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DEAFNESS AS AN EPIDEMIC DISEASE IN AUSTRALIA

A NOTE ON CENSUS AND INSTITUTIONAL DATA

BY

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It has generally been assumed that the epidemics of deafness and other congenital defects associated with births in the years 1938-41 and reported by Gregg (1941), Swan *et al.* (1943), Patrick (1948), and others from the various Australian states were a new and unusual manifestation of rubella. So far as we are aware there has been no report of an extensive epidemic, prior to these years, giving rise to cases of deafness. It is proposed to put on record here certain observations suggesting that similar epidemics have occurred in the past, notably a very extensive epidemic of births of the deaf in 1899 in the states of Australia. We have definite knowledge of a great epidemic of rubella throughout Australasia in the previous year. It is reasonable to presume provisionally that many of the cases of deafness were due to that disease, although it is not possible to relate individual cases of deafness to a history of maternal rubella.

Epidemic Nature of some Forms of Deafness

In the three successive Australian censuses of 1911, 1921, and 1933 the statistician's report on the census gave a chapter to the answers on the questions regarding blindness and deaf-mutism in the census. It was apparent that the prevalence of blindness rose with increasing age in the population. On the other hand, the prevalence of deaf-mutism showed a maximum in each census corresponding in each case to persons born in the years 1896-1900. The fact that 12 years elapsed between two of the censuses makes it possible to deduce that the excess of births of these deaf may have

occurred in the years 1898-1900. The occurrence of a modal age for the prevalence of deafness was most evident in New South Wales. The numbers of deaf-mutes enumerated at the three censuses in New South Wales are given by age and sex in Table I. The numbers

TABLE I.—The Deaf-mutes in New South Wales as Enumerated at the Three Censuses

Age Group	1911 Census		1921 Census		1933 Census	
	Males	Females	Males	Females	Males	Females
0-	8	8	7	10	7	4
5-	34	25	39	33	57	38
10-	(54)	(57)	43	43	56	33
15-	35	29	30	27	68	73
20-	36	29	(69)	(46)	49	49
25-	34	26	36	23	44	25
30-	24	30	35	32	(78)	(62)
35-	35	22	35	27	44	27
40-	14	22	22	25	31	28
45-	19	13	25	25	29	24
50-	13	15	9	17	28	18
55-	8	6	13	11	18	22
60-	11	7	12	14	15	14
65+	4	16	21	29	14	25
Unclassified ..	1	5	0	3	1	1
Total	330	310	396	365	539	443

in the modal age groups are given in parentheses. In 1911 the maximum prevalence of deaf-mutism occurred in the age group 10-14 years, and the statistician, G. H. Knibbs (1917), was inclined to ascribe the maximum to the more complete enumeration of the deaf at the school ages. In 1921, however, it was clear that this explanation was inadequate, for the maximum was to be found at the age group 20-24 years, and this maximum was due to the same "cohort" or group of persons, who had merely aged in between the censuses. The statistician, C. H. Wickens (1927), considered the possibilities of epidemic disease as a cause of the deafness in the following words: "The age incidence of the deaf-mutism varies in such a manner that it is apparent that the cause of the disability is of variable intensity, and there is some evidence to suggest that the increase in incidence of deaf-mutism at certain ages synchronizes with the occurrence of epidemic diseases, such as scarlet fever, diphtheria, measles, and whooping-cough." At the report on the census of 1933 the statistician, Roland Wilson (1942), again discussed infective disease as the cause of the deafness. We have followed the lead given by these census reports and have determined the date of birth of the deaf admitted to certain of the institutions throughout Australia. Here only the data from the New South Wales Institution for the Deaf and Dumb and the Blind will be discussed in detail, but similar considerations will apply to the data from the other states, which are also presented in the tables.

Births of the Deaf in New South Wales

Since the opening in 1861 of the New South Wales Institution for the Deaf and Dumb and the Blind there has been a well-kept register of the admissions. For the earlier admissions the month of birth was not always noted. We have been able to distinguish the sex, wherever it has not been explicitly stated, by means of the Christian name of the patient. In Table II the numbers of those born deaf admitted to institutions are given for New South Wales and other states. Since in the earlier years the admissions were few in number and did not seem to suggest epidemic occurrences, the results have been pooled up to the year 1880. From this year onwards the numbers of births of the deaf,

TABLE II.—Numbers Born Deaf Admitted to Certain Institutions in the States (or Colonies) of Australia, by Years

