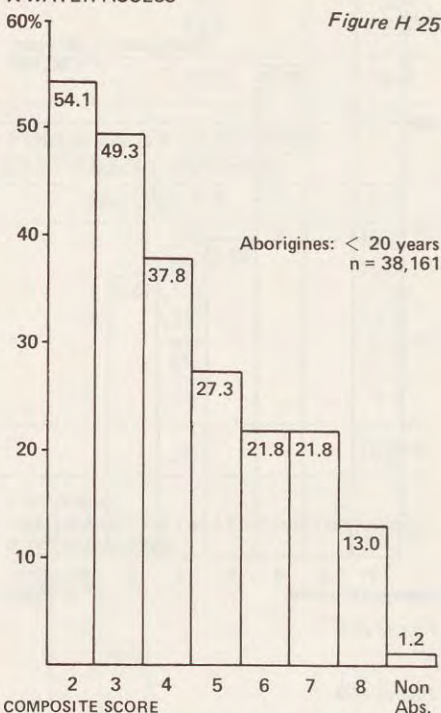
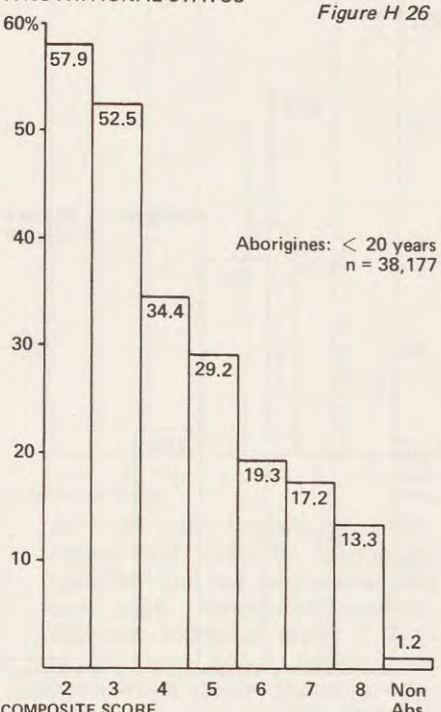


Figure H 24



5. NASAL DISCHARGE. For all the six hygiene variables nasal discharge prevalence rates fell regularly with increase in the composite scores. See Figures H 25 to H 30, inclusive. For each hygiene factor there was a reduction of the

PREVALENCE OF NASAL DISCHARGE
X WATER ACCESSPREVALENCE OF NASAL DISCHARGE
X NUTRITIONAL STATUS

nasal discharge rate to at least one third of the rate at the worse end of the hygiene score. For only one variable did the lowest prevalence rate for Aborigines come within 10 times the non-Aboriginal rate — sewerage systems composite score 8 at 8.3 per cent — but the large fall in prevalence rates as composite scores increase for all six variables show the sensitivity of this health variable to improvement in hygiene factors.

