Prevalence of Leprosy in Gudiyatham Taluk,⁴ South India Part I. Specific Rates with Reference to Age, Sex and Type^{1,2}

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Studies on the existence of leprosy in different parts of the world have shown wide variations not only in terms of the total prevalence rate but also with regard to the type of leprosy seen (12). At the same time certain common trends have been noticed such as the predominance of males as compared to females and the excess of cases among adults as compared to children. Control of leprosy depends upon the knowledge available on the epidemiological features of the disease and more data appears to be necessary if further progress is to be made. A preliminary report on prevalence of leprosy in Gudiyatham Taluk,4 South India, has been published (5,9). A further paper described the familial aggregation of leprosy and discussed the relationships observed (8). In this paper a detailed description of the prevalence is given and discussed with specific reference to age, sex and type.

MATERIALS AND METHODS

Gudiyatham Taluk (area: 510 sq. miles) is one of the eleven administrative divisions of North Arcot District in Tamil Nadu, South India. A detailed description of this area has already been given (5). According

⁴ An administrative subdivision of North Arcot District.

to the 1961 census, the population of the area was 385,228 of which 40.3% were below 15 years of age. Seventy-eight percent of the population reside in rural areas, the chief occupation being agriculture. The climate of the area is warm throughout the year with a low relative humidity and an average rainfall of 800-900 mm per year. The leprosy control program began in the latter part of 1962 and the entire population was subjected to a screening survey by 1967. Trained paramedical workers, each responsible for a population of about 20,-000, were given necessary orientation towards the survey and examination. Cases suspected of leprosy were referred to the nearest peripheral clinic and subjected to detailed clinical assessment by a physician. Skin smears were taken and the Bacterial Index determined according to Ridley's scale (10). Classification as to type was based on these and clinical findings. A re-survey of this area was completed during 1969-1970. Excluding Gudiyatham town, which has to be treated separately due to a high migration rate, a total of 305,096 persons were surveyed, of which 276,568 (91%) were examined as of April 1970. Nearly 95% coverage by examination was achieved among children as compared to 85% among the adult males and 90% among adult females. Sample checks revealed that the omissions were random and the chief reason for nonavailability was the absence of the persons from home due to occupation. The numbers examined in each age group by sex are shown in Table 1.

Up to the end of April 1970, a total of 8,909 patients were discovered and registered. Of these, 538 belong to Gudiyatham town which is not included in this paper. Another 726 patients were from outside the taluk and 503 had died, migrated or were otherwise lost to follow-up. Thus, there were 7,142 patients resident in the study

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TABLE 1. Distribution of population examined by age and sex.

Age group	Male	' Female	Total
0-4	23,006	22,139	45,145
5-9	20,694	20,181	40,875
10-14	17,652	16,004	33,656
15-19	11,268	10,557	21,825
20-24	10,218	11,076	21,294
25-29	9,979	11,146	21,125
30-34	8,156	8,951	17,107
35-39	7,790	7,941	15,731
40-44 ·	6,951	6,685	13,636
45-49	6,134	5,673	11,807
50-54	5,380	5,143	10,523
55-59	3,523	3,198	6,721
60-64	3,605	3,675	7,280
65-69	1,887	1,821	3,708
70 or more	3,165	2,970	6,135
Total	139,408	137,160	276,568

group. Sex ratio Age group Population Patients 0-4962 864 5-9 975 780 10-14 907 826 15 - 19937 55220-24 1,084 553 25-29 1,117 710 30-34 1,097 887 35-39 1,019 908 40-44962 65245-49 925 768 50-54956 704 55-59 908 563 60-64 1,019825 65-69 965 827 70 or more 938 455 Total 984 731

TABLE 2. Sex ratio of patients in each age

area who comprised the material for this paper. For each patient registered the basic details regarding age, sex and type were available from the records.

RESULTS

Of these 7,142 patients, 1,814 or 25.4% were children (persons less than 15 years of age). While there were 984 females per 1,000 males in the population examined, there were only 731 female patients per 1,000 male patients. The sex ratios (number of females per 1,000 males) of the patients in the various age groups are shown in Table 2. The total prevalence rate

in the area is 25.82 per 1,000 population. Among children it was 16.35 for boys and 13.92 for girls. Among adults, the prevalence rate was 40 for men and 27.97 for women. The difference between the males and females among adults attains statistical significance (P < .01), but not so among children. The age-specific prevalence rates are displayed in Figure 1.

