

CHARACTERISTICS OF URBAN MORTALITY FROM CHAGAS' DISEASE IN BRAZIL'S FEDERAL DISTRICT¹

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A review of death certificates in Brazil's Federal District was conducted to help define the impact of Chagas' disease in that area. The following account presents the results of that review.

Introduction

Chagas' disease is endemic in extensive rural areas of Brazil and other Latin American countries, where there are millions of infected persons (1). Moreover, it is one of the chief causes of sudden death in apparently healthy young persons, and is also responsible for a high degree of morbidity involving congestive cardiac failure and pathologic enlargements of the esophagus and colon (2).

Brazil's Federal District, where the capital city of Brasília is located, is considered free of Chagas' disease transmission by the conenosed (triatomid) bug that is the ailment's natural vector. However, significant numbers of the city's residents have contracted the infection in endemic zones, being infected by the disease agent *Trypanosoma cruzi* before being attracted to the new capital by job opportunities.

Ever since it was built toward the end of the 1950s, Brasília has been a magnet for job-seekers. Overall, it has experienced a higher population growth rate during the past 20 years than any other metropolitan area in Brazil. During 1970-1980, for example, its population grew at an annual average rate of 8.3 per cent, as compared to 2.5 per cent for the national population as a whole, topping the one million mark in 1978.

The study whose results are reported here

was undertaken in response to a previous review of vital statistics that found Chagas' disease listed as the cause of death on large numbers of death certificates (3). The study's purpose was to help define some aspects of Chagas' disease mortality among residents of the Federal District, to estimate the impact of the disease, and to make some general recommendations for its control.

Materials and Methods

The data used were the mortality statistics maintained by the district's secretariat of health which classify dead Federal District residents by sex, age, and the basic causes of death shown on lists A and B of the *Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death (Eighth Revision)* (4). Data on nonresidents are not included. The most recent data available at the time of the study (1982) covered the years 1977 and 1978; these 1977-1978 data were analyzed together in order to enlarge the statistical sample and thereby improve the opportunities to assess the patterns of mortality involved.

The population estimates employed were based on extrapolations from the 1960 and 1970 ten-year censuses and corrections derived from the school censuses of 1973 and 1978 (5). The age pyramid obtained in this manner showed a very young population (43.6 per cent below 15 years of age) and few elderly residents (only 1.1 per cent over 65 years old).

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The quality of the Federal District's vital statistics system is considered good. The law requires that all deaths be registered at official civil registry offices. Each death is certificated, and each certificate is made out in two copies, one of which goes to the Secretariat of Health. There the data are coded by specialized staff members and forwarded to the Ministry of Health for electronic tabulation.

Certain local factors help to keep under-recording of deaths to a minimum. Specifically, Brasília is a planned city, there being at least one public hospital and one civil registry office in each of the seven main residential quarters comprising the Federal District; 97 per cent of the population is urban; there are about 3.5 hospital beds and 2.5 physicians per thousand inhabitants; and there are no clandestine cemeteries.

In all cases of death, the cause of that death must be stated by a physician—either at the hospital involved in a routine case or at the Medical Legal Institute after verification of the cause in cases where the cause was uncertain or where no physician was present (6). In general, most deaths occur at hospitals and autopsies are common; in 1977, for example, autopsies were performed in connection with 49.3 per cent of all recorded deaths. The proportion of certificates citing poorly defined causes (another indicator of the quality of mortality statistics) has been relatively low; in 1977-1978 the proportion citing "poorly defined causes" was on the order of 3 per cent (7).

Local health facilities are aware that a diagnosis of Chagas' disease is always possible in young patients from endemic areas, whether or not they display specific symptoms, and also in patients with congestive cardiac failure or gastrointestinal pathology. Laboratory tests to detect infection with *T. cruzi* are routinely performed on countless occasions, such as when people are hired, during periodic check-ups, upon hospitalization, at blood banks, and at outpatient facilities.

In this regard, data from one blood bank (8) indicate that out of 2,413 donors tested in

1968-1970, 14.6 per cent were found to be positive, the great majority of these being low-income immigrants tested for Chagas' disease in the course of preemployment medical examinations. Broken down by the immigrants' areas of origin, these data indicated that above-average percentages of those from the neighboring states of Goiás and Minas Gerais tested positively, the respective positive rates being 30.1 and 17.4 per cent. Until 1980, Goiás accounted for 15.4 per cent of the migration into the Federal District and Minas Gerais accounted for 21.5 per cent (10).

It should also be noted that during the mid-1970s only about 3.6 per cent of the Federal District's adult residents (those at least 20 years of age) had been born within the district (9). Furthermore, the available population data (9, 10) indicate that some 69 per cent of the immigrants to the Federal District had come from the states of the Northeast or Midwest or from Minas Gerais—all regions where Chagas' disease is endemic (11)—and that 29 per cent of the immigrants were from rural areas. In effect, this meant that about one out of every five immigrant adults in the Federal District came from a rural area where Chagas' disease was endemic.