Figure H 27

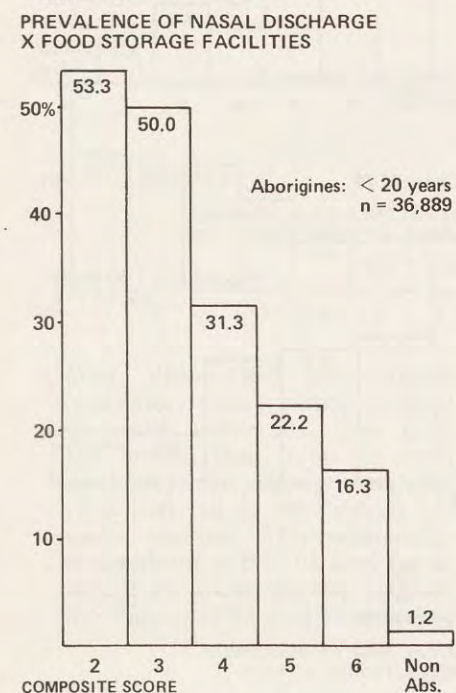


Figure H 28

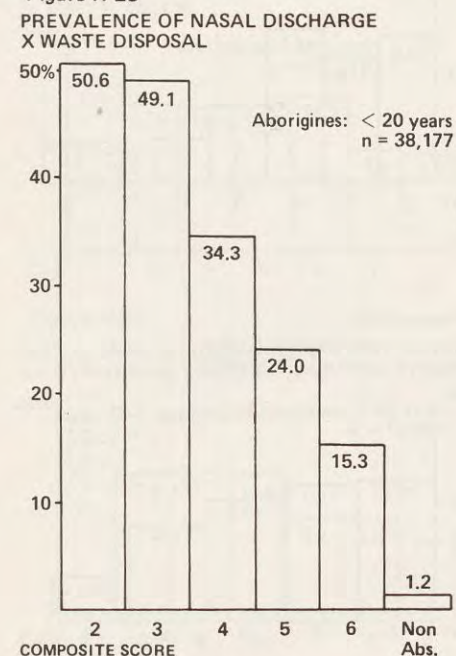


Figure H 29

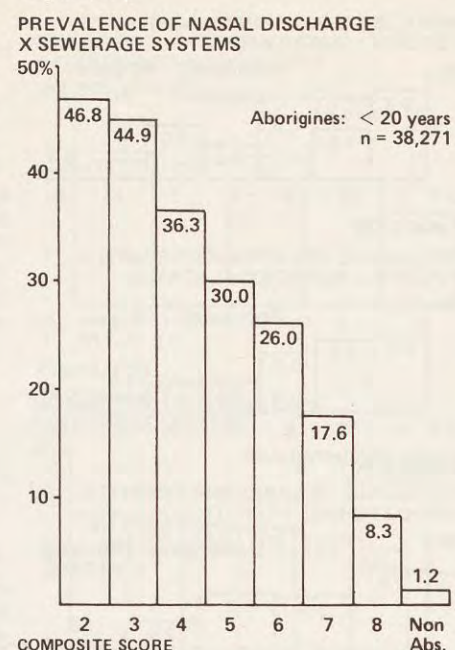


Figure H 30

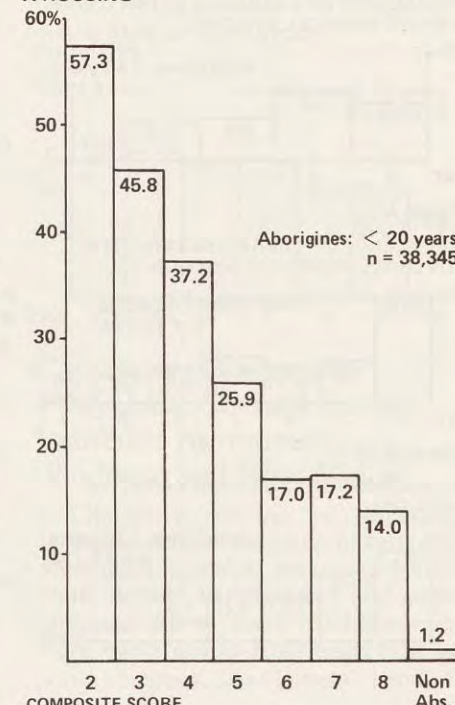
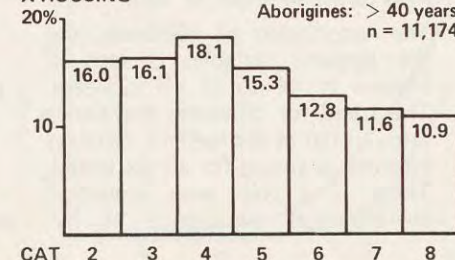


Figure H 31



Hygiene and Cataract, Pterygium, Corneal Scars, Labrador Keratopathy, Blindness and Poor Vision

Although each of these conditions relates partly to climate, because hygiene factors may increase or reduce the frequency and/or severity of these conditions they were each tested for the association of their prevalence with composite scores for the 'hygiene' variables. In these computations the presence or absence of the ocular condition and not the severity was used.

1. Cataract and the Hygiene Variables. There was an association between prevalence of cataract in the over 40's for Aborigines and Housing, $r_s = .8$, $p < .05$. This was the only significant association. See Figure H 31.

2. Pterygium and the Hygiene Variables. For this condition there were no statistically significant ranking associations of prevalence and the hygiene variables.

3. Corneal Scars and the Hygiene Variables. The prevalence of this condition, thought to be related to trachoma, is clearly associated with hygiene variables. See Figures H 32 to 37. The association was very strong for housing. In the best housed group, the prevalence rate was less than one quarter of that in the worst housed group. Associations were found with water access, nutritional status, sewerage and waste disposal systems and food storage.

4. Labrador Keratopathy and Hygiene Variables. This condition, otherwise known as climatic droplet keratopathy, is shown, in Figures H 38 to 43 inclusive, to be strongly related to the hygiene variables. The ranking was perfect for nutritional status and significant for the other variables.

Figure H 32

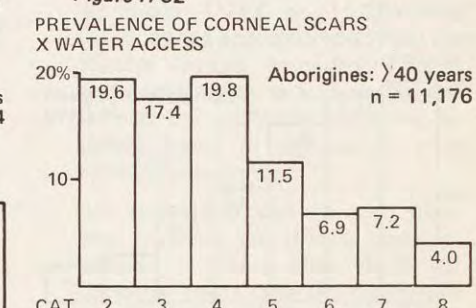


Figure H 33

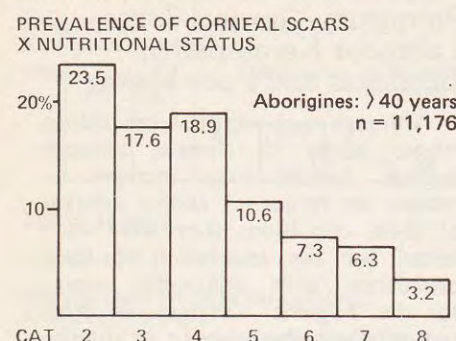


Figure H 34

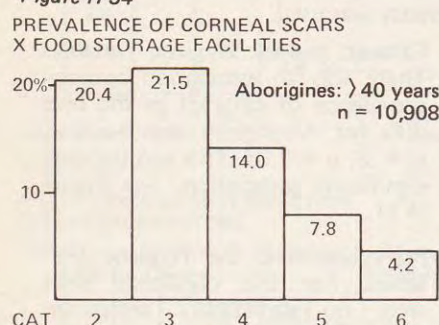


Figure H 35

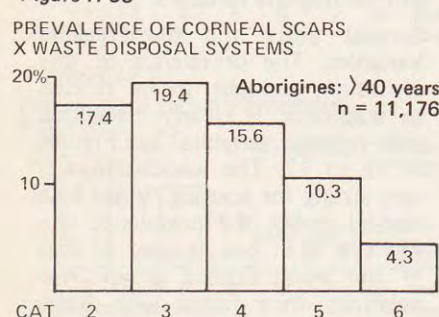


Figure H 36

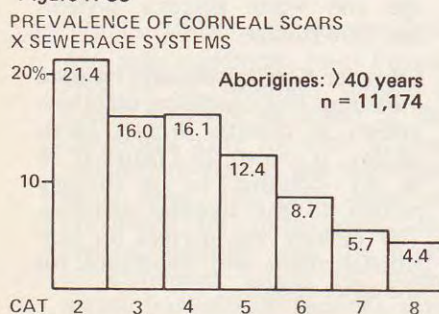


Figure H 37

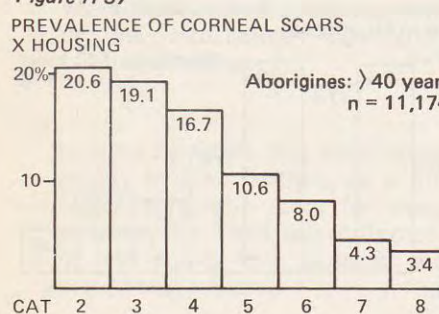


Figure H 38

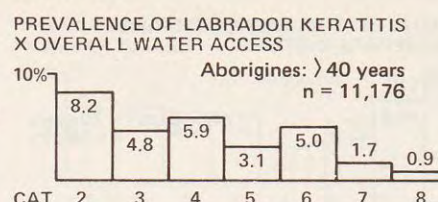


Figure H 39

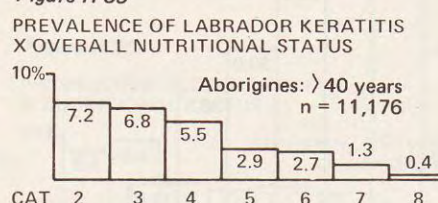


Figure H 40

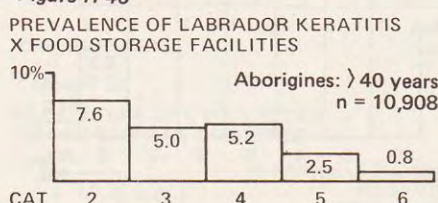


Figure H 41

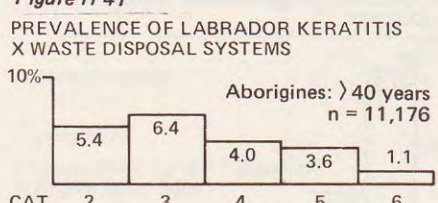


Figure H 42

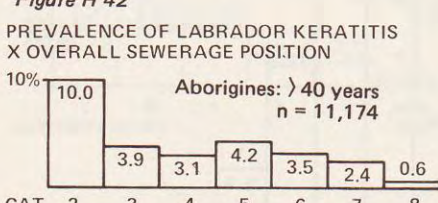
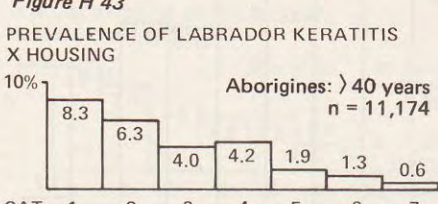


Figure H 43



5. Blindness and the Hygiene Variables, i.e. Vision equal to or worse than 6/60 in both or better eye.

The association of blindness and the hygiene variables is seen in Figures H 44 to H 49 inclusive. The trend for blindness prevalence rates to fall as the hygiene variables improve is strong for all six tested. There is a step wise reduction in blindness prevalence as hy-

giene variables improve. For all the six hygiene factors, the blindness prevalence for the best hygiene score is at least half that of the worst hygiene score.

Figure H 44

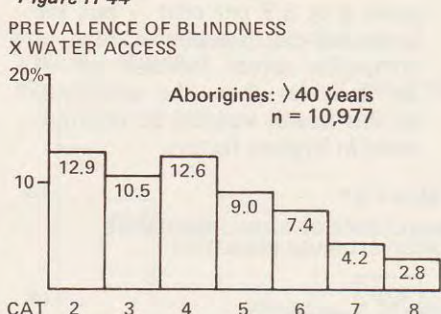


Figure H 45

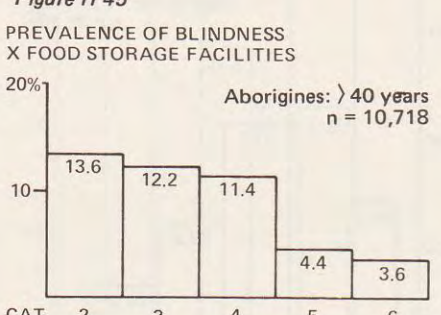


Figure H 46

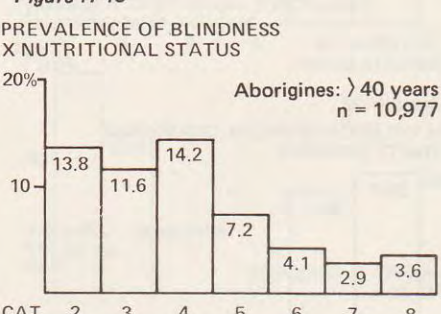


Figure H 47

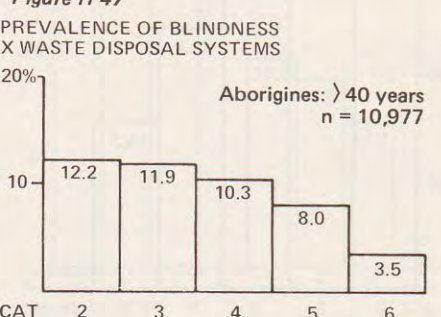


Figure H 48

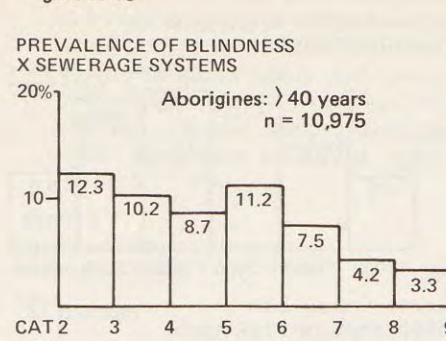
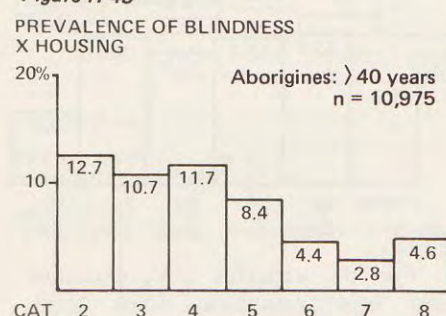


Figure H 49



6. Poor Vision and the Hygiene Variables. Poor vision, defined as visual acuity less than 6/12 but better than 6/60 in both or better eye, shows prevalence rates that fall as the hygiene variables improve. This relationship is significant at p = .05 level for all except the waste disposal variable. See Figures H 50 to H 54 inclusive.

Figure H 50

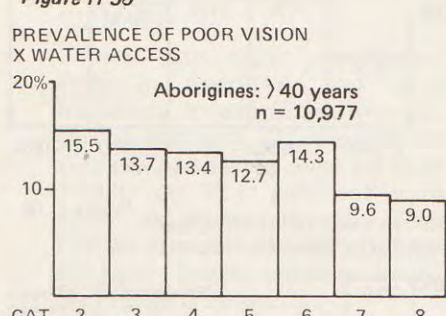


Figure H 51

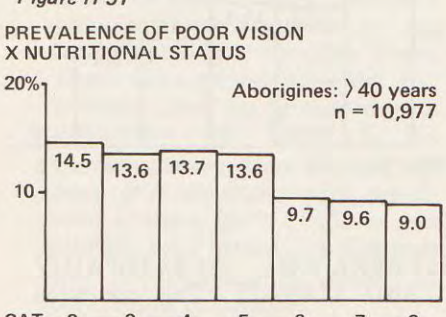


Figure H 52

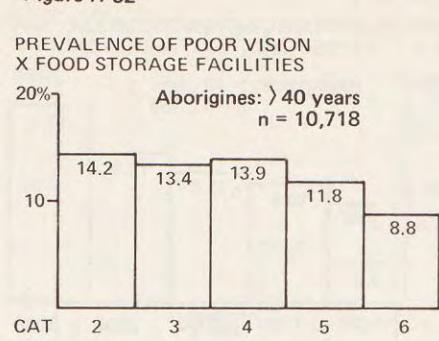


Figure H 53

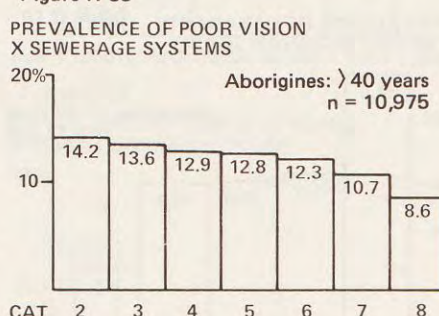
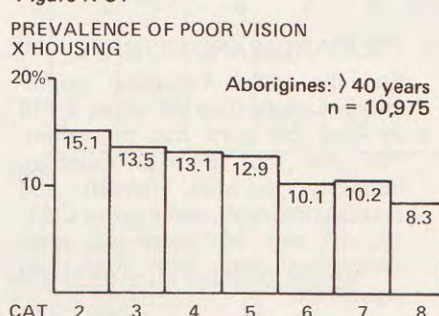


Figure H 54



Climate and Cataract, Pterygium, Corneal Scars, Labrador Keratopathy, Blindness and Poor Vision

Climate is known, or suspected to play a part in the cause of cataract, pterygium, labrador keratopathy (climatic droplet keratopathy) and corneal scars. All of these conditions are more numerous in Aborigines than in non-Aborigines. See Figures C 1 to C 4 inclusive.

Figure C 1

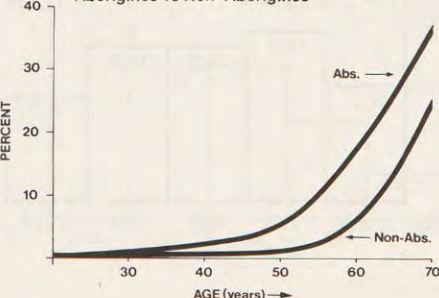


Figure C 2

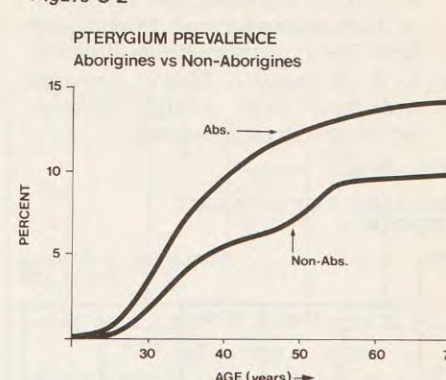


Figure C 3

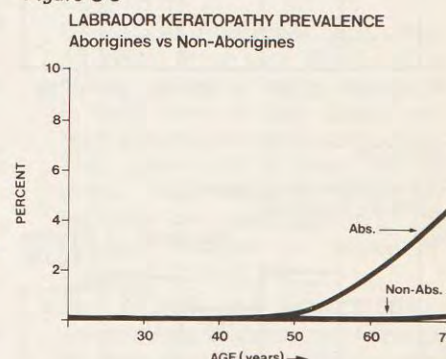
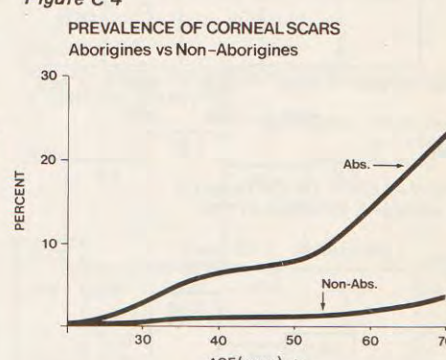