The prevalence rate increases rapidly with age up to the age group 15-19 years for males and up to the age group 10-14 years for females. There is depression in the age group 20-24 years for males and in



FIG. 1. Age-sex prevalence rate.

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the age group 15-24 years for females. Subsequently, the prevalence rate increases with age in both the sexes up to the age group 50-54 years after which it declines.

The type specific rates per 1,000 were 4.55 for lepromatous, 2.71 for borderline, 14.33 for tuberculoid, and 4.23 for indeterminate. The prevalence by type of leprosy among children and adults by sex is shown in Table 3.

In general, the prevalence rates among females were significantly less than that among males for every type of leprosy. However, in children the differences between boys and girls by type were not significant except for the tuberculoid type; whereas among adults, the differences were significant for all types of leprosy (P < .01). The prevalence rates for the lepromatous and borderline types by age groups in each sex are presented in Table 4.

In the lepromatous type of leprosy, the peak prevalence is seen in the age group 50-54 years for males and 45-49 years for females. In the borderline (intermediate) type of leprosy, the peak prevalence is seen in the age group 55-59 years for males and 50-54 years for females.

It is interesting to note that the depression seen in the age-sex specific total prevalence rate in the age group 15-24 years does not hold good in the case of the lepromatous type and is negligible in the case of the borderline type.

The prevalence rates of tuberculoid and indeterminate types in different age groups by sex are given in Table 5.

For males, the prevalence rate of tuber-

TABLE 3. Type-specific prevalence rate by sex among children and adults.

Туре		Male			Female		
	Children	Adult	Total	Children	Adult	Total	Total
Lepromatous	0.41	11.13	6.41	0.33	4.39	2.66	4.55
Borderline	0.73	5.38	3.34	0.84	2.97	2.06	2.71
Tuberculoid	10.61	18.91	15.26	9.04	16.62	13.39	14.33
Indeterminate	4.60	4.57	4.58	3.72	4.00	3.88	4.23
All types	16.35	40.00	29.59	13.92	27.97	22.00	25.82

TABLE 4. Prevalence rate of lepromatous and borderline types of disease by age and sex per 1,000 population.

Age group	Lepromatous type			Borderline type		
	Male	Female	Total	Male	Female	Total
0-4	0.00	0.00	0.00	0.04	0.05	0.04
5-9	0.19	0.10	0.15	0.58	0.64	0.61
10-14	1.19	1.06	1.13	1.81	2.19	1.96
15-19	3.82	1.61	2.75	3.90	2.56	3.25
20-24	6.26	2.44	4.27	4.21	2.08	3.15
25-29	10.92	3.95	7.24	4.91	2.78	3.79
30-34	13.24	6.48	9.70	6.25	2.79	4.44
35-39	12.84	5.92	9.34	4.62	4.16	4.39
40-44	14.82	4.94	9.97	6.76	3.74	5.28
45-49	17.93	8.11	13.21	6.52	4.05	5.34
50-54	21.19	5.83	13.68	7.81	4.86	6.37
55-59	15.04	5.94	10.71	11.92	2.81	7.59
60-64	10.54	3.81	7.14	2.77	1.36	2.06
65-69	9.54	4.39	7.01	2.65	1.65	2.16
70 or more	2.84	1.01	1.96	3.48	1.68	2.61
Total	6.41	2.66	4.55	3.34	2.06	2.71

Age group	' Tuberculoid type			Indeterminate type			
	Male	Female	Total	Male	Female	Total	
0-4	0.61	0.50	0.55	0.30	0.32	0.31	
5-9	12.23	10.01	11.13	5.22	3.82	4.53	
10-14	21.75	19.62	20.74	9.46	8.31	8.91	
15-19	23.96	14.49	19.38	7.72	4.55	6.19	
20-24	17.81	8.40	12.91	4.11	3.61	3.85	
25-29	19.04	14.89	16.85	5.21	3.86	4.50	
30-34	23.66	23.80	23.73	4.78	5.70	5.26	
35-39	18.49	20.53	19.52	4.49	5.41	4.96	
40-44	21.29	19.30	20.31	3.02	3.14	3.08	
45-49	17.44	21.33	19.31	4.56	5.11	4.83	
50-54	19.89	24.30	22.05	3.90	3.89	3.90	
55-59	14.48	16.26	15.33	3.97	3.13	3.57	
60-64	11.65	14.97	13.32	1.94	1.63	1.79	
65-69	13.25	15.93	14.56	2.12	1.65	1.89	
70 or more	5.37	3.70	4.56	2.21	0.34	1.30	
Total	15.26	13.39	14.33	4.58	3.88	4.23	