Results

Of the 10,367 deaths that occurred in the two-year period covered by this study, 443 (4.3 per cent) were attributed to Chagas' disease; that is, American trypanosomiasis was cited as the underlying cause of death. These deaths (yielding an annual mortality of 22 deaths per 100,000 population) accounted for a significant share of the mortality attributed to infectious and parasitic diseases, which in turn accounted for the largest single share (16.3 per cent) of all recorded deaths in the Federal District (Table 1). Moreover, within the infectious and parasitic disease category, Chagas' disease emerged clearly as the leading cause of death among adults, being responsible for fully 71 per cent of the adult deaths attributed to causes in this category (Table 2). It

Table 1. Principal causes of death among inhabitants of Brazil's Federal District in 1977-1978.

| Causes | Average annual deaths per 100,000 inhabitants | % of all recorded deaths |
|--------------------------------------|---|--------------------------|
| Infectious and parasitic diseases | 84 | 16.3 |
| Cardiovascular diseases | 81 | 15.7 |
| Accidents, poisonings, and violence | 74 | 14.3 |
| Perinatal causes | 66 | 12.9 |
| Influenza, pneumonia, and bronchitis | 59 | 11.4 |
| Tumors | 43 | 8.3 |
| Poorly defined causes | 19 | 3.7 |
| Other causes | 90 | 17.4 |
| Total | 516 | 100.0 |

Table 3. Chagas' disease mortality among residents of the Federal District 15 years of age or older, by sex and age group, 1977-1978.

| Age group (in years) | Deaths per 100,000 among | | Deaths per 100,000 (both sexes) |
|----------------------|--------------------------|--------------------|---------------------------------|
| | Males | Females | |
| 15-24 | 7.4 | 3.8 | 5.5 |
| 25-34 | 21.6 ^a | 9.9 ^a | 15.9 |
| 35-44 | 52.8 | 38.3 | 46.0 |
| 45-54 | 100.6 ^b | 84.4 ^b | 93.0 |
| 55-54 | 206.4 | 163.1 | 184.6 |
| ≥ 65 | 393.0 ^b | 237.8 ^b | 308.0 |
| Total | 45.4 ^a | 30.9 ^a | 38.2 |

^a $p < 0.01$.
^b $p < 0.05$.

Table 2. Distribution of the deaths caused by infectious and parasitic diseases, showing the percentage caused by Chagas' disease among residents below 15 years of age and among older residents in the Federal District (1977-1978).

| Causes of death (infectious and parasitic diseases) | % of deaths attributed to the indicated cause among subjects | | % of recorded deaths (among all age groups) attributed to the indicated cause |
|---|--|----------------|---|
| | < 15 years old | ≥ 15 years old | |
| Gastroenteritis | 75 | 5 | 51 |
| Tuberculosis | 2 | 12 | 5 |
| Trypanosomiasis (Chagas' disease) | 1 | 71 | 25 |
| Other infectious and parasitic diseases | 22 | 12 | 19 |
| Total (%) | 100 | 100 | 100 |
| Total No. of deaths | 1,158 | 615 | 1,773 |

should be noted, however, that most respiratory ailments—including influenza, pneumonia, and bronchitis—are not included in the category of "infectious and parasitic diseases" by the *International Classification of Diseases* (4), and that a considerable number of adult deaths in the study period (305) were attributed to these three respiratory causes. Nevertheless, this total was still less than the 443 deaths attributed to Chagas' disease in the same period.

The findings also indicate that Chagas' disease mortality is about half again as frequent among men as among women, and that such mortality tends to increase with age in both

sexes (Table 3). The percentages of overall mortality attributed to Chagas' disease, broken down by age, are shown in Table 4. These data indicate that about one death in ten among people between 25 and 64 years old was directly associated with Chagas' disease.

Figure 1 points up the difference between the distribution of all registered deaths among the total population, regardless of cause, and the distribution of registered deaths attributed to Chagas' disease. The former distribution is strongly influenced by infant mortality (especially that from perinatal causes, diarrheal diseases, and respiratory diseases—3), while the

Table 4. Deaths from Chagas' disease compared to deaths from all causes in the Federal District, by age group, 1977-1978.

| Age group (in years) | No. of deaths from: | | % of all deaths attributed to Chagas' disease |
|----------------------|---------------------|------------|---|
| | Chagas' disease | All causes | |
| <5 | 3 | 4,153 | 0.1 |
| 5-14 | 5 | 345 | 1.4 |
| 15-24 | 22 | 665 | 3.3 |
| 25-34 | 56 | 795 | 7.0 |
| 35-44 | 97 | 875 | 11.1 |
| 45-54 | 96 | 911 | 10.5 |
| 55-64 | 92 | 928 | 9.9 |
| 65-74 | 51 | 906 | 5.6 |
| ≥ 75 | 20 | 636 | 3.1 |
| Unknown | 1 | 153 | 0.7 |
| Total | 443 | 10,367 | 4.3 |

latter distribution illustrates the relatively high share of Chagas' disease deaths occurring in adults.

Table 5 compares Chagas' disease mortality

among male and female residents 15 to 64 years old with other selected causes of mortality in these groups. The figures show that Chagas' disease mortality is considerably lower than mortality from "external" causes (accidents, poisonings, and violence) in this age range, but that it is far higher than tuberculosis mortality and is roughly on a par with mortality attributed to cancer, to heart disease, and to stroke (3).

To help assess Chagas' disease's economic impact, the number of working years lost through death from this cause per 100,000 persons of economically active age was estimