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AN APPRAISAL OF THE EPIDEMIOLOGY OF *TRYPANOSOMA CRUZI* SEROLOGY IN BRAZIL

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A large bibliographic survey provided data on Trypanosoma cruzi *serology covering the period 1948-1984. Epidemiological-demographic methods provided an estimate of 11% for the prevalence of positive serology in Brazil, by 1984. Significant temporal trends were observed for most of the Brazilian geographical regions as well as for Brazil, as a whole. The parabolic curve that fit best for the entire country, indicates that by 1991, the incidence of new positive serology would be close to zero. This conclusion needs further fine-adjustment, since the forecast point is somewhat distant from the measured period.*

Key words: *Trypanosoma cruzi* serology – temporal variation – seroepidemiology

In the last decades, the *Trypanosoma cruzi* serology has kept the attention of many investigators, both in blood banks and in serologic field research that covered most of the Brazilian geographical regions. Although some further knowledge of the sero-epidemiologic data of *T. cruzi* infection is necessary for the understanding of the natural history of Chagas' disease as well as to disclose some patterns of the dynamics of the infection in Brazil, some broad considerations about the distribution of Chagas' disease in Brazil are already known (cf. Castro Filho & Silveira, 1979).

Several large sero-epidemiological surveys were conducted in Brazil (Castro Filho & Silveira, 1979; Camargo et al., 1984), providing a good picture of *T. cruzi* infection in Brazil, at a certain momment of the Chagas' disease natural history in the country.

These informations together with the available sero-epidemiological data collected by many studies, performed in different times and places could provide some further clues on the trends of this infection in Brazil. The present study is an attempt to disclose some of these trends, by means of epidemiological and demographic methodologies.

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MATERIALS AND METHODS

A large bibliographical search provided data, from 1948-1984, on the serology of *T. cruzi* infection. This search included 131 articles with 196 samples, derived mainly from blood bank data and field sero-epidemyological surveys. The data on prevalence of positive serology to *T. cruzi*, geographical location, sample size, as well as the source and year of publication, are fully presented in the Appendix.

It should be stressed that the data utilized in the present study refers only to serological reaction (both complement fixation and immunofluorescence techniques). Doubtful reations were neglected.

Statistical analyses was based mainly on stepwise multiple regression, employing both the SPSS software and programs from the GENIOC library from the Department of Genetics, Oswaldo Cruz Institute (Cabello & Krieger, 1990).

RESULTS AND DISCUSSION

The average prevalences for positive reactions against *T. cruzi,* as well as their standard deviations for each of the Brazilian geographical regions, are presented in Table I.

These values, weighted by their respective population sizes (source: Brazilian Institute of Geography and Statistics – IBGE, 1984) provided a rough estimate for the prevalence of *T. cruzi* infection in Brazil of 11.17%.

TABLE I

Distribution of positive serology against *Trypanosoma cruzi*

Geographical region	Prevalence	+/– SD
North	0.96	0.91
Northeast	14.41	9.33
Southeast	9.95	14.08
South	13.02	9.12
Middle-West	8.95	8.19

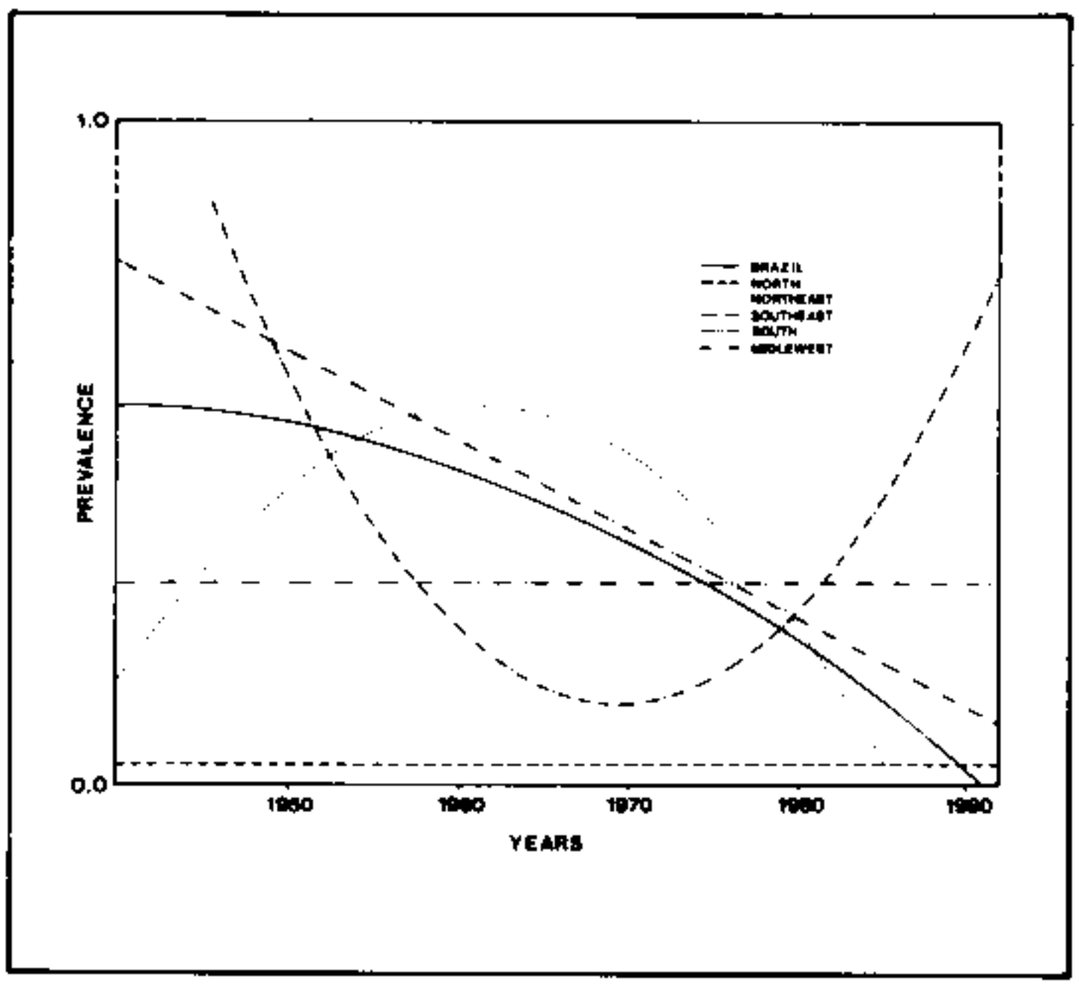
TABLE II

Analyses of variance results of the most parcimonious regression models of serologic prevalence of *Trypanosoma cruzi* infection on year

		D. F.		F		Model
Region		Regression	Residual			
North	Prevalence	1	6	0.024	n.s	no effect
	Ln of Prevalence	1	6	0.051	n.s	no effect
Northeast	Prevalence	2	91	16.548	*a*	parabolic
	LN of Prevalence	2	91	31.908	*a*	parabolic
Southeast	Prevalence	2	5	5.872	*a*	parabolic
	Ln of Prevalence	1	56	2.401	n.s	no effect
South	Prevalence	1	19	5.373	*a*	linear
	Ln of Prevalence	1	19	3.435	n.s	no effect
Middle-West	Prevalence	2	11	0.615	n.s	no effect
	Ln of Prevalence	2	11	0.062	n.s	no effect
Brazil	Prevalence	2	192	17.426	*a*	parabolic
	Ln of Prevalence	2	192	20.352	*a*	parabolic

a: significant at the 0.01 P level.

Since the data cover a rather large period of time, it was tried to uncover possible temporal trends on the prevalence of positive serology, through multiple regression analyses. The results of these analyses are summarized in Table II, and ploted in Figure. As can be seen, there is no temporal effect at the Northern and Midle-West geographical regions (it should be pointed out that for the Northeastern region trere is only information on two years, cf. Appendix), while for both the Northeastern and the Southeastern regions, the temporal effect seems to be parabolic, with maximum/minimum point at around 1963 and 1969, respectively. As for the southern region, it seems that the temporal effect is linear and negative. The whole picture for Brazil shows a parabolic trend, similar to that of the Northeastern region.



Regression plots of serological prevalence for *Trypanosoma cruzi* in Brazil as a whole, and subdivided by geographical regions.

In order to avoid spurious effects due to normal distribution's departure, a natural logarithm transformation was applyed to the prevalence data. These analyses were also shown in Table II. Except for the Southeastern and Southern region, the results of the previous analyses were consistent with the analyses employing the logarithm of positive serologic prevalence as dependent variable. It should be pointed out, that for the Southern region, although the log analysis did not reach the choosed level of significance (0.05), the face values of the regression coefficients are consistent with each other.

However, caution should be taken in the interpretation of this graph. As the prevalence values are assumed to be independent, the curves indicate that by around 1991 there

would be no new cases of positive serology for Chagas' disease. Of course, this conclusion is weakly supported by statistical inference, since it is a relative distant forecast point from the employed range of observations and there is some apparent discrepancies among the region trends. Moreover, there is no support for taking as representative the prevalence figures presented by most of the reports. Nevertheless, there is no available evidence that contradicts the representativeness of this data set. A reanalysis of this problem, based on 1985-1990 data is being conducted in order to improve the prediction curves. Temporal trends of prevalence are important tools for the epidemiologist in order to uncover agents and/or nosogenic mechanisms introduced or removed from populations and to determine their effects upon the development of certain diseases. As for infections disease, it can provide valuable informations of the dynamics of transmission and on the effectiveness of adopted prophylactic measures. The techniques employed above could give some of the answers asked by public health experts and also could be applyed to other endemic diseases data in order to disclose these trends.

APPENDIX

Prevalence of *Trypanosoma cruzi* infection in several Brazilian locaties

State	Localities	Year	Sample size	% Positivity	References
NORTH					
Rondônia		1984		0.41	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
Acre		1984		2.39	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
Amazonas		1979	10,054	1.8	Castro Filho & Silveira, 1979. *Rev. Bras. Malar. D. Trop., 31:* 85-98.
		1984		1.88	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
Roraima		1984		0.31	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
Pará		1979		0.3	Castro Filho & Silveira, 1979. *Rev. Bras. Malar. D. Trop., 31:* 85-98.
		1984		0.56	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
Amapá		1984		0.0	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
NORTHEAST					
Maranhão		1979	51,529	0.2	Castro Filho & Silveira, 1979. *Rev. Bras. Malar. D. Trop., 31:* 85-98.
		1984		0.12	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
Piauí	Oeiras	1977		12.1	Lima et al., 1977. *Com. XIII Congr. Soc. Bras. Med. Trop.*, Brasília.
	Oeiras	1979	37,720	3.7	Castro Filho & Silveira, 1979. *Rev. Bras. Malar. D. Trop., 31:* 85-98.
		1984		4.04	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
Ceará		1963	46	26.1	Alencar et al., 1963. *J. Bras. Med., 7:* 593-605.
	(Região Cariri) Barbalha	1963	111	32.0	Alencar et al., 1963. *Rev. Bras. Malar. D. Chagas, 15:* 551-565.

State	Localities	Year	Sample size	% Positivity	References
	Crato	1963	250	41.0	Ibid.
	Jardim	1963	3	0.0	Ibid.
	Juazeiro	1963	6	25.0	Ibid.
	(Região Baturité)				
	Palmácia	1963	53	15.0	Ibid.
	Pacoti	1963	147	11.0	Ibid.
	Fortaleza	1967	267	5.2	Lima et al., 1967. *Rev. Fac. Med. Univ. Fed.*, Ceará, *7:* 3-13.
	Fortaleza	1967	420	8.6	Ibid.
		1977	7.757	2.9	Alencar et al., 1977. *Com. XIII Congr. Soc. Bras. Med. Trop.* Brasília.
		1979	29,973	1.3	Castro Filho & Silveira, 1979. *Rev. Bras. Malar. D. Trop., 31:* 85-98.
		1984		0.84	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
Rio Grande do Norte	(Agreste)				
	Santa Cruz	1970	199	12.1	Lucena, 1970. *Rev. Bras. Malar. D. Chagas, 22:* 3-173.
	(Centro Norte)				
	Açú	1970	303	11.9	Ibid.
	(Chapada do Apori)				
	Augusto Severo	1970	190	14.7	Ibid.
	Mossoró	1970	393	10.7	Ibid.
	Apodi	1970	206	20.4	Ibid.
	(Seridó)				
	Caiacó	1970	377	12.7	Ibid.
	Florânia	1970	193	9.3	Ibid.
	Jardim do Seridó	1970	206	6.3	Ibid.
	Acari	1970	213	13.1	Ibid.
		1979	29,941	1.2	Castro Filho & Silveira, 1979. *Rev. Bras. Malar. D. Trop., 31:* 85-98.
		1984		1.78	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
Paraíba	(Litoral-Brejo)				
	Bananeiras	1957	333	27.6	Lucena & Costa. 1957. *Rev. Bras. Med., 14:* 323-327.
	Serraria	1957	169	23.1	Ibid.
	Pirpirituba	1957	128	23.4	Ibid.
	Santa Rosa	1957	16	12.5	Ibid.
	Espírito Santo	1957	50	22.0	Ibid.
	Campina Grande	1957	399	10.0	Ibid.
	(Caatinga Curimataú-Cariri)				
	Pilar	1957	131	27.5	Ibid.
	Itabaiana	1957	381	24.1	Ibid.
	Pedra de Fogo	1957	65	24.6	Ibid.
	Ingá	1957	72	12.5	Ibid.
	Guarabira	1957	307	16.0	Ibid.
	Caiçara	1957	84	13.1	Ibid.
	Monteiro	1957	214	14.0	Ibid.
	Sumé	1957	124	8.9	Ibid.
	Taperoá	1957	62	8.1	Ibid.
	(Sertão)				
	Teixeira	1957	306	16.0	Ibid.
	Curema	1957	47	21.3	Ibid.
	Piancó	1957	246	28.9	Ibid.
	Patos	1957	464	25.0	Ibid.
	Patos	1970	400	27.2	Lucena, 1970. *Rev. Bras. Malar. O Chagas, 22:* 3-173.

State	Localities	Year	Sample size	% Positivity	References
		1979	42,484	2.3	Castro Filho & Silveira, 1979. *Rev. Bras. Malar. D. Trop., 31:* 85-98.
		1984		3.48	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
Pernambuco	Nazaré da Mata	1954	410	20.87	Borba et al., 1954. *Arq. Bras. Cardiol., 7:* 191-200.
	Recife	1954	62	4.84	Ibid.
	Timbaúba	1955	1,062	13.43	Marques, 1955. (cit. Lucena, 1959).
	Recife	1956	222	3.6	Silva et al., 1956. *Publ. Méd., S. Paulo, 27:* 23-25.
	(Litoral-Mata)				
	Aliança	1959	299	17.1	Lucena, 1959. *Rev. Bras. Med., 15:* 864-866.
	Catende	1959	325	12.3	Ibid.
	Gemeleira	1959	67	11.9	Ibid.
	Palmares	1959	309	6.5	Ibid.
	Nazaré da Mata	1970	948	21.0	Lucena, 1970. *Rev. Bras. Malar. D. Chagas, 22:* 3-173.
	Timbaúba	1970	631	20.0	Ibid.
	Carpina	1970	625	20.5	Ibid.
	(Agreste)				
	Limoeira	1959	592	13.3	Ibid.
	Bom Jardim	1959	303	16.8	Ibid.
	Orobó	1959	321	17.1	Ibid.
	Surubim	1959	328	14.9	Ibid.
	(Sertão)				
	Salgueiro	1959	206	14.1	Lucena, 1959. *Rev. Bras. Med., 15:* 864-866.
	Ouricuri	1959	203	15.3	Ibid.
	Sertania	1970	310	20.0	Lucena, 1970. *Rev. Bras. Malar. D. Chagas, 22:* 3-173.
	Pedra	1970	323	13.6	Ibid.
	Petrolina	1970	365	21.1	Ibid.
	Recife	1970	136	4.41	Huggins et al., 1970. *Rev. Soc. Bras. Med. Trop., 4:* 105-112.
		1979	53,754	2.1	Castro Filho & Silveira, 1979. *Rev. Bras. Malar. D. Trop., 31:* 85-98.
		1984		2.79	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
Alagoas	(Marítma)				
	S. Luiz Quitunde	1961	301	18.3	Lucena, 1961. *Rev. Bras. Med., 18:* 258-261.
	Passo Camaragibe	1961	303	26.4	Ibid.
	(Mata)				
	Muruci	1961	400	16.2	Ibid.
	São José da Lage	1961	407	12.5	Ibid.
	União dos Palmares	1970	398	32.7	Lucena, 1970. *Rev. Bras. Malar. D. Chagas, 22:* 3-173.
	Porto Calvo	1970	299	20.7	Ibid.
	(Sertão)				
	Santana do Ipanema	1970	202	13.4	Ibid.
	Arapiraca	1970	201	21.4	Ibid.
	Palmeira dos Índios	1970	302	15.6	Ibid.
	(Sanfranciscana)				
	Pão de Açúcar	1970	398	32.7	Ibid.
		1979	10,193	5.1	Castro Filho & Silveira, 1979. *Rev. Bras. Malar. D. Trop., 31:* 85-98.
		1984		2.48	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
Sergipe		1979	20,777	4.8	Castro Filho & Silveira, 1979. *Rev. Bras. Malar. D. Trop., 31:* 85-98.

State	Localities	Year	Sample size	% Positivity	References
		1984		5.97	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
Bahia	Salvador	1960	8,411	25.0	Pondé, 1960. *Hospital., 58:* 1073-1097.
	Paulo Afonso	1968	689	2.75	Salgado & Pellegrino, 1968. (cit. Barretto, 1979).
	Castro Alves	1976	1,051	38,3	Mott et al., 1976. *Am. J. Trop. Med., Hyg., 25:* 552-562.
	Castro Alves (Fazenda Sapé)	1979	166	33.7	Hoff et al., 1979. *Am. Soc. Trop. Med. Hyg., 28:* 461-466.
		1979	58,969	7.4	Castro Filho & Silveira, 1979. *Rev. Bras. Malar. D. Trop., 31:* 85-98.
		1984	58,969	7.4	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
SOUTHEAST					
Minas Gerais	Bambuí	1948	312	38.1	Dias et al., 1948. *Brasil – Médio, 62* (49, 50, 51, 52): 412-413.
	Belo Horizonte	1949	177	1.69	Pellegrino, 1949. *Rev. Bras. Med., 6:* 297-301.
	Belo Horizonte	1951	565	2.47	Pellegrino et al., 1951. *Mem. Inst. Oswaldo Cruz, 49:* 555-564.
	(Região Oeste)	1951	312	39.1	Laranja et al., 1951. *Hospital, 40:* 945-988.
	Pedra Branca-Sertãozinho	1952	312	35.08	Dias & Brant, 1952. *An. IX Congr. Brasil. Hig.*, P. Alegre, p. 267-270.
	Araguari	1953	233	19.1	Biancalana et al., 1953. *Hospital, 44:* 745-749.
	Belo Horizonte	1959	10,982	6.79	Pellegrino, 1959. *Rev. Bras. Malar. D. Trop., 11:* 697-706.
	Uberaba	1959	640	15.0	Jatene & Jacomo, 1959. *Rev. Goiana Med., 5:* 23-30.
		1963	28,615	6.19	Salgado Pellegrino, 1963. *Proc. 7th Inter. Congr. Med. Mal., 2:* 260.
	Belo Horizonte	1971	45,236	2.5	Tavares 1971. *Rev. Assist. Méd. Minas Gerais, 22:* 183-190.
	Pains	1974	920	11.41	Coura, 1974. (cit. Freitas, 1974-1975).
	Pains	1974	1,060	9.42	Ibid.
	Iguatama	1974	698	18.05	Ibid.
	Iguatama	1974	653	16.25	Ibid.
	Virgem da Lapa	1977	2,723	12.89	Dubous et al., 1977. *Com. XIII Congr. Soc. Bras. Med. Trop.* Brasília.
		1979	50,298	16.3	Castro Filho & Silveira, 1979. *Rev. Bras. Malar. D. Trop., 31:* 85-98.
	Botumirim	1982	1,113	27.58	Dias, 1982. *Rev. Goiana Med., 28:* 97-102.
	Montalvânia	1982	334	10.78	Ibid.
		1984		8.83	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
Espírito Santo		1969	6,583	0.4	Santos et al., 1969. *Rev. Soc. Bras. Med. Trop., 3:* 51-52.
		1975	3,000	0.066	Barros et al., 1975. *Rev. Inst. Med. Trop. S. Paulo, 17:* 319-329.
		1979	19,193	0.2	Castro Filho & Silveira, 1979. *Rev. Bras. Malar. D. Trop., 31:* 85-98.
		1980	4,108	0.36	Barros et al., 1980. *Rev. Pat. Trop., S. Paulo, 9:* 153-156.
		1984		0.32	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
Rio de Janeiro	Rio de Janeiro	1960	642	0.464	Morteo, 1960. (cit. Coura et al., 1966).

State	Localities	Year	Sample size	% Positivity	References
	Rio de Janeiro	1961	435	1.8	Silva et al., 1961. *Arq. Bras. Med., 51:* 35-38.
	Rio de Janeiro	1966	4,595	1.26	Coura et al., 1966. *Hospital, 69:* 991-998.
	Rio de Janeiro	1966	319	0.0	Ibid.
	Rio de Janeiro	1966	2,242	3.56	Ibid.
		1967	25,508	0.52	Gonzaga et al., 1967. *Arq. Bras. Med., 54:* 289-301.
	Caxias	1971	110	0.055	Coura et al., 1971. *Rev. Soc. Bras. Med. Trop., 5:* 123-129.
	Caxias	1975	597	0.0067	Coura & Pentana, 1975. *Rev. Soc. Bras. Med. Trop., 9:* 83-87.
		1979	22,275	2.5	Castro Filho & Silveira, 1979. *Rev. Bras. Malar. D. Trop., 31:* 85-98.
		1984		1.75	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
São Paulo		1949	500	67.4	Ramos et al., 1949. *Arq. Bras. Cardiol., 2:* 111-162.
	São Paulo	1950	500	1.0	Faria et al., 1950. *Folia Clin. Biol., 16:* 158.
	São Paulo	1951	92	7.2	Faria, 1951. *Folia Clin. Biol., 17:* 113-117.
	São Paulo	1952	826	2.5	Freitas et al., 1952. *Hospital, 41:* 229-236.
	São Paulo	1952	796	1.7	Ibid.
	Laranjal Paulista	1952	28	10.7	Alves & Alves., 1952. *Arq. Hig. Saúde Púb., 17:* 109-115.
	Ribeirão Preto	1953	19	21.1	Biancalana et al., 1953. *Hospital, 44:* 745-749.
	Santos	1953	94	0.0	Ibid.
	São J. Rio Preto	1953	134	14.9	Ibid.
	São Paulo	1953	536	4.1	Passalacqua et al., 1953. *Hospital, 43:* 443-447.
	São Paulo	1954	786	5.4	Almeida et al., 1954. *Amer. J. Trop. Med. Hyg., 3:* 490-494.
	São Paulo	1955	178	1.7	Nussenzweig et al. 1955. *Rev. Clín. Fac. Med. S. Paulo, 10:* 265-283.
	São Paulo	1958	627	2.0	Castro & Uvo, 1958. *Arq. Bras. Cardiol., 11:* 114-120.
	Ribeirão Preto	1959	3,055	14.4	Freitas & Siqueira, 1959. (cit. Baldy et al., 1978).
	Ribeirão Preto	1959	6,405	10.8	Ibid.
	Ribeirão Preto	1959	626	10.9	Ibid.
	São Paulo	1960	16,624	1.5	Mellone et al., 1960. *Rev. Clin. Cient., 29:* 101-102.
		1962	15,271	9.31	Coutinho, 1962. *Arq. Hig. Saúde Públ., 94:* 317-330.
		1964	34,710	13.93	Silva, 1964. *Arq. Hig. Saúde Públ., 29:* 129-140.
	São Paulo	1965	62,575	1.45	Mellone & Pagenotto, 1965. *Rev. Hosp. Clín. Fac. Med. S. Paulo, 20:* 165-167.
	São Paulo	1972	15,341	1.95	Meira et al., 1972. *Rev. Medicina, 56:* 327-331.
	Ribeirão Preto	1972	3,493	9.5	Volpon et al., 1972. (cit. Baldy, 1978).
	Ribeirão Preto	1972	4,147	4.3	Ibid.
	Ribeirão Preto	1976	1,000	10.10	Vichi et al., 1976. *Arq. Bras. Cardiol., 29:* 87.
SOUTH					
Paraná	Londrina	1958		7.0	Brofman, 1958. *Arq. Bras. Cardiol., 11:* 209-210.
	Londrina	1958	1,330	6.9	Queiroz & Pascual, 1958. *Rev. Méd. Paraná, 27:* 27-30.
	Londrina	1978	3,744	7.9	Baldy et al., 1978. *Rev. Saúde Públ., São Paulo, 12:* 409-416.
	Londrina	1978	726	5.9	Ibid.

State	Localities	Year	Sample size	% Positivity	References
		1979	51,959	7.5	Castro Filho & Silveira, 1979. *Rev. Bras. Malar. D. Trop., 31:* 85-98.
		1984		4.0	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
Santa Catarina		1968	1,104	0.09	Salgado & Pellegrino, 1968. (cit. Barretto, 1979).
		1979	23,833	2.4	Castro Filho & Silveira, 1979. *Rev. Bras. Malar. D. Trop., 31:* 85-98.
		1984		1.39	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
Rio Grande do Sul		1957	5,460	23.9	Brant et al., 1957. *Rev. Bras. Malar. D. Trop., 9:* 141-176.
	Encruzilhada Sul	1959	976	18.9	Sessen & Arnt, 1959. *Rev. Med. Rio Grande do Sul, 15:* 133-142.
	São Jerônimo	1959	1,822	18.1	Ibid.
	Rosário do Sul	1959	1,265	27.1	Ibid.
	Itaqui	1959	1,394	31.9	Ibid.
	Santa Rosa	1959	1,872	9.7	Ibid.
		1964	31,646	2.8	Mello et al., 1964 (cit Coura, 1966. *Rev. Bras. Malar. D. Trop., 18:* 9-98).
	Herval do Sul, Lavar do Sul, Caçapava do Sul and Pelotas	1973	1,041	18.8	Baruffa & Alcantara, 1973. *Rev. Soc. Bras. Med. Trop., 7:* 329-332.
		1977	5,530	17.59	Baruffa & Alcantara, 1977. *Com. XIII Congr. Soc. Bras. Med. Trop.*, Bras.
	Pelotas	1979	3,501	3.91	Baruffa, 1979. *Rev. Inst. Med. Trop., S. Paulo, 21:* 37-42.
		1979	26,606	19.5	Castro Filho & Silveira, 1979. *Rev. Bras. Malar. D. Trop., 31:* 85-98.
		1984		8.84	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
MIDWEST					
Mato Grosso		1979	21,762	2.3	Castro Filho & Silveira, 1979. *Rev. Bras. Malar. D. Trop., 31:* 85-98.
		1984			Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
Mato Grosso do Sul		1984		2.46	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.
Goiás	Rio Verde	1951	239	12.55	Freitas & Mendonça, 1951. *Hospital, 39:* 251-261.
	Goiânia	1951	43	0.0	Freitas & Figueiredo, 1951. *Arq. Hig. Saúde Públ., 16:* 227-230.
	Trindade	1951	40	27.5	Ibid.
	Hidrolândia	1951	60	13.3	Ibid.
	Goiânia	1964	1,474	11.0	Alexandre, 1964 (cit. Rezende, et al., 1965. *Rev. Goiana Med. 11:* 35-47).
	Goiânia	1975	4,372	10.43	Campos et al., 1975. *Rev. Soc. Bras. Med. Trop., 9:* 165-174.
	Jataí	1976	12,976	10.90	Camargo et al., 1976. *Com. XII Congr. Soc. Bras. Med. Trop.*, Belém.
		1979	56,590	10.4	Castro Filho & Silveira, 1979. *Rev. Bras. Malar. D. Trop., 31:* 85-98.
		1984		7.4	Camargo et al., 1984. *Rev. Inst. Med. Trop., 26:* 192-204.

State	Localities	Year	Sample size	% Positivity	References
Distrito Federal		1960	242	0.413	Silva & Queiroz, 1960. *J. Bras. Med., 2:* 483-488.
		1977		17.80	Tosta et al., 1977. *Com. XIII Congr. Soc. Bras. Med. Trop.*, Brasília.

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