

CHAGAS' DISEASE AND SOCIAL SECURITY. A CASE-CONTROL STUDY IN AN URBAN AREA, GOIÁS, BRAZIL*

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ABSTRACT: One hundred and twenty subjects with Chagas' cardiopathy and 120 non-infected subjects were randomly selected from first time claimants of sickness benefits in the National Institute of Social Security (INPS) in Goiás. Cases of Chagas' cardiopathy were defined based on serological test, history of residence in an endemic area and, clinical and/or electrocardiogram (ECG) alterations suggestive of Chagas' cardiomyopathy. Controls were defined as subjects with at least two negative serological tests. Case and controls were compared in the analysis for age, sex, place of birth, migration history, socio-economic level, occupation, physical exertion at work, age at affiliation and years of contribution to the social security scheme, clinical course of their disease and ECG abnormalities. Chagas' disease patients were younger than other subjects and predominantly of rural origin. Non-infected subjects presented a better socio-economic level, were performing more skilled activities and had less changes of job than cases. No important difference was observed in relation to age at affiliation to INPS. About 60% of cases have claimed for benefits within the first four years of contribution while among controls this proportion was 38.5%. Cases were involved, proportionally more than controls, in "heavy" activities. A risk of 2.3 (95%CL 1.5 - 4.6) and 1.8 (95%CL 1.2 - 3.5) was obtained comparing respectively "heavy" and "moderate" physical activity against "light". A relative risk of 8.5 (95%CL 4.9 - 14.8) associated with the presence of cardiopathy was estimated comparing the initial sample of seropositive subjects and controls. A high relative risk was observed in relation to right bundle branch block (RR = 37.1 95%CL = 8.8 - 155.6) and left anterior hemiblock (RR = 4.4, 95%CL = 2.1 - 9.1).

UNITERMS: Trypanosomiasis, South American. Social security. Workers. Control groups. Working risks.

INTRODUCTION

As a result of rapid development, the social and economic consequences of the progressive urbanization of Chagas' disease in Brazil have become more apparent. Incapacity for work, premature retirement, heavy demand for social benefits, transfusional transmission and the demands for health care of those affected are some indicators of the problem^{3, 17, 18}.

Studies carried out on migrants from rural to urban areas have shown the social difficulties they face and their poor adjustment to the society. In S. Paulo, prevalences of *T. cruzi* positive serology of 7.5% and 4.9% have been reported among migrants and urban civil servants, respectively^{5, 7}. Among workers in the industrial sector, a prevalence of 2.2% and a rate of 4.4 cases of Chagas' cardiopathy per 1,000 workers were found⁶. High prevalences of infection (13.8% and 9.7%) have also been

reported among taxi and bus drivers in urban areas of Minas Gerais^{8, 15}. The impact of the disease on urban workers has not been assessed, however, in a population-based study.

Studies based on social security records in Goiás, in 1980, showed that Chagas' cardiopathy was the cause for 4.2% of all sickness benefits awarded and 9.1% of invalidity benefits²⁰. A rate of 4,212 potential future productive years of life lost (PPYLL) per 10,000 workers per year was estimated, representing 9.7% of the total PPYLL due to any cause¹⁹.

The present investigation was carried out with the objective of assessing occupational and social characteristics of Chagas' disease patients among urban workers in the State of Goiás, with a view to better understanding of the social and medical importance of the disease as a cause of disability.

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MATERIAL AND METHODS

Study Area

The study was carried out in Goiânia, central Brazil. It is the capital of the State of Goiás in which the major economic activity is traditional agriculture and has a population of 3.8 million. There was intense migration from rural to urban areas, in the 60s and 70s, related to the settlement of "Brasília" (Brazil) and widening of commerce and service. In rural areas of the state, a prevalence of *T. cruzi* infection (seropositivity) of 7.5% and a relative risk of electrocardiographic (ECG) alteration of 2.8 due to the Chagas' disease among the seropositive ones have been reported^{2, 19}.

Study Population

Between March 1984 and Feb 1985, 120 subjects with Chagas' cardiopathy and 120 non-infected subjects were randomly selected among first time claimants of sickness benefits in the National Institute of Social Security (INPS) in Goiás. The sample of diseased subjects corresponded to 23% of all such attendances in that year and the non-infected group represented a 1% sample (approximately).

Cases of Chagas' cardiopathy were defined as subjects presenting at least one positive serological test to *T. cruzi* with a history of residence in an endemic area, clinical and/or (ECG) alterations suggestive of Chagas' cardiomyopathy¹⁶. One of the following ECG abnormalities had to be observed: atrioventricular block (first, second degree or complete), intraventricular block (right bundle branch and/or left anterior hemiblock), sinus bradycardia (under 50/min) associated with extrasystoles or primary and diffuse changes in ventricular repolarization, ventricular extrasystoles when five or more per minute (or 10% or more of recorded complexes) or multifocal or bigeminy, large Q or QS waves, complex arrhythmias. Individuals with a normal ECG or other ECG abnormalities presenting clinical evidence or cardiac involvement (symptoms of palpitations, dizziness, loss of consciousness, dyspnoea on exertion) were also included in this group. The 120 cases of Chagas' cardiopathy were drawn from 148 seropositive subjects selected initially. The remaining 28 (18.9%) subjects had the indeterminate or digestive form of Chagas' disease and were not included in the study. Cases were classified into 4 groups in relation to

the stage of cardiopathy according to OMS/OPAS (1974)¹ criteria.

A control was selected as the first seronegative subject (two tests: complement fixation and indirect immunofluorescence) examined after each case by the same physician. Controls were not matched to cases with respect to age or other characteristics.

Examination and Analysis

Cases and controls were clinically examined and interviewed by independent examiners. The ECGs were coded according to the system of the New York Heart Association and later validated with the Minnesota code adapted for Chagas' disease^{9, 14}. A standard questionnaire was applied to each subject to collect information on their social and occupational history. Cases and controls were compared in the analysis for age, sex, place of birth, migration history, socio-economic level, occupation, physical exertion at work, age at affiliation and years of contribution to the social security, clinical course of their disease and ECG abnormalities.

The socio-economic level of each subject was assessed according to their contribution to the INPS, which is based on salary and occupation. As the subjects did not present a wide variation in income they were classified into 3 categories only: a) employers, skilled self-employed and employees paying social security based on an income of over 3 minimum wages (the local official minimum wages was equivalent, at that time, to US\$ 80); b) semi-skilled self-employed and employees with an income between 2 and 3 minimum wages; and c) unskilled self-employed and employees earning less than 2 minimum wages. The subjects were allocated according to the demand of physical activity of their occupations into 3 groups (light, moderate or heavy). Working position (sitting, walking), lifting weights and daily working hours were considered. The clinical course of the disease was evaluated by estimating the time from the onset of symptoms to the time the patient was too disabled to work, as judged by the medical service of the INPS. This period is estimated routinely during the medical examination for social security benefits and used administratively for awarding sickness benefits. Two major points are usually defined: the date of the onset of the disease and the date of the onset of the incapacity to work. Standard methods have been developed for this assessment.

The distribution of each variable was compared with cases and controls, using t-tests of significance for the difference between means, chi-square tests for the differences between proportions and frequency distribution, and odds ratios (95% confidence limits and test of significance) to estimate the relative risk associated with the different exposures. Tests for trend and for heterogeneity of the relative risks were applied when appropriate. Mantel and Haenszel¹⁰ estimates of relative risk were calculated to summarize the relative risk associated with the particular exposure across several strata. Age and sex were the main confounders (stratification variables) considered in the analyses.

RESULTS

Demographic Characteristics

Cases and controls were of different mean age, 43.9 (SD 9.2), and 47.5 (SD 12.1), respectively ($p < 0.01$). Seventy five per cent of the cases aged under 50 years in comparison with only half of the non-infected subjects. No significant difference was found in the sex distribution, approximately 53% of the cases and controls were males. The proportion of migrants from other states was similar for cases and controls, about 40% came from other Brazilian state (Table 1). Eighty three percent of the cases came from rural areas in comparison with 66.7% of non-infected subjects ($p < 0.01$). The majority of migrants came from Minas Gerais (22.1%) and Bahia (7.1%). This was consistent among both sexes. The proportion of cases originating from Minas Gerais (28.3%) was higher than in controls (15.8%) whereas 3.3% of cases and 10.8% of controls came from Bahia.

TABLE 1

Demographic characteristics of 120 cases of Chagas' cardiopathy and 120 controls selected from claimants of sickness benefits, National Institute of Social Security (INPS), Goiânia, Brazil.

	Cases	Controls	p value
Mean age (SD)	43.9 (9.2)	47.5 (12.1)	$p < 0.01$
Males (%)	52.5	54.2	n.s.
Females (%)	47.5	45.8	n.s.
Migrants other States (%)	40.0	39.2	n.s.
Rural Origin	83.3	66.7	$p < 0.01$

(SD) Standard Deviation.

n.s. non significant ($p > 0.05$)

Social and Occupational Characteristics

The cases tended to be of lower socio-economic status than the controls (Table 2 X^2 $p = 0.03$). Relative risk estimates of 2.8 (95%CL 1.3-6.1) and 2.2 (1.1-4.5) were associated with the socio-economic levels II and III respectively, in comparison with level I (Table 2). The main occupational groups of cases and controls were similar (maid, building worker, shop assistant) but, the control group included a teacher, a nurse, a sportsman, an airman and other high status occupations which were not represented among the cases. Almost all the women were classified in two occupational groups: maid (78%) and dress-maker (17%). The probable explanation for this is that due to socio-economic constraints, many housewives have affiliated to the social security system as self-employed so as to supplement the household income by an eventual sickness benefit.

The number of previous occupations and the length of time in the last one were compared so as to assess job mobility. After adjusting for age, the cases had spent an average of 7.5 (SD 3.7) working years in their last occupation and the controls 12.9 (SD 9.6) years, a difference which is significant at 1%. The cases also had more changes of occupation than the controls ($p < 0.05$).

After the adjusting for age and sex "heavy" activity at work was associated with a relative risk of 2.3 (95%CL 1.5-4.6) and "moderate" activity with a relative risk of 1.8 (95%CL 1.2 - 3.5), compared to those reporting only "light" physical activity at work.

Sixty three per cent of cases were registered with the social security system as self-employed and 36.7% as employees while 58.3% of the controls were self-employed, 33.3% were employees and 4.2% were employers. This

TABLE 2

Socio-economic level of cases of Chagas' cardiopathy and controls selected from claimants of sickness benefits, National Institute of Social Security (INPS), Goiânia, Brazil.

Socio-economic level*	Cases	Controls	RR**	95% CI
I	24	29	1.0	
II	46	34	2.8	1.3-6.1
III	60	57	2.2	1.1-4.5

* In descending order.

** Relative risk adjusted for age, sex, and migration history-socio-economic level II and III against I. X^2 $p = 0.03$.

distribution was not statistically different ($p > 0.05$). There was also no difference in the mean age at affiliation. Cases affiliated on the average of 37.5 (SD 11.2) years of age and controls at 40.4 (SD 13.6) ($p > 0.05$). However, if we exclude from the analysis subjects over 50 years old, who are proportionally fewer among the cases, the difference in age at the time of affiliation is significantly higher among the cases ($p < 0.05$). The possible reason for this is that diseased subjects are likely to have been selectively excluded from the working population earlier in life due to symptoms or premature death and thus a lower overall mean age at affiliation might be expected for the cases.

About 60% of the cases had claimed sickness benefits within the first 4 years of contribution to the INPS. Among the controls, only 38.5% had applied for sickness benefits within the first 4 years of contribution and 29.2% after 11 years. On the average this period was 6.3 (SD 2.1) for the cases and 8.1 (SD 2.5) for the controls ($p < 0.01$). This difference may indicate that the cases had a shorter healthy working time than the controls. Despite the difference observed one should bear in mind that part of the self-employed affiliation (which was proportionally higher among the cases) occurs just with the intention of claiming sickness benefits.

Clinical Aspects

Cases were selected based on the results of the serological, clinical and ECG examinations. Subjects with the indeterminate form (24 cases - 16.2%) or the digestive form of the disease without cardiac involvement (4 cases - 2.7%) were not included in the study in order to have amore homogeneous group.

Table 3 presents the clinical classification of cases according to the evolutive stage of

TABLE 3

Cases of Chagas' cardiopathy selected from claimants of sickness benefits, according to the evolutive stage,* National Institute of Social Security (INPS), Goiânia, Brazil.

Stage	Males (%)	Females (%)	Total
CI	6 (9.5)	14 (24.6)	20 (16.7)
CII	30 (47.6)	28 (49.1)	58 (48.3)
CIII	12 (19.0)	12 (21.1)	24 (20.0)
CIV	15 (23.8)	3 (5.3)	18 (15.0)

* OMS/OPAS¹ (1974)

cardiopathy. Thirty five per cent of the cases (males 43%, females 26%, $p=0.04$) had an advanced stage of heart disease (CIII and CIV). The difference between the sexes persisted even after adjusting for age. This may indicate that males are more likely to develop severe disease than females, otherwise it may be caused by chance or a bias in the selection of the two groups. We believe that women are likely to claim sickness benefits earlier than men and, therefore, the disease is also likely to be detected in an early phase. The stage of cardiopathy was age-related. Seventy four per cent of severe cases (CIII and CIV) were diagnosed in 40-60 years old patients while 60% of the CI or CII cases were diagnosed in 21-40 years old patients. No correlation was observed between the evolutive stage of cardiopathy and the physical exertion at work. Cases were evenly distributed in relation to the intensity of physical activity regardless to the degree of cardiopathy.

Circulatory and osteoskeletal diseases were the main causes of disability in male and female controls. They accounted for 33.3% and 30.0%, respectively. Hypertensive disease, ischaemic heart disease and peripheral circulatory disease were the main diagnoses in the first group.

A relative risk of 8.5 (95%CL = 4.9 - 14.8) associated with the presence of cardiopathy was estimated comparing it with the initial sample of seropositive subjects and controls. Obviously, this risk is overestimated since infected individuals with cardiopathy are more likely to apply for sickness benefits than those with other clinical forms of the disease. Hypertension was much less frequent among cases than controls (RR = 0.23).

The risk associated with some ECG abnormalities is presented in the Table 4. An abnormal ECG was recorded more frequently in men than in women ($p < 0.05$). High relative risks were observed in relation to the right bundle branch block (RR = 37.1, 95%CL = 8.8 - 155.6) and left anterior hemiblock (RR = 4.4, 95%CL = 2.1 - 9.1). This indicates that those ECG alterations are more characteristic of Chagas' disease. The risk associated with any type of alteration was 15.3 (95%CL = 8.1 - 29.0). A possible effect of the difference in age between cases and controls would bias the risk estimation towards a lower value since fewer ECG abnormalities may be expected in younger people, the cases in this study. If true, the risks presented would be higher.

TABLE 4

Relative risk of specific ECG abnormalities among seropositive (initial sample of potential cases) and seronegative subjects (control group), selected among claimants of sickness benefits, National Institute of Social Security (INPS), Goiânia, Brazil.

Alteration*	Seropositive	Seronegative	RR**	95% CL
Ventr. extrasystoles	50	15	3.2	1.7 - 6.1
Supra-ventr. extrasystoles	10	3	2.8	0.8 - 10.5
BAV 1st degree	4	1	3.1	0.3 - 28.0
Right branch block	61	2	37.1	8.8 - 155.6
Left anterior hemiblock	45	10	4.4	2.1 - 9.1
Synusal bradycardia	13	5	2.1	0.7 - 5.9
Other alterations	10	8	0.9	0.4 - 2.5
Any ECG alteration	16	76	15.3	8.1 - 29.0

* Subjects may present more than one ECG abnormality.

** Relative risk associated with the specific ECG alteration comparing seropositive and seronegative subjects.

DISCUSSION

Data based on persons claiming sickness benefits are usually a biased source of health information since they refer to the part of the diseased population who have access to the social security. Nevertheless, in Brazil a great majority of the population is covered by the national medical and social security scheme (INPS). Sickness benefit is due after 15 days of incapacity for working after a year of contributory period. The claim is the legal mean of justifying the absence from work even when the contributory period has not been completed. Theoretically, examining first time claimants, we only lose subjects with a disability of fewer than 15 days. However, part of the potential demand is not detected due to non-official links with work, non-defined occupation, unemployment and affiliation to some independent social security system. In the same way, only those individuals who have been able to work or, at least, to pay the insurance are eligible to apply for benefits. In spite of that, this source of cases seems to be less biased than the one of hospital patients, in which patients are subject to a strong selective process of referral and hospitalization.

The essential condition in a case-control study to avoid distortion in the estimation of the effect associated with a exposure is to assure that every subject within each group (cases and controls) has the same selection probability of the respective reference population regardless of the exposure status. Cases and controls were randomly selected among claimants of sickness benefits from the respective populations assuring the same selection probability. Nevertheless, the findings and the risk estimates presented are valid only in the context of that specific population.

Among claimants of sickness benefits, Chagas' disease patients were younger than other subjects. This suggests, in accordance with population studies, that infected individuals become disabled for work earlier than the general population. They also presented a similar age distribution from that of infected individuals observed in cross-sectional studies in rural areas where clinical manifestation are observed more frequently around the fourth and fifth decades of life^{4, 13}.

In Goiás, the labour market is formed mainly by men, but both sexes have approximately equal demand for sickness benefits. Rates of sickness benefits claims of 32.4/1000 insured women and 30/1000 insured men were estimated. As expected, cases were predominantly of rural origin but no difference was observed in relation to the proportion of migrants from other states. Although Goiás is not an industrialized state it is an area of attraction of migrants even after the period of settlement of Brasília. Maybe the possibility of still being able to lead a rural life has been the main reason for the migration flow. The high proportion of migrants in the demand for sickness benefits is an expression of the difficulty of their adaptation to the labour market.

Non-infected subjects seem to be better adjusted into the society. They presented better socio-economic levels, were performing more skilled activities and had fewer changes of job than the cases.

Cases were proportionally more involved in "heavy" activities than controls. A risk of 2.3 and 1.8 was obtained comparing respectively "heavy" and "moderate" physical activity againsty "light". The heavier the demand of physical activity is the lesser skill demanding is

the job. This was also verified within the industrial sector in S. Paulo⁶.

Of 148 seropositive subjects initially selected only 24 (16.2%) were in the indeterminate form of Chagas' disease. This reflects the selective effect of the source of cases. Due to the selection most cases were in an advanced stage of heart involvement with a higher proportion in males. The evolutive stage was also related to age as reported in population studies^{4, 12}, but what was obviously different in the study was the proportion of severe clinical forms.

The study was unable to verify any association between physical exertion at work and Chagas' heart disease. This association has been suggested in a follow-up study of rural workers in which those permanently exposed to heavy activities presented a higher incidence of cardiopathy in comparison with other workers¹¹. Using prevalent cases in the advanced stage of the disease it is difficult to study this association. In the event of a positive association, exposed subjects with severe cardiopathy might be excluded from the study population by disability or death and for this reason no association or even a protective effect might be detected. We also believe that the sample size, the limited range of occupational categories and the way of assessing physical

activity was not appropriated for this purpose.

The high relative risk observed for the right bundle branch block and the left anterior hemiblock in the ECG examination confirms the specificity of these two alterations. The Minnesota code for ECG coding which is widely used in epidemiological studies of chronic cardiovascular disease to overcome observer variation has rarely been used in Chagas' disease. Its introduction is highly recommended as a standard in epidemiological studies on Chagas' disease as the first step of a uniform characterization of heart involvement. An overall relative risk of ECG alteration of 15.3 (95% CL = 8.1 - 29.0) was estimated considering any type of alteration. Of course, this value may vary among different groups of cases and controls.

The study addressed for the first time a specific group of Chagas' disease patients which has challenged the medical care and social security system for more appropriated measures. It sought to emphasize social and occupational aspects of the disease as a preliminary approach to studying Chagas' disease in urban area. Population-based studies in urban area should be encouraged as means for better understanding the magnitude of the problem and for a real assessment of risk factors in the evolution of the Chagas' disease.

ZICKER, F. Doença de Chagas e previdência social. Estudo caso-controle em uma área urbana, Goiás, Brasil. *Rev. Saúde públ.*, S. Paulo, 22:281-7, 1988.

RESUMO: São descritas as características sociais e ocupacionais de um grupo de pacientes chagásicos em área urbana no intuito de se estudar a importância médico-social da doença de Chagas como causa de incapacidade laborativa. Cento e vinte pacientes portadores de cardiopatia chagásica e 120 pacientes controles, não infectados pelo *Trypanosoma cruzi*, foram selecionados ao acaso entre os requerentes de auxílio doença-previdenciário no Instituto Nacional de Previdência Social (INPS) de Goiás (Brasil). Os dois grupos foram comparados em relação a idade, sexo, local de nascimento, história de migração, nível sócio-econômico, esforço físico no trabalho, idade de filiação e anos de contribuição ao INPS, evolução clínica e presença de alterações eletrocardiográficas. Verificou-se que os indivíduos chagásicos apresentavam nível sócio-econômico mais baixo, desenvolviam atividades profissionais de menor especialização e recorriam à previdência social para benefícios por incapacidade em idade mais jovem e com menor tempo de contribuição quando comparados ao grupo controle. O esforço físico ocupacional estava associado a um risco relativo de 2,3 (LC95% 1,5-4,6) e 1,8 (LC95% 1,2-3,5) comparando-se, respectivamente, atividades físicas "pesada" e "moderada" em relação a atividades ocupacionais "leves". Comparando-se a amostra inicial de soropositivos e soronegativos (controles), foi estimado um risco relativo associado à cardiopatia de 8,5 (LC95% 4,9-14,8). Riscos relativos de 37,1 (8,8 - 155,6) e 4,4 (2,1 - 9,1) foram obtidos para o bloqueio de ramo direito e hemibloqueio anterior esquerdo, respectivamente.

UNITERMOS: Tripanossomose sul-americana. Previdência social. Trabalhadores. Grupos controle. Riscos ocupacionais.

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