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CHICKENPOX IN KERALA

by

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Introduction

During January and February 1976, 45 deaths due to chickenpox (varicella) were reported to the Smallpox Eradication unit by the State of Kerala. No chickenpox deaths had been reported from neighbouring States during this period, although investigation indicated that not all chickenpox deaths had been reported. At that time, eight deaths in Kerala were investigated by visiting the homes of those who had died. In each case, there was clear epidemiological evidence that the patients had been suffering from chickenpox, and not smallpox at the time of their death.

Chickenpox is a notifiable disease in Kerala and chickenpox deaths have been recorded since 1973. Each year the number of reported chickenpox cases begins to rise in October, reaches a maximum in January and February and then falls off from April, when the rainy season begins, to reach its lowest level in July and August (Table 1). The notifications of deaths due to chickenpox have followed the same pattern.

TABLE 1. DISTRIBUTION OF DEATHS BY MONTH REPORTED

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1975	27	21	11	1	5	2	3	2	6	10	11	8	107
1976 (Jan.-Mar.)	41	58	54	.....	.....	.....	.....	.....	.....	.....	.....	.....	153

At the end of March 1976, a further visit was made to Kerala. On this occasion, all 11 districts were visited and a retrospective investigation of all chickenpox deaths during the period November 1975 to March 1976 was performed. This was done partly by field investigation and partly by examination of the records available at the offices of the District Medical Officers and Primary Health Centres (PHCs). As a means of estimating the incidence and age/sex distribution of chickenpox cases in Kerala, a selected PHC was visited in each district and information on the age/sex distribution of the cases of chickenpox recorded in the Infectious Disease Register was noted. The Medical Officers in charge of these PHCs were asked to submit details of the age/sex distribution of all chickenpox cases detected during the Active Smallpox Search in April 1976. Basic information on all recorded chickenpox deaths for 1975 was obtained from the records at the district level offices.

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Results of investigation

There is a wide variation in the number of chickenpox deaths reported by district (Table 2). This cannot be related to the population of the districts or to the incidence of chickenpox in the district, as calculated from the notifications (see Appendix). It is possible that in some districts, the reporting of chickenpox deaths is not complete.

TABLE 2. DISTRIBUTION OF CHICKENPOX DEATHS BY DISTRICT

District	1975	1976 (Jan.-Mar.)	Population (1000s)
Trivandrum	13	28	2 199
Quilon	27	42	2 413
Alleppey	10	14	2 126
Kottayam	11	11	1 539
Iduki	7	2	766
Ernaculum	13	14	2 164
Trichur	10	8	2 129
Palghat	6	16	1 625
Malapuram	1	5	1 856
Kozhikode	7	5	2 106
Cannanore	2	8	2 365
Total	107	153	21 288

The information obtained from the Active Smallpox Search in April 1976, and from the PHC Infectious Diseases Registers indicates that more than 70% of all cases of chickenpox occur in those aged less than 30 and only 3% of the cases occur in those aged 60 or more.

Fewer than 10% of the deaths recorded were in those aged less than 30 but almost 60% were in those aged 60 or more (Table 3). There is also a considerable excess of males in the reported deaths. The prevalence rates in males and females, estimated from the data obtained in the April 1976 Search are similar, 69 per 100 000 for males and 71 for females. The estimated population for Kerala in 1974 was 22 739 000, of which 49.7% were male and 50.3% female. There may be a sex bias in the reporting of chickenpox cases. Notification frequently results from application for a medical certificate to explain absence from school or work and this is required more often for males than for females. This bias is unlikely to extend to the reporting of deaths so these figures may represent a real difference between men and women in the case fatality rate.

A more detailed study was made of the deaths which occurred during the period November 1975 to March 1976, inclusive. A higher number of deaths were reported during this period than in previous years. Medical officers in Kerala felt that there were more cases of chickenpox than usual during these months and hence more deaths. The first few months of 1976 were unusually dry; no rain fell until the end of March. The unusually high incidence of chickenpox cases and deaths may have been associated with the weather conditions.

Information on the deaths investigated was obtained from records at the PHCs and District Medical Offices, supplemented by field visits where possible. In most cases, investigation of the deaths had been made by the PHC Medical Officer or Paramedical Assistant (PMA) at district level. Subsequently, some families were visited by medical officers from State or district level or by a WHO epidemiologist. Thirty-one per cent. of all deaths were investigated by a medical officer from the State level or from WHO. In only three cases (2%), no medical officer or senior PMA was involved in the investigation (Table 4).

TABLE 3. DISTRIBUTION OF CHICKENPOX DEATHS BY AGE AND SEX

Age in years	1975			1976 (Jan.-Mar.)		
	Male	Female	Total	Male	Female	Total
0-	2	2	4	4	1	5
5-	2	-	2	-	1	1
10-	2	-	2	1	-	1
15-	1	1	2	-	2	2
20-	-	1	1	1	2	3
30-	9	-	9	5	3	8
40-	19	-	19	15	1	16
50-	11	2	13	23	3	26
60-	13	5	18	18	9	27
70+	31	6	37	43	21	64
Total	90	17	107	110	43	153

TABLE 4. DESCRIPTION OF OFFICER INVESTIGATING CHICKENPOX DEATHS, 1975-76

Description	No. of cases	%
WHO epidemiologist	25	14.5
State Programme Officer or Smallpox Team Leader	29	16.9
District Medical Officer	38	22.1
PHC Medical Officer	55	32.0
District PMA	22	12.8
Health Supervisor or Sanitary Inspector	3	1.7
Total	172	100.0

An essential part of the investigation was the determination of the deceased person's vaccination status. This was frequently difficult to obtain from the relatives. Table 5 shows that, even if those for whom no history was obtained are included in the unprotected group, these make up only 14% of the total. Of those who died, 25% had been revaccinated less than five years before death.

TABLE 5. SMALLPOX IMMUNITY STATUS OF REPORTED CHICKENPOX DEATHS

Vaccination status	Number	%
Previous smallpox	1	0.6
Revaccinated, <5 yr prev.	43	25.0
Revaccinated, >5 yr prev.	9	5.2
Primary vacc., >5 yr prev.	5	2.9
Revaccinated, date unknown	90	52.3
Not vaccinated	5*	2.9
Vacc. status unknown	19	11.0
Total	172	99.9

* All five in this group were children less than one year of age.

Twelve specimens were submitted for virological examination; five were from the bodies of those who died, six from vaccinated contacts and one from an unvaccinated contact. All 12 specimens were negative for variola.

In each case, epidemiological evidence indicated that the disease from which the patient was suffering at the time of his death was chickenpox. In 130 cases, other family members had chickenpox at the time of the investigation and, in 41 cases, there were outbreaks in the neighbourhood. In only one case was it impossible to obtain a history of contact with a known case of chickenpox.

An attempt was made in all cases to obtain a clinical history of the terminal illness. The quality of the information was variable but usually a history from the family was all that was available as many patients were not seen by a medical practitioner during the course of their illness. Table 6 indicates the level of medical care received. It is not complete as advice was sometimes sought from more than one source. It is probable that consultations with homeopathic and ayurvedic practitioners were under-reported when the questioners were allopathic practitioners.

Five of those who died had recovered from chickenpox, with separation of all scabs, some time before their death. All five died from three to five weeks after the onset of the disease; one died of gastroenteritis, one of intestinal obstruction, one of old age and debility and, in two cases, the cause of death was not determined.

TABLE 6. MEDICAL ATTENTION RECEIVED DURING THE TERMINAL ILLNESS

Type of care	Number of patients
Hospital	15
PHC Medical Officer	20
Private practitioner	16
Homeopathic practitioner	4
Ayurvedic practitioner	5
Health Supervisor/Sanitary Inspector	5
Basic health worker	10
None	97
Total	172

TABLE 7. TIME ELAPSING BETWEEN ONSET OF DISEASE AND DEATH

Time in days	Number	%
<5	10	5.8
5-9	84	48.8
10-14	51	29.7
15-19	22	12.8
20+	5	2.9
Total	172	100.0

The diagnostic groupings used in Table 8 are, of necessity, arbitrary and are described below.

Enceph. - varicella encephalitis. In each case, the patient received medical attention and the diagnosis of the attending physician was accepted.

1°pneu. - varicella pneumonia. Where this was given as the cause of death by the investigating officer, it was usually accepted. Also included in this group were those with a clear history of respiratory symptoms of early onset and where death occurred within seven days after onset of rash.

2°inf. - secondary bacterial infection of the lesions. This was accepted as the cause of death when infection of the lesions, with fever, was described as the most striking aspect of the disease.

2°pneu. - secondary lower respiratory tract infection. In this group were placed all those where the attending medical practitioner made this diagnosis and those who developed respiratory symptoms fairly late in the course of the disease. Also included in this group were those cases where it was indicated that chickenpox had precipitated an "acute-on-chronic" respiratory infection.

Old age - included in this group were all those for whom the cause of death was given as "old age and debility", with or without an accompanying chronic complaint.

Other illness - in this group are those in whom it was considered that, although chickenpox might have precipitated the death, the underlying cause of death was a chronic condition or an acute illness already under treatment when the chickenpox rash developed.

Chronic condition:	Diabetes	2
	Ulcerative colitis	2
	"Chronic uraemia"	1
	Debilitated child, "fits since birth"	1
Disease under treatment:	Urinary infection	2
	Congestive cardiac failure	5
	Cerebrovascular accident	1
	Pulmonary tuberculosis	3
	Ascaris respiratory infest.	2
	Cancer	2
	Leukaemia	1
	Dysentery	2

Unrelated illness - this group is composed of those who developed an apparently unrelated illness, considered to be the cause of their death, during the course of their chickenpox infection.

Myocardial infarction	8
Acute abdominal conditions (no surgery performed)	4
Haematemesis	2
Acute dysentery	3

It is possible that some of these apparently "unrelated" deaths were a direct result of chickenpox. The medical literature contains accounts of individual cases in whom lesions of chickenpox in the gut, peritoneum, myocardium and mucous membranes have been found. Such cases have presented variously with haematemesis, melaena, gastritis and abdominal pain. Usually such cases are reported in adults and, where chickenpox is unusual in adults, such cases are rare. It is possible that, in Kerala where chickenpox in adults is relatively common, such complications may occur frequently enough to be remarked upon. The relatives of those who had died frequently volunteered the information that, during the last few days of life, the patient's main complaint was of pain in the throat and difficulty in swallowing. Lesions of the mucous membranes have been described in chickenpox and these symptoms may indicate that similar lesions were present in the oesophagus in these patients. However, in this study, only those who had died, apparently as the result of chickenpox were considered. No information was available on the incidence of complications in those adults who recovered from the disease.

TABLE 8. CAUSE OF DEATH BY SEX AND AGE

Sex	Enceph.	1°pneu.	2°inf.	2°pneu.	Old age	Other illness	Unrelated illness	Late	Total
Male	5	23	8	31	26	14	16	3	126
Female	1	8	-	10	10	11	4	2	46
Total	6	31	8	41	36	25	20	5	172
Age in years									
0-	-	1	-	4	-	1	-	-	6
5-	-	1	-	-	-	-	-	-	1
10-	-	-	-	-	-	1	-	-	1
15-	-	-	-	-	-	2	-	-	2
20-	1	1	-	-	-	-	1	-	3
30-	-	2	-	-	-	3	2	1	8
40-	1	6	1	4	-	2	4	1	19
50-	1	5	2	11	-	6	5	1	31
60-	1	5	-	11	3	5	4	1	30
70+	2	10	5	11	33	5	4	1	71
Total	6	31	8	41	36	25	20	5	172

The large number of males in this group of chickenpox deaths has already been remarked upon.

In this series, all six cases of varicella encephalitis were in adults over the age of 20 years. It is usually considered that encephalitis is commoner in young children. This may be another example of an uncommon complication of the disease in adults which appears to be relatively common in Kerala because of the high incidence of chickenpox in adults.

Varicella pneumonia has followed the accepted pattern with most cases occurring in adults and a few in very young children. This is a relatively common complication of chickenpox and here the pattern is similar to that seen in countries where chickenpox is predominantly a disease of childhood. Only a small number of those who developed respiratory symptoms were treated with antimicrobial drugs. This factor may have contributed to the comparatively high number of middle-aged persons who died of secondary pneumonia.

Conclusions

Although chickenpox deaths are numerous in Kerala, it is mainly the old who die as a result of this disease. The incidence of the disease in adults appears to be higher in Kerala than in the northern states of India and in Western Europe and the United States of America. But even in Kerala, most cases occur in school-age children and here the morbidity and mortality is slight and possibly no higher than in other states or countries. In Europe, it is generally accepted that chickenpox can be a severe disease in adults with a considerably risk of death in older age-groups (Christie, 1974).

In Kerala today, the general picture suggests that chickenpox is a "new" disease with a high incidence in non-immune adults and so has a relatively high mortality (Millous 1936). Herpes zoster is almost unknown in Kerala which suggests that primary infection with the varicella zoster virus has not been widespread. Kerala is a land of inlets and lagoons and each family prefers to have a separate house and garden area. In the past, transport was

difficult and contact between communities slight. Traditionally, cases of chickenpox have been isolated with no visitors coming to the house and the case nursed by someone who had already had the disease. Now, roads and bridges have improved and Kerala is the most highly literate state in India. Over 90% of the children attend school, frequently travelling by public transport to another area to do so. The population today is much more mobile than it was 20 years ago and a highly infectious disease like chickenpox can now be disseminated widely in a short space of time. Possibly, as non-immune adults are infected over the next few years, the pool of susceptibles over school-age will decrease, as most schoolchildren contract the disease during their schooldays. It may be that, in 15 or 20 years time, the age distribution of cases of chickenpox in Kerala will be similar to that of Europe and the United States of America and chickenpox deaths will become rare.

APPENDIX

POPULATION OF KERALA STATE, BY AGE AND SEX (IN THOUSANDS)
(AS ESTIMATED IN 1974 , GOVERMENT OF INDIA)

Age	Male	%	Female	%	Total	%
0-	1 715	15.2	1 639	14.3	3 354	14.7
5-	1 566	13.9	1 496	13.1	3 062	13.5
10-	1 363	12.1	1 323	11.6	2 686	11.8
15-	1 161	10.3	1 152	10.1	2 313	10.2
20-	1 848	16.3	1 923	16.8	3 771	16.6
30-	1 353	12.0	1 470	12.9	2 823	12.4
40-	990	8.7	1 053	9.2	2 043	9.0
50-	688	6.0	700	6.1	1 388	6.1
60-	407	3.6	430	3.7	837	3.7
70+	215	1.9	247	2.2	462	2.0
Total	11 306	100.0	11 433	100.0	22 739	100.0

PHCs PROVIDING INFORMATION ON CHICKENPOX DETECTED IN
ACTIVE SMALLPOX SEARCH, 1976

District	PHC	Pop. of PHC
Trivandrum	Vizhinjam	82 800
Quilon	Thrikadavoor	116 000
Alleppey	Mannar	71 000
Kottayam	Adhirampuzha	151 500
Iduki	Purapuzha	102 600
Ernaculum	Kumbalangi	51 400
Trichur	Vellanikara	147 100
Palghat	Alanallur	145 400
Malapuram	Kuttipuram	144 000
Kozhikode	Balussery	161 100
Cannanore	Iritty	218 200
Total		1 391 100

Chickenpox is a notifiable disease in Kerala. Each district provides the Directorate of Health in Trivandrum with the number of cases in that district for each month. In November 1975, a study of the epidemiology of chickenpox was attempted and each PHC was asked to provide details of their chickenpox notifications by month of year and by age/sex distribution, for 1974. Unfortunately, the notifications received as a result of these requests differed and differed from those previously submitted to the Directorate.

Appendix

DATA ON CHICKENPOX NOTIFICATIONS, FROM OFFICIAL NOTIFICATIONS AND AS A RESULT OF SPECIAL REQUESTS

Source	1973		1974		1975	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
Quoted by Mendez						
Notifications	12 680	0	26 139	26	Not given	
Data from PHC						
by month	15 055	11	42 456	40	Not given	
by age-group	Not given		44 909	31	Not given	
Directorate notifications (1976)	16 827	16	37 803	90	51 139	89*

* Although only 89 deaths were notified to the Directorate of Health for 1975, examination of the records at the District Medical Offices, gave a total of 107 deaths in 1975.

This table indicates that the notifications have been inconsistent in the past and it is probable that the largest figures given above represent the minimum number of cases and deaths which have occurred in the State. The increase in both cases and deaths since 1973 may be accounted for, at least in part, by the increased interest in chickenpox in the State over this period.

Using the estimated population of Kerala for 1974 and the highest figures given in the table above, the estimated minimum annual incidence of chickenpox, the crude death rate and the case fatality rate have been calculated for the years 1973-75.

	1973	1974	1975
Annual incidence (per 100 000)	74.0	197.5	224.9
Death rate, crude (per 1000)	0.0007	0.0040	0.0047
Case fatality rate (per 100)	0.10	0.20	0.21

The notifications of chickenpox cases to the Directorate of Health for February 1976 amounted to 9538. Details of 1028 cases of chickenpox were entered in the chickenpox registers of the 11 PHCs visited for the same month. The total population of these 11 PHCs (one in each district of Kerala) is 1 391 100. If they can be considered representative, one would have expected almost 17 000 cases to have been reported in the State during the month of February. Even allowing for a substantial error on such an estimation, there appears to be under-notification.

Medical officers in Kerala are of the opinion that most cases of chickenpox occur in adults. The notifications seem at first sight to support this view. Such notifications may be biased. They frequently result from an application to a medical officer for a medical certificate to explain absence from school or work, hence cases in children may not

Appendix

be reported so frequently. Similarly, medical officers are more aware of cases where complications have arisen and this is more likely to happen in adults than in children.

Mendez (1976) obtained information on the notifications, by age-group, from the Infectious Disease Registers of 138 of the 166 PHCs in Kerala. Although a higher percentage of the notified cases occurred in adults than would be expected in a "disease of childhood", the distribution of cases is similar to the age distribution of the population as a whole but shows an excess of cases in the school-age group, 5-15 years, over the number expected if the distribution of cases was random. The total population for the 138 PHCs from which data was obtained has not been given so it is not possible to calculate the incidence of the disease by age-group for 1974. The information obtained from the Infectious Disease Registers of the 11 PHCs for February and March 1976 shows a similar distribution of reported cases by age-group.

During the Active Smallpox Searches, inquiry is made about cases of chickenpox in the household and information on the age and sex of the cases recorded. This information was supplied by each of the 11 PHCs. As all cases occurring in the household are recorded by the search worker, there should be no bias in the reporting of the cases detected in the Search. As in the PHC Registers, it appeared that a large percentage of the cases occurred in school-age children and a larger proportion of the cases was reported from young children, aged less than five years. A prevalence rate for the period of the Search was calculated, using the age-structure of the population as a whole and the total population of the 11 PHCs.

It can be seen from the table below that the prevalence rate for chickenpox cases found in the April Search was greatest in the 5-15 age-group; the prevalence then drops for the older age-group. This is consistent with the epidemiology of the disease, as observed in the West. The infection is commonest in school-age children and is spread via the schools. The children take the disease into their homes. In Kerala, where there is a non-immune adult population, the disease is spread to older family members as well as to younger siblings. The incidence of the disease is similar in males and females.

Appendix

CHICKENPOX NOTIFICATIONS FOR KERALA, 1974, AND 11 PHCs FOR FEBRUARY AND MARCH 1976 AND REPORTS FROM ACTIVE SMALLPOX SEARCH, APRIL 1976

Age	Pop. Kerala (%)	1974 (138 PHCs)	1976 (11 PHCs)		1976, April Search	
			Feb.	Mar.	Number	Prev./100 000
0-	14.7	3 085 6.9%	67 6.5%	47 5.8%	131 13.3%	64
5-	13.5	7 731 17.2%	184 17.9%	109 13.4%	199 20.2%	102
10-	11.8	8 080 18.0%	217 21.1%	198 24.4%	166 16.9%	101
15-	10.2	5 659 12.6%	107 10.4%	99 12.2%	102 10.4%	72
20-	16.6	7 342 16.3%	177 17.2%	119 14.6%	137 13.9%	59
30-	12.4	5 719 12.7%	127 12.4%	118 14.5%	96 9.8%	56
40-	9.0	3 966 8.8%	84 8.2%	91 11.2%	86 8.7%	69
50-	6.1	2 329 5.2%	34 3.3%	15 1.8%	41 4.2%	48
60-	3.7	1 001 2.2%	15 1.5%	12 1.5%	16 1.6%	31
70+	2.0		9 0.9%	4 0.5%	10 1.0%	36
N.K.			7 0.7%	1 0.1%	-	
Total	100.0	44 912 99.9%	1 028 100.1	813 100.0	984 100.0	71
Sex						
Male	49.7	22 629 50.4%	520 50.6%	373 45.9%	473 48.1%	69
Female	50.3	22 283 49.6%	508 49.4%	440 54.1%	511 51.9%	73
Total	100.0	44 912 100.0%	1 028 100.0%	813 100.0%	984 100.0%	71

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