Figure C 4



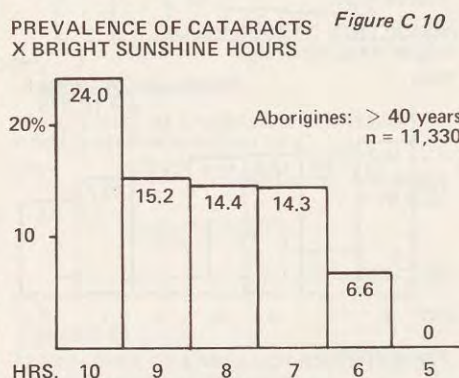
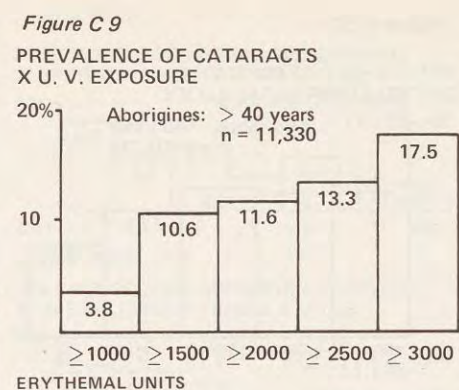
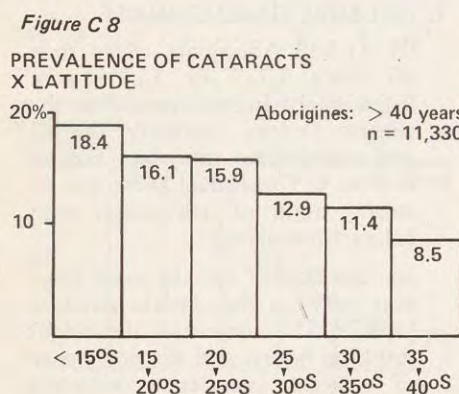
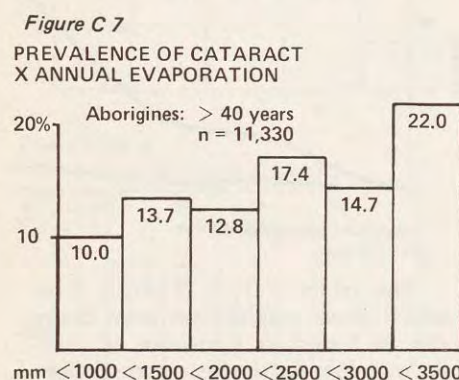
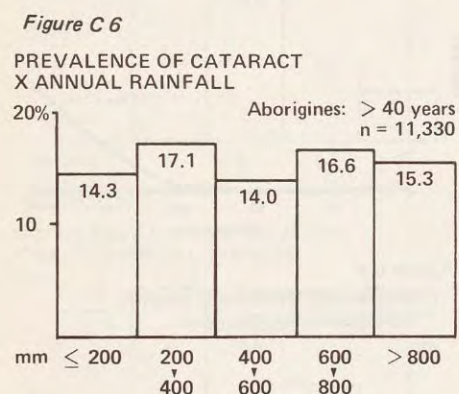
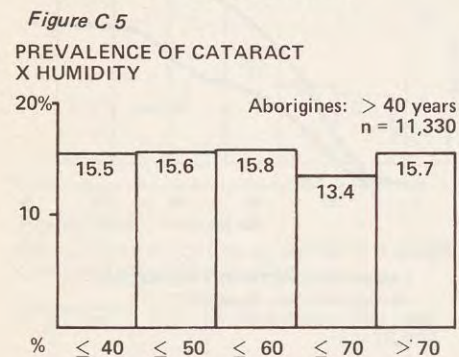
The tables C 1, 2, 3 and 4, from which these graphs have been drawn can be found in Appendix 4C. Similarly, tables for the histograms following can be found in Appendix 4C.

1. CATARACT AND CLIMATE

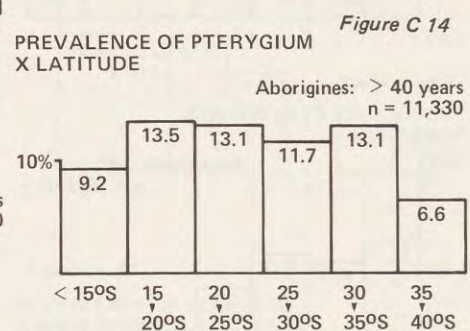
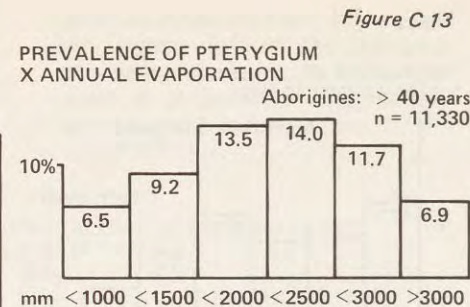
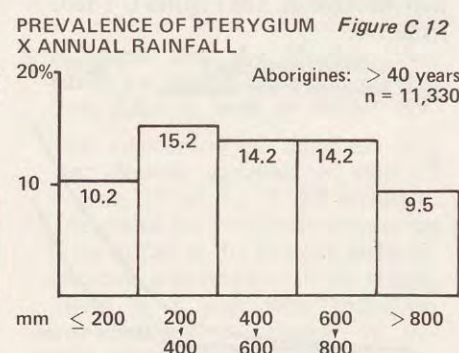
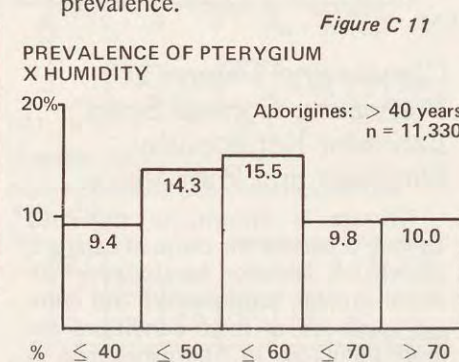
Of 11,330 Aborigines older than 40 years 1,717 or 15.2% were listed as having cataract. For the climate factors, humidity, rainfall and evaporation rate, (see Figures C 5 to C 7 inclusive) there was no strong trend of association with cataract prevalence.

An association can be seen however between the climate variables latitude, U.V. exposure and bright sunshine hours, and the prevalence of cataract; prevalence decreased

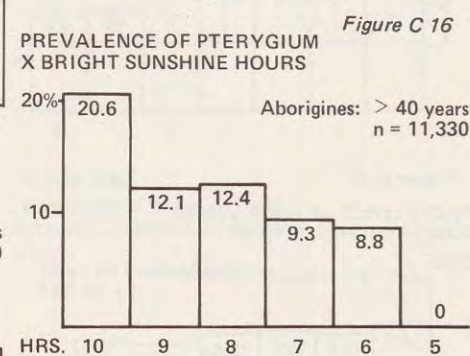
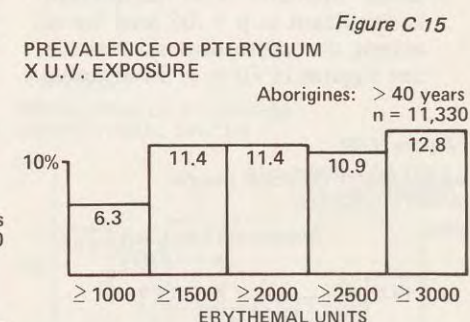
as latitude increased, and increased as U.V. exposure and bright sunshine hours increased. See Figures C 8, 9 and 10. Clearly cataract and these three sunlight climate factors are strongly related.



2. PTERYGIUM AND CLIMATE.
For the same Aboriginal population of more than 40 years, 1,346 or 12.1 per cent had pterygium. For the four climate variables, humidity, latitude, rainfall and evaporation rates, see Figures C 11, 12, 13 and 14, there was poor association only with pterygium prevalence.

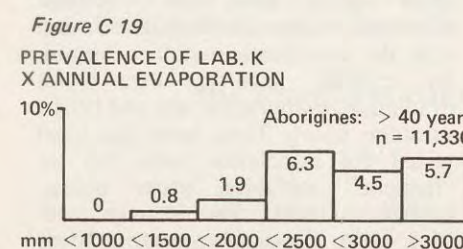
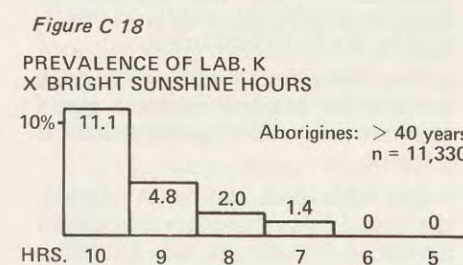
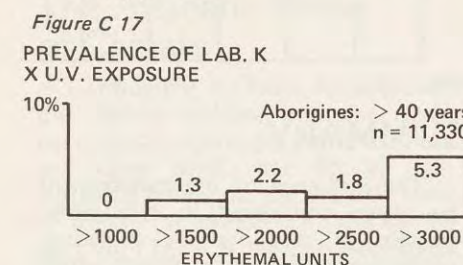


For the variables U.V. exposure and bright sunshine hours there were trends for higher levels of prevalence for higher levels of the climate factor but only for bright sunshine hours was the association statistically significant ($p = < .05$). See Figures C 15 and 16. It appears that there is a significant sunlight influence on pterygium prevalence.



3. LABRADOR KERATOPATHY AND CLIMATE. This condition had a low overall prevalence rate

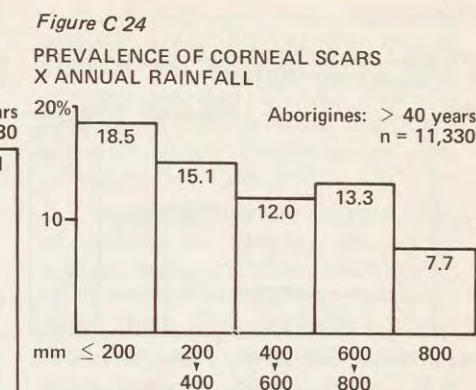
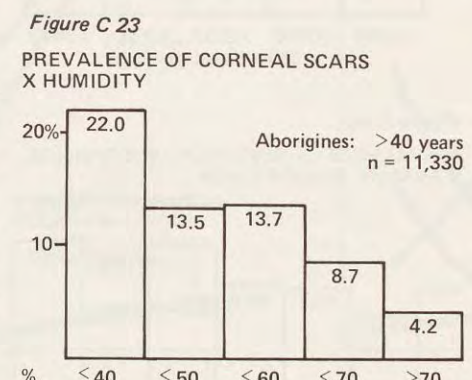
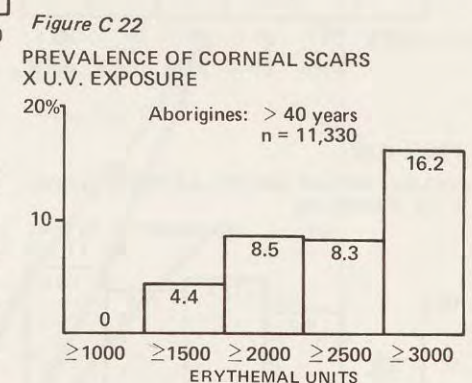
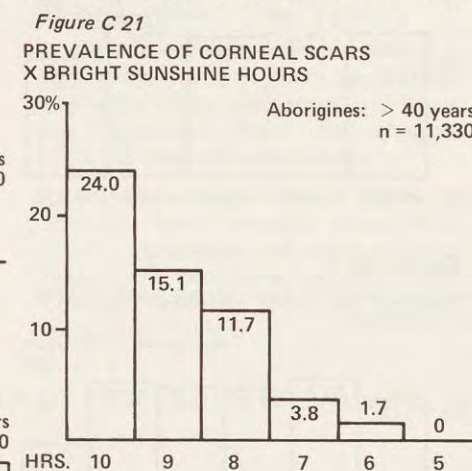
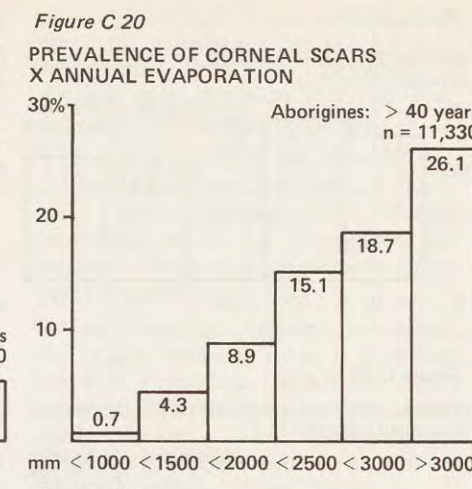
in the over 40 year old Aborigines, 3.8 per cent. For the sunlight climate factors of U.V. exposure, bright sunshine hours and annual evaporation rate, (see Figures C 17, 18 and 19) the same association with prevalence rates was significant, $p = < .05$.



4. CORNEAL SCARS AND CLIMATE

Corneal scars occur more frequently in Aborigines and more frequently in association with cicatricial trachoma. Of the over 40 year old Aborigines, some 1,422 of 11,330 or 12.6 per cent were listed as having corneal scars. For the climate variables, evaporation and bright sunshine hours, see Figures C 20 and 21.

There was a very strong association of corneal scars prevalence and increasing evaporation and increasing bright sunshine hours. There was a weaker trend for U.V. exposure level to be ranked with prevalence. See Figure C 22. Humidity changes (see Figure C 23) were also associated with prevalence changes ($p = < .05$) as was rainfall, see Figure C 24. Latitude was not significantly related to corneal scar prevalence.



5. ABORIGINAL BLINDNESS AND CLIMATE

Of 11,330 Aborigines older than 40 years, there were 944 listed as having vision no better than 6/60 in both eyes or their better eye. Such persons are pensionably blind. They form 8.5% of those over 40 years. The prevalence rates for blindness are associated with the climate variables as shown in Figures C 25 to C 30.

For rainfall and latitude, there are no strong associations of change in prevalence rate with changing climate variables, see Figures C 25 and C 26.

