

## HUMAN LEPTOSPIROSIS IN A SLUM AREA IN THE CITY OF RIO DE JANEIRO, BRAZIL – A SEROLOGICAL AND EPIDEMIOLOGICAL STUDY

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*A serologic survey was carried out on slum dwellers in the city of Rio de Janeiro. A total of 259 serum samples from male and female individuals of different age groups were tested for the presence of antileptospire antibodies by microagglutination. Prevalence data were analyzed in relation to the major risk factors present at the site, mainly represented by the presence of carrier animals and the occurrence of frequent floods. Of the samples tested, 25% reacted with antigens of different serogroups at titres ranging from 1:100 to 1:6400, with a predominance of titres  $\leq$  1:400; 35% of positive sera reacted with leptospirae of the Icterohaemorrhagiae serogroup. Reactions with Djasiman, Panama, Javanica, Canicola, Pyrogenes, Australis, Ballum, Sejroe, Bataviae, Grippotyphosa, Autumnalis and Cynopteri were also detected, though at lower frequencies. There was no statistically significant difference between sexes, but higher prevalence rates were found to be associated with increasing age. A focus of infection was characterized, in which social and economic factors contribute to the persistence of leptospirae by favoring the proliferation of the main reservoir.*

Key words: human leptospirosis – serology – epidemiology

Leptospirosis is a Public Health problem of increasing recognize in Brazil. The condition is endemic in large urban centers and can reach epidemic proportions after torrential rains that cause flooding in critical areas. Icterohaemorrhagiae stands out as the presumptive infecting serogroup in most leptospirosis cases recorded in Rio de Janeiro, as observed by Andrade & Brandão (1987) in 775 patients diagnosed from 1979 to 1982. Reactions with antigens of the same serogroup were also predominant in the serological diagnosis of cases detected during urban epidemic outbreaks in the states of Pernambuco (Oliveira et al., 1977), Bahia (Caldas et al., 1979) and Rio de Janeiro, where 1750 cases and 84 deaths were reported after the flood of January 1988 which affected extensive areas in the state (Secretaria Estadual de Saúde do Rio de Janeiro, unpublished results).

In the present paper we report the results of a serological survey on a low-income population from a slum area the city of Rio de Ja-

neiro. The microregion is called Parque Carlos Chagas and is located in the borough of Mangueiros between the rivers Faria and Jacaré. According to City data, this is an area of 33,240 m<sup>2</sup> with a population estimated at 2,636 inhabitants at the time of the survey. Basic sanitation conditions in this area are precarious and the frequent floods that reach the interior of the slum dwellings are part of the history of the local community. Features related to risk factors and the possible reasons of the maintenance of leptospiras in the ecosystem are discussed.

### MATERIALS AND METHODS

To obtain the cooperation of the community, the purposes of the investigation and preliminary data concerning leptospire infection among rodents and dogs in the area were explained to the public. Meetings were held with community leaders and members for ample discussion of the question of leptospirosis. Taking into consideration the probability of refusal to cooperate, which was predicted by the community leaders themselves, we established a criterion for material collection that would permit us to obtain the participation of

the largest possible number of individuals. As suggested by community members, sites for blood collection and for filling out questionnaires were selected at different points strategically distributed within the area. Collection dates were agreed upon and no efforts were spared to guarantee that this information would reach everybody. People who had been living in the community for less than 6 months were not included in the sample. The youngest age group (0-5) was not representative in the sample due to the inherent difficulties of the populations surveys and place of work. Therefore, the information related to this groups was restricted to indications of risk exposure and existence of an infection rate in children younger than 5, that must be conveniently appreciated in a further study. At the time of blood collection, a short and objective questionnaire was filled out with name and address and the main data of epidemiologic interest such as sex, age, profession, time of residence in the area, contact with animals and past or present history of leptospirosis. Additional data related to risk factors at the place of work were also recorded.

The presence of antibodies was detected by the microagglutination technique using live antigens, as described by Turner (1968) and Myers (1985). The following serovars were used as antigens: *icterohaemorrhagiae*, *coepnageni*, *javanica*, *canicola*, *castellonis*, *pyrogenes*, *cynopteri*, *autumnalis*, *sentot*, *djasiman*, *australis*, *pomona*, *grippotyphosa*, *hebdomadis*, *wolffi*, *sejroe*, *saxkoebing*, *bataviae*, *tarassovi* and *panama*.

Data were analyzed statically for association between variables by the  $X^2$  test, with the levels of significance set at 0.05 and 0.01. Data concerning prevalence per age group were adjusted according to an exponential function by the least squares method (Fleiss, 1973).

## RESULTS

A total of 259 sera and corresponding questionnaires containing data of epidemiologic interest represented the sample, which included 10% of the population studied. Sample distribution by sex and age range corresponded to the patterns for the general population, except for the 0-5 year group (Forattini, 1986). Analysis of prevalence in relation to sex and age range is shown in Table I. Both sexes were equally

susceptible to infection ( $P > 0.05$ ). Positivity indices were lower for younger groups and increased as a function of age ( $P < 0.01$ ). Table II refers to the prevalence curve shown in the Fig. in which adjustment of the histogram to an ascending curve provides an image compatible with the interpretation of cumulative risk in an endemic region.

TABLE I

Positivity by sex and age range determined by microscopic serum agglutination in the population of Parque Carlos Chagas, Rio de Janeiro, 1983

Age range <sup>b</sup>	Sex <sup>a</sup>					
	Male		Female		Total	
	Test/ Positive %		Test/ Positive %		Test/ Positive %	
0 - 5	10/2	20.00	8/-	-	18/2	11.1
6 - 10	25/3	12.00	24/5	20.83	49/8	16.3
11 - 15	19/1	5.3	28/4	14.3	47/5	10.6
16 - 25	22/5	22.7	28/7	25.0	50/12	24.0
26 - 35	17/7	41.2	15/6	40.0	32/13	40.6
36 - 45	12/6	50.0	13/3	23.1	25/9	36.0
46 - 55	10/5	50.0	7/1	14.3	17/6	35.3
56 - 65	6/4	66.6	7/3	42.8	13/7	53.8
> 65	2/2	100.0	6/2	33.3	8/4	50.0
Total	123/35	28.4	136/31	22.8	259/66	25.5

a:  $X^2 = 1.11$   $P > 0.05$  b:  $X^2 = 26.28$   $P < 0.01$ .

TABLE II

Curve of leptospirosis prevalence. Infection by age range determined by microscopic serum agglutination in the population of Parque Carlos Chagas, Rio de Janeiro, 1983

Age Group	P	$\bar{P}$
0 - 5	0.1111	0.1043
6 - 10	0.1632	0.1492
11 - 15	0.1063	0.1880
16 - 25	0.2400	0.2430
26 - 35	0.4062	0.3031
36 - 45	0.3600	0.3720
46 - 55	0.3529	0.4280
56 - 65	0.5384	0.4791
66 - 75	0.5000	0.5255

$\hat{Y} = 0.9212$   $e^{-0.0093}$   $r^2 = 0.8621$

Table III shows the prevalence and variation in titre of the 259 sera tested against serovars representative of *Leptospira interrogans*. We detected 25.5% serological positivity, a large number of cross reactions and a predominance

TABLE III

Titre prevalence and variation in 259 samples tested against serovars representative of *Leptospira interrogans* serogroups

Sero group	Serovar	Positive tests %	Titre variation	Geometrical mean of titres
Icterohaemorrhagie	<i>icterohaemorrhagie</i>	8.5	100 - 3200	220
	<i>copenhageni</i>	3.1	100 - 800	238
Javanica	<i>javanica</i>	3.1	100 - 400	119
Canicola	<i>canicola</i>	2.3	100 - 6400	898
Ballum	<i>castellonis</i>	1.5	100	100
Pyrogenes	<i>pyrogenes</i>	2.3	200 - 800	400
Cynopteri	<i>cynopteri</i>	0.8	200 - 800	400
Autumnalis	<i>autumnalis</i>	1.2	100 - 200	119
Djasiman	<i>sentot</i>	1.9	100 - 400	194
	<i>djasiman</i>	5.4	100 - 400	283
Australis	<i>australis</i>	2.3	100 - 800	178
Grippotyphosa	<i>grippotyphosa</i>	1.5	100 - 800	168
Sejroe	<i>wolffi</i>	0.4	100	100
	<i>sejroe</i>	1.2	100 - 200	159
	<i>saxkoebing</i>	0.7	400 - 1600	800
Bataviae	<i>bataviae</i>	1.5	100 - 800	283
Panama	<i>panama</i>	3.1	100 - 800	218

TABLE IV

Prevalence of anti-leptospira antibodies in the human population in relation to the presence of animals within or around the home. Parque Carlos Chagas, Rio de Janeiro, 1983

Animals	Test/Positive	Positivity	pa
Dogs	104/26	25.0	P < 0.70
Pigs	70/13	18.6	P < 0.30
Rats	205/48	23.4	P < 0.70
None	25/6	24.0	P < 0.30
Total included in the study	259/66	25.5	

a: The P values refer to the regions of acceptance of the hypothesis of independence obtained by separate analysis of each risk factor.

of low titres ( $\leq 1:400$ ). There was no report of past or present disease compatible with the diagnosis of severe forms of leptospirosis among the individuals interviewed, nor was any information given about other cases in the area.

Statistical analysis of data concerning time of residence in the area and presence of animals inside or around the house did not show significant association (Table IV and V,  $P < 0.05$ ). Association of prevalence data with main occupation was detected after sample stratification (Table VI,  $P > 0.01$ ).