Number of Deaf Births in the State of											
Year	N.S.W.	V.	Q.	S.A.	W.A.	Year	N.S.W.	V.	Q.	S.A.	W.A.
-1879	239		1	64	19	1916	(32)	8	(15)	7	4
1880	5	2	4	4	1	1917	19	9	11	11	2
1	16	—	4	4	—	1918	13	12	8	4	4
2	13	—	3	—	—	1919	11	9	9	4	3
3	10	2	4	4	—	1920	19	9	11	5	3
4	8	2	4	4	2	1	14	10	14	8	6
5	12	7	6	2	2	2	17	10	10	10	4
6	11	1	7	1	3	3	18	11	8	8	2
7	17	4	4	4	4	4	(27)	(20)	10	10	2
8	12	3	4	4	3	5	(29)	7	13	5	5
9	14	2	7	1	6	6	14	7	6	5	2
1890	8	6	4	4	4	7	11	10	10	6	5
1	8	12	3	8	3	8	12	10	7	4	4
2	10	6	3	5	3	9	15	7	9	3	4
3	12	7	4	4	2	1930	23	5	14	6	4
4	10	7	2	3	2	1	17	5	7	7	2
5	11	4	3	7	1	2	11	6	4	2	2
6	16	4	1	7	3	3	10	7	4	2	4
7	12	5	12	4	5	4	19	3	6	1	3
8	15	12	4	(10)	(8)	5	15	5	10	6	1
9	(70)	(14)	(20)	(22)	(9)	6	19	6	6	3	5
1900	16	11	6	9	2	7	21	5	11	7	6
1	7	6	4	6	2	8	(33)	(17)	(74)	4	4
2	8	13	8	3	5	9	14	(33)	8	2	4
3	13	9	4	5	2	1940	(28)	(39)	7	(17)	(18)
4	14	7	8	7	2	1	(104)	(64)	(81)	(17)	(13)
5	8	11	4	4	2	2	9	14	11	7	1
6	11	4	10	3	3	3	(23)	(20)	(25)	11	3
7	13	6	3	7	5	4	10	7	11	3	6
8	13	7	8	11	5	5	9	4	7	6	4
9	12	12	6	7	2	6	2	2	4	4	4
1910	15	14	8	11	4						
1	16	13	12	9	4						
2	13	9	5	6	3						
3	16	7	6	4	5						
4	21	11	5	7	1						
5	16	15	10	2	1						

later admitted to the Institution, are given for each individual calendar year. As usually the children are not admitted to the institutions until they reach school age, the entries from the year 1942 onwards are much more incomplete as a record of deaf persons than the figures for earlier years. A further cause of incompleteness is the recent opening of special schools for the deaf, other than the Institution. Perhaps, too, there has been a change in the outlook of the parents over the years, so that more of them now send their children and have them admitted at an earlier age than formerly. In any case, these differences will not trouble us, as we shall be interested only in comparing the number of births of the deaf in the Institution in a single year with the numbers in the two neighbouring years with a view to deciding whether the central year is to be regarded as an epidemic year for births of the deaf. The term "epidemic" is in no way confined to an infective cause, as other, non-infective, causes may also be epidemic—for example, the avitaminoses. It is immediately apparent that the years 1899, 1938, 1941, and perhaps 1916, 1924, and 1925, are to be regarded as epidemic years for the births of the deaf in New South Wales. 1940 itself did not contain a number of such births greatly increased above expectation, but when the monthly incidence is examined it is evident that the epidemic of births of the deaf in 1941 began in December, 1940, and continued throughout the first eight months of 1941.

Analysing the figures for New South Wales in more detail, we find that there were 70 births of the deaf in 1899 but only 15 in 1898 and 16 in 1900. This great excess of births of the deaf in 1899 as compared with the numbers in the previous and following years can be explained only by presuming an epidemic cause acting from without. Thus we should regard such a finding as very unlikely on the hypothesis that the

cause was genetic and hence that each of the events—the births of the deaf—was independent. In Table III and the Graph the monthly incidence of the births of the deaf is given. The births in the epidemic years are not distributed evenly throughout the year, but tend to be grouped around the month of June. Thus we find that the monthly incidence in 1899 for New South Wales is 1 case in January, 5 in February, 2 in March, followed by 8 in each of the months of the second quarter, 14 in July, 12 in August, and 6 in September. We may regard this month as the end of the epidemic, for there were but 1, 3, and 2 births in the last three months of the year. Of course, the case for an epidemic cause is strengthened by the fact that in 1899 there were also excessive numbers of births of the deaf in other Australia colonies.