TABLE 5. Prevalence rate of tuberculoid and indeterminate types of disease by age and sex per 1,000 population.

culoid type leprosy increases with age and attains its peak in the age group 15-19 years after which it declines with random fluctuations. The depression is more in the age group 20-24 years. For females, the rate increases steadily with age up to the age group 10-14 years. After a deep depression in the age group 20-24 years the rate increases with age until it attains its peak in

TABLE 6. Lepromatous index by age and sex.

Age group	Male	Female	Total	
0-4	0.00	0.00		
5-9	1.06	0.68	0.89	
10-14	3.48	3.41	3.45	
15-19	9.68	6.94	8.71	
20-24	19.34	14.75	17.67	
25-29	27.25	15.49	22.37	
30-34	27.62	16.71	22.49	
35-39	31.75	16.43	24.46	
40-44	32.29	15.87	25.81	
45-49	38.60	21.00	30.95	
50-54	40.14	15.00	29.75	
55-59	33.13	21.11	28.80	
60-64	39.18	17.50	29.38	
65-69	34.62	18.60	27.37	
70 or more	e 20.45	15.00	18.75	
Total	21.67	12.10	17.63	

the age group 50-54 years, after which the rate decreases.

In the case of the indeterminate type, the prevalence rate increased with age until it reaches its peak in the age group 10-14 years. After that the rate decreases with age in both males and females.

The lepromatous index (number of lepromatous cases in 100 patients with leprosy) is presented by age and sex in Table 6.

The lepromatous index among males increased with age steadily up to 50-54 years, after which it shows a decline. Among females, the index increases up to the age group 20-24 years and remains steady subsequently with random fluctuations. The prevalence rates are described further by age and type among males in Figure 2, and among females in Figure 3.

The trends mentioned earlier can be seen clearly in the two figures especially with regard to the lepromatous prevalence among males.

DISCUSSION

Observations throughout the world have shown that leprosy is more common among males than females (⁴). It has been suggested that females have greater resistance to infection except at periods of life involv-



FIG. 2. Prevalence rate for male by age and type of disease.

ing special strain and that the males are infected more probably because of greater strain borne by men and the greater opportunity that they have for contacts with infectious patients while away from home. Lowe (6) suggested that there may be a possibility of a physiological element in the endocrine or cytological make-up of women as compared to men. On the other hand, it has been suggested that the apparent sex differences are due to the difference in the probability of ascertainment of leprosy between men and women (11). No definite conclusion has been arrived at for the cause of the variation of prevalence among males and females.

The prevalence of the lepromatous type of leprosy is more predominant among males than females. The sex ratio of lepromatous prevalence rate is 2.4:1, 1.6:1 for borderline type, 1.1:1 for tuberculoid, and 1.2:1 for indeterminate leprosy. Guinto, Rodriguez and Doull (³) reported that the lepromatous prevalence rate was reduced by 14 years treatment while total prevalence remained the same in Cordova and Talisay, Cebu Province in the Philippines.

The prevalence among adults is more than twice that of children. The prevalence rate increases with age up to the age group 54-59 years with depression in the age group 15-24 years. Similar results have been noted by other investigators (2.4.7). Brown (²) suggested that the opportunity for infection occurs at two periods separated by an interval during which losses by death are not replaced by new cases. The first period is childhood and involves susceptible adolescents of healthy families leaving the isolation of their homes and, for the first time, encountering the infection. The low prevalence in the older age group may be explained by the high mortality among leprosy patients, especially among lepromatous leprosy patients among the aged.



FIG. 3. Prevalence rate for female by age and type of disease.

While the total leprosy depression is noted in the age group 20-24 years for males, it is in the age group of 15-24 years for females. For the lepromatous type there is no such depression for either sex. For the borderline type, there is no such depression among males and a negligibly small depression in the age group 20-24 years for females. The depression in total prevalence in the age group 15-24 is probably due to depression in the tuberculoid type rate and partially by depression in indeterminate rate. If this is the case then the assumed two periods of infection do not hold true. The reason for the depression in the tuberculoid and indeterminate prevalence needs further investigation. One possible explanation may be the known fact that in more than half the children with tuberculoid and indeterminate types of leprosy, the disease is self-limiting and is liable to undergo spontaneous healing over a period of time. Thus with advancing age, the tuberculoid and indeterminate rate tends to drop. There may be several factors affecting the variation of leprosy among specific groups and more studies are required to throw light on this still obscure area.

SUMMARY

A total of 276,568 persons constituting 91% of the rural population in Gudiyatham Taluk, South India, were examined for the presence of leprosy. As of April 1970, a total of 7,142 leprosy patients were discovered and resident in the area; one-fourth of these were children. For every 1,000 male patients there were only 731 female patients as compared to 984 females per 1,000 males in the general population. The total prevalence rate per 1,000 was 25.82. Significantly higher rates among adults as compared to children and among men as compared to women are confirmed. The trends observed by age and sex in the total as well as in the type-specific prevalence are described. The total prevalence increases with age up to 15-19 years for males and 10-14 for females. After this, there is a depression for about a decade followed by a continually increasing prevalence up to the age of 50 years before registering a decline. There are deviations from this pattern when studied by type of leprosy. The findings are discussed in relation to comparable studies carried out elsewhere.

RESUMEN

Se examinaron un total de 276.568 personas que constituían el 91% de la población rural de Gudiyatham Taluk, India del Sur, buscando la presencia de lepra. Hasta Abril de 1970 se habían descubierto un total de 7.142 pacientes de lepra residentes en esta área; una cuarta parte de ellos eran niños. Para cada 1.000 pacientes varones habían solamente 731 pacientes hembras, en comparación con 984 hembras por cada 1.000 varones en la población en general. La tasa de prevalencia total por 1.000 fué de 25,82. Se confirmó la existencia de tasas significativamente mayores entre los adultos en comparación con los niños y entre los hombres en comparación con las mujeres. Se describen las tendencias observadas en la prevalencia total y en la prevalencia tipo-específico por edad y sexo. La prevalencia total aumenta con la edad hasta los 15-19 años para los varones y los 10-14 años para las hembras. Después de esto, hay una depresión durante alrededor de una década, seguida de una prevalencia continuamente creciente hasta la edad de 50 años, antes que se registre un descenso. So observan desviaciones de este patrón cuando el estudio se hace por tipo de lepra. Se discuten los hallazgos en relación con estudios comparables realizadoes en otros lugares.

RÉSUMÉ

Dans le Gudiyatham Taluk, en Inde Méridionale, 91 pour cent de la population rurale, soit un total de 276.568 personnes, ont été examinées, en vue de déceler la lèpre. Jusqu'en avril 1970, un total de 7.142 malades ont été découverts, qui résidaient dans cette région. Un quart d'entre eux était des enfants. Pour 1.000 malades de sexe masculin qui avaient été détectés, on n'a enregistré que 731 malades du sexe féminin, alors que dans la population générale, ce rapport est de 984 femmes pour 1.000 hommes. Le taux de prévalence total pour 1.000 s'élevait á 25,82. On a pu confirmer l'existence de taux significativement plus élevés parmi les adultes, comparés aux trouvés chez les enfants, de même que chez les hommes par comparison aux femmes. Les particularités des taux de prévalence par âge et par sexe sont décrites dans cet article, pour l'ensemble des malades, ainsi que par type de la maladie. La prévalence totale augment avec l'âge jusqua'à

15-19 ans pour les hommes, et jusqu'à 10-14 ans pour les femmes. Après cet âge, on constate une diminution pour environ dix années, qui est alors suivie par une prévalence qui s'accroît continuellement jusqu'à l'âge de 50 ans, avant de manifester à nouveau une diminution. Quand on étudie ce profil en fonction du type de lèpre, on constate des déviations. Les observations sont discutées en relation avec des études similaries qui ont été menées ailleurs.

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