TABLE V

Positivity in relation to time of residence at Parque Carlos Chagas, Rio de Janeiro, 1983

Time	Number of cases	
	Test	Positive %
6 months to 5 years	66/14	21.1
6 to 10 years	66/17	25.7
11 to 15 years	44/7	15.9
16 to 20 years	40/12	30.0
> 20 years	35/14	40.0
No information	8/2	25.0
Total	259/66	25.5

$X^2 = 8.356$

$p > 0.05$

TABLE VI

Positivity in relation to main occupation within and outside the area under study, as determined by microagglutination. Parque Carlos Chagas, Rio de Janeiro, 1983

Group/Occupation	Number of cases	
	Test	Positive %
A - Children < 5 years	18/2	11.1
B - Schoolchildren	95/13	13.7
C - Women working as maids	67/18	26.9
D - Retired persons and/or person with no defined occupation	15/8	53.3
E - Industrial and Construction workers	24/11	45.8
F - General services	40/14	35.0
Total	259/66	25.5

 $X^2 = 28.74$ 
 $P < 0.01$ 

### DISCUSSION

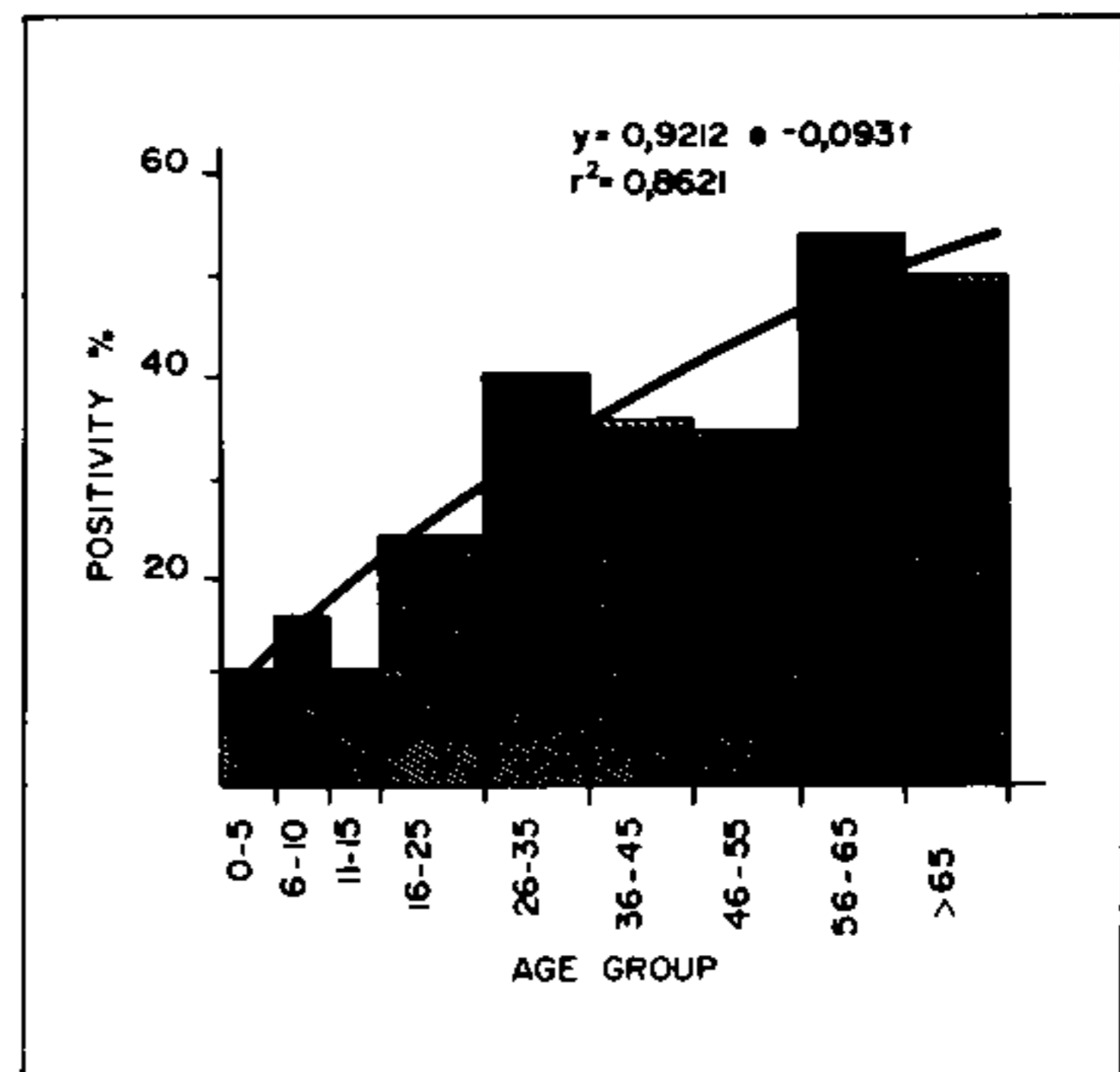
The area selected for the survey shows environmental conditions frequently reported by patients with leptospirosis in Rio de Janeiro, both in terms of risk factors the home and socioeconomic characteristics of the population. Gonçalves et al. (1981) and Andrade & Brandão (1987) have reported the epidemiologic importance of the presence of rodents in the home or work environment and the possibility of water transport of the bacteria in the history of patients with leptospirosis. These authors have also discussed the higher prevalence of the disease among adult males and the profession of affected subjects, who usually represent unqualified manpower performing diverse activities which make it difficult to identify high-risk groups.

Investigations conducted during the same year as the present study at Parque Carlos Chagas revealed the circulation of leptospiras among animals, the rate of infection being 39% in 104 rodents. Twenty strains isolated from *Rattus norvegicus* were identified as belonging to the Icterohaemorrhagiae serogroup, 7 of them belonging to the *copenhageni* serovar

(Pereira & Andrade, 1988). The rate of serologic positivity was 63% among 58 dogs that had not been vaccinated against leptospirosis (90% of the dogs at the site), with a predominance of reaction for Icterohaemorrhagiae.

The percentage of serological positivity detected in the population of Parque Carlos Chagas (25.5%) represents one of the highest indices observed in general population surveys that have been published thus far for different regions of Brazil. Lins et al. (1986) detected a 9 to 20% prevalence in the population of different areas of the Northern region located in the states of Amazonas, Pará and Maranhão. We admit a certain skewness for the Parque Carlos Chagas sample, but we believe that the 25.5% index is not far from the real prevalence for the population and that the conclusions have not been seriously distorted by the possible selection of volunteers.

No statistically significant differences were detected between sexes, confirming data reported by Alston & Broom (1958) that infection did not differ between sexes when men and women were equally exposed. In the present study, prevalence by age, in addition to showing significant differences between young and adult individuals of both sexes, permitted us to estimate a rate of infection of approximately 1% per year for this people (Table II and Fig.).



Curve of leptospirosis prevalence. Infection by age. Parque Carlos Chagas, Rio de Janeiro, 1983.

The serological profile of the population studied did not correspond to the information available about clinical cases of leptospirosis in the large urban centers of Brazil, where a sharp predominance of positive reactions to the Icterohaemorrhagiae serogroup was observed by Correa (1969/70) and Andrade & Brandão (1987). The multiple serovars involved are not explained in terms of their circulation in a microregion of the urban zone, where the number of animal species is limited. It was not possible to determine to what extent serological pattern observed reflected circumstances of natural infection involving the infecting zone, immunogenicity and virulence of the local strain, immunologic system of the host, and reinfection or past infections in other regions of the country.

If we consider the positive reactions with antigens of the Icterohaemorrhagiae serogroup independently of co-reaction and titre predominance (35% of positive serums), we may attribute a relevant weight to the probability of transmission from rodents with the participation of dogs within the area. Reactions with Canicola occurred at 16,400 titres both in human and canine sera (Pereira & Andrade, unpublished results), suggesting the presence of a member of this serogroup at the site. The low prevalence of Canicola may be related to the dynamics itself of the murine and canine populations.

Among the risk factors within the area, the presence of carrier animals is of primary importance. The fact that we did not observe significant associations leads us to conclude that multifactorial nature of the links that maintain the transmission of the agents does not permit the detection of separate causal factors. The occurrence of frequent floods probably represents a factor of dissemination of leptospirae eliminated by carrier animals.

The variables "time of residence in the area" and "main occupation" are related to the permanence in the risk environment (Tables V and VI). There was no significant relationship between the positive cases and the time of residence in the area. However the risk imputed to the studied environment can be analysed according to the report of the sample presented in Table VI. Joining school students (6-15 years of age), women, pensioners and children younger than 5, together we could have a big

risk group within the area. The group identified as "general services" included professions of low occupational risk from the epidemiological view point, such as office, school and hospital employees, drivers, doormen, etc. Industrial and construction workers were the ones most exposed to risk at the work place. Analysis of prevalence in this stratum should take into account that the components of the group were males involved in activities considered highly risky such as sewer cleaning, garbage pick-up, etc.

Interpretation of the data concerning the main occupation cannot be separated from prevalence by age, reinforcing the hypothesis of maintenance of incidence in the population and suggesting that this incidence is associated to local points of infection in other similar areas in the city of Rio de Janeiro and represent the main elements that maintain the endemic levels of the disease as well as a considerably epidemic potentiality.

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