EPIDEMICS OF BIRTHS OF THE DEAF

lian colonies. Notable epidemics occurred in Western Australia and Queensland, but the numbers were not convincingly raised in Victoria. It seems that we must regard 1898, too, as an epidemic year in Western Australia and in South Australia. If so, it is tempting to trace the beginning of the epidemic to the port nearest to Europe and to suggest that rubella may have died out completely in Australia before that year. The number of births in New South Wales for 1916 was not so strikingly above that for the neighbouring years, but within the year there was a concentration of the births in the months of June, when there were nine births, and of July, when there were six births. Support for the view that 1916 was an epidemic year comes from Queensland. Again, in 1924 there were 27 births of the deaf in New South Wales, four being in March and six in April. There was also an excess of births of the deaf in 1924 in Victoria. In New South Wales an excessive number of births (29) were recorded in 1925, of which four occurred in July and six in August.

There is more definite ground when we deal with the most recent years. 1938 was definitely an epidemic

TABLE III.—Date of Birth of the Deaf in Australia in Certain "Epidemic Years"

State	Year	Number of Births Recorded of the Deaf in the Month of												Male	Female	Total
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.			
S.A. ...	1898	—	—	1	—	2	—	1	—	—	1	2	3	8	2	10
W.A. ...	1898	—	—	—	—	1	—	4	—	—	—	2	1	5	3	8
N.S.W. ...	1899	1	5	2	8	8	8	14	12	6	1	3	2	49	21	70
Vic. ...	1899	3	2	1	1	3	1	1	—	—	—	1	1	9	5	14
Q. ...	1899	1	—	3	4	1	4	2	4	—	—	1	—	13	7	20
S.A. ...	1899	1	4	1	3	1	3	2	2	2	3	—	—	8	14	22
W.A. ...	1899	3	1	2	2	—	—	—	1	—	—	—	—	3	6	9
N.S.W. ...	1916	1	—	4	1	3	9	6	2	4	1	1	—	17	15	32
Vic. ...	1916	1	1	—	1	2	1	1	1	—	1	—	—	3	5	8
Q. ...	1916	2	—	—	2	4	2	—	1	—	1	2	—	7	8	15
S.A. ...	1916	—	—	1	—	1	—	1	2	2	—	—	—	3	4	7
W.A. ...	1916	1	—	—	—	—	—	—	—	—	—	—	1	2	—	2
N.S.W. ...	1938	2	—	8	3	5	2	3	2	4	3	—	1	18	15	33
Vic. ...	1938	—	1	—	4	4	1	1	1	—	—	3	1	10	7	17
Q. ...	1938	2	6	18	11	27	2	3	1	2	1	—	1	40	34	74
S.A. ...	1938	—	—	—	1	—	—	1	—	1	—	—	—	2	2	4
W.A. ...	1938	—	—	—	1	—	—	1	—	—	—	1	1	3	1	4
N.S.W. ...	1940	1	1	1	5	2	2	—	3	3	2	2	6	17	11	28
Vic. ...	1940	3	2	3	4	7	2	5	1	7	1	3	1	21	18	39
Q. ...	1940	—	—	—	—	1	1	2	—	—	—	—	3	4	3	7
S.A. ...	1940	—	2	4	2	—	1	5	—	2	—	—	1	11	6	17
W.A. ...	1940	—	1	2	2	4	—	1	2	1	—	2	3	9	9	18
N.S.W. ...	1941	12	11	30	18	14	5	4	4	2	1	2	1	53	51	104
Vic. ...	1941	8	13	10	15	7	2	3	2	1	1	1	1	28	36	64
Q. ...	1941	3	3	24	22	19	5	2	3	—	—	—	—	38	43	81
S.A. ...	1941	1	2	2	5	—	1	—	3	1	1	1	—	7	10	17
W.A. ...	1941	4	2	1	2	1	—	2	1	—	—	—	—	8	5	13
Total ..		50	57	118	117	117	52	65	48	39	19	27	28	396	341	737

TABLE IV.—Month of Birth of the Deaf in Australia as Recorded in Non-epidemic Years

State	Years	Number of Births of the Deaf Recorded in the Month of													Sex		Total
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Uncl.*	M	F	
N.S.W. ...	1872 to 1898	28	22	28	28	25	21	32	34	32	21	16	20	15	195	127	322
Vic. ...	1890 .. 1898	4	5	3	11	6	5	8	2	2	7	5	5	—	31	32	63
Q. ...	1872 .. 1898	4	10	4	5	4	4	5	2	3	9	6	0	—	32	24	56
S.A. ...	1870 .. 1897	12	7	7	10	8	11	16	9	7	13	16	10	3	78	51	129
W.A. ...	1877 .. 1897	5	3	2	2	3	4	4	5	2	3	3	1	5	21	21	42
N.S.W. ...	1900 .. 1915	12	11	17	21	28	17	14	20	23	14	21	14	—	120	92	212
Vic. ...	1900 .. 1915	11	17	14	12	7	14	11	14	14	16	8	17	—	82	73	155
Q. ...	1900 .. 1915	16	10	9	13	7	8	10	7	9	11	6	0	—	61	45	106
S.A. ...	1900 .. 1915	6	14	8	10	5	11	6	6	9	11	8	7	—	52	49	101
W.A. ...	1900 .. 1915	4	6	6	2	2	6	1	3	2	9	5	1	1	24	24	48
N.S.W. ...	1917 .. 1937	23	32	33	31	29	25	34	32	34	31	32	23	1	193	167	360
Vic. ...	1917 .. 1937	20	10	14	11	14	15	17	15	14	18	12	13	—	98	75	173
Q. ...	1917 .. 1937	18	18	17	20	19	15	15	23	11	9	16	7	—	97	91	188
S.A. ...	1917 .. 1937	9	12	10	11	11	8	15	11	11	7	5	7	—	47	70	117
W.A. ...	1917 .. 1937	3	5	7	10	4	6	5	11	7	8	6	3	—	49	26	75
Summary:																	
Australia, up to 1897-8		53	47	44	56	46	45	65	52	46	53	46	36	23	357	255	612
" 1900 to 1915		49	58	54	58	49	56	42	50	57	61	48	39	1	339	283	622
" 1917 to 1937		73	77	81	83	77	69	86	92	77	73	71	53	1	484	429	913
" to 1937 ..		175	182	179	197	172	170	193	194	180	187	165	128	25	1,180	967	2,147

* Uncl. = Unclassified by month.

year in New South Wales, Victoria, and Queensland. The epidemic appears to have lingered on in Victoria, reaching a peak in 1941. In New South Wales, on the other hand, there is no evidence of an epidemic in 1939 or in 1940 until December, when the births were six, the epidemic then continuing to August, 1941. In Queensland, too, there were two epidemics separated by a period of about two years, in 1938 and in 1941, with no evidence of epidemic incidence intervening. In Western Australia the epidemic years were 1940 and 1941. In any year regarded as epidemic, or as possibly epidemic, the incidence of the births by months is of interest. We have used the fact of concentration in certain months of the year as corroborative evidence that the year was epidemic. We notice from the tables that, although the interepidemic births are, roughly, equally spaced throughout the year, the greatest incidence in the epidemic years falls in the early months of the year, with usually the greatest incidence in

February to July. In the epidemic of which there is precise information, that of 1941, the peak incidence was in March, with 30 births, and April, with 18. These totals are not exhaustive for New South Wales. In 1899, however, the peak was in June, so that we should expect to find the activating cause acting in October, 1898. We shall see in a later section that in 1898, in Sydney, there were concurrent epidemics of measles (morbilli) and German measles (rubella). It seems easy in 1950 to suggest that the epidemics of the births and the rubella were causally related, with the reservation that some or all of the cases may have been due to measles, since this disease is thought sometimes to cause congenital defects (Packer, 1950).

The main points of the tables may be summarized as follows:

1. Among deaf children born in either epidemic or inter-epidemic periods there is a slight excess of male births. Thus in the epidemic years 396 males and 341 females were

born, and in the interepidemic years 1,180 males and 967 females. The proportion of male births is thus 0.537 for the epidemic years and 0.550 for the interepidemic years. This difference is small, and is not significant, as it corresponds to a χ^2 of 0.334 for one degree of freedom.

2. In epidemic years the births have a characteristic grouping about the month of April, but in the interepidemic periods they are scattered throughout the year.

3. If we compare the number of deaf persons born in New South Wales in 1897-1901 who later entered the Institution with the number of deaf-mutes enumerated at the 1911 census in the age-group 10 to 14 years, we find that the births outnumber the deaf-mutes. One perhaps would have expected more deaf-mutes to be enumerated than to have attended the Institution. The anomaly is to be explained partly by some of the children at the Institution not being considered mute if their hearing had been lost in childhood, and partly by the form of the question regarding deaf-mutism which was asked at the census. In 1911, for example, the census schedule directed: "Enter . . . as deaf and dumb only those who are dumb as well as deaf." Probably a number of those with congenital deafness would have learned to speak to some extent and so have passed out of the class to be enumerated. We suggest that the question (not asked in 1947), if reintroduced at future censuses, should be directed towards deafness rather than towards deaf-mutism.

4. Since the foundation of the New South Wales Institution, in 1861, about one-quarter of all cases admitted to it have been born in epidemic years. We may say that about 20% of the total admissions have been due to epidemic causes.

Some Epidemics of Rubella in Australia

The data on rubella incidence in Australia are fragmentary. Little interest has been displayed in a disease whose chief importance lies in its differential diagnosis from the other exanthemata of childhood. We have sought references to the occurrence of outbreaks of the disease in Australia. In the earliest Australian note on the disease, Thomas (1867) reported the occurrence of epidemics of scarlet fever, morbilli, and rubella in Melbourne. Jamison (1873) reported an epidemic of rubella at Warrnambool, Victoria, and commented on the high proportion of cases among adults. Ryan (1883) gave another clear account of the disease in Melbourne.

In New South Wales several papers of the greatest interest to us here were given by Scot Skirving (1898) and Spencer (1899). We may get an indirect idea of the magnitude of the epidemic in Sydney if we note that 389 deaths from measles occurred there in 1898, and that Spencer in his private practice had 231 cases of measles and 147 cases of rubella. Spencer noted that the cases of rubella occurred in the months May to October.

In Queensland, in the same year, Jackson (1898) reported an epidemic of rubella in Brisbane. In New Zealand we find Colquhoun (1898) reporting a big epidemic of rubella and noting the heavy incidence among the adult population. It is evident that, notwithstanding the slow communication between the colonies, there was a widespread outbreak of rubella in Australasia in 1898. The admissions to hospitals in later years would perhaps be useful in determining the incidence of the disease. At present this information is not in a condition to be included in this paper. Dr. W. J. Stevenson (personal communication) has found that 1923 and 1924, among others, were years of high rubella incidence in Melbourne.

Conclusions and Summary

Deafness has appeared in epidemic form in Australia in the past, notably among children born in 1899, 1916, 1924, 1925, and in 1938-41. There is some presumptive evidence that all these epidemics, with the exception of that in 1916, were caused by antecedent epidemics of rubella.

Until there are more detailed studies of the epidemiology of deaf-mutism in other countries, we cannot tell if the conditions which brought about the several epidemics of deaf-mutism in Australia are peculiar to it. It will be of interest to inquire whether in other more populous countries the disease virtually dies out in the interepidemic periods and a large reservoir of non-immunes are produced, with the occurrence of infection irregularly in childhood and adult life, giving rise to cases of maternal rubella.

ADDENDUM.—Since this paper was written Mr. N. E. Murray, director of the Commonwealth Acoustics Laboratory, Sydney, has informed me that he has audiograms of four persons born in New South Wales in the years 1924-5, each of the form likely to be encountered in patients deaf as a result of maternal rubella. The first of these patients, a female born on June 8, 1924, had a history strongly suggestive of maternal rubella and had been referred to Mr. Murray with the diagnosis already made. The second patient was a male born on July 4, 1925. His sister claimed that his mother had had rubella at the sixth month of pregnancy. The third and fourth patients, a male and a female, could not be traced for further questioning or the exact date of their birth, which had been stated to be approximately 1924. It is apparent that in the years 1924 and 1925, which I had regarded only tentatively as epidemic, there were persons born deaf as a result of maternal rubella.

I have to thank the Director-General of Health, Commonwealth of Australia, for permission to publish this paper; the superintendents of the institutions for the deaf, dumb, and the blind in the various states for abstracting or allowing me access to their records of admissions; and Professor L. Dods for encouragement and criticism in the preparation of this paper. Mr. W. D. Davies has drawn the graph.

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An article in the *New York Times*, December 3, has some interesting notes on various aspects of dentistry, culled from recent meetings of the American Academy of Dental Medicine and the New York Society of Dentistry for Children. One speaker emphasized the importance of psychiatric knowledge, because of a relation between diseases of the mouth and emotional disorders. Another felt that the good dentist should observe the patient as a whole and not merely his mouth, so that the proper time was chosen to refer him to a doctor. Dr. H. R. Klein, assistant professor of children's dentistry at New York University, said that premature extraction of the primary or milk teeth was responsible for at least 50% of adult tooth trouble. Parents often saw no harm in the extraction of teeth which would later fall out anyway, but in fact it led to malformation of the permanent teeth which followed. Every effort should be made to conserve teeth wherever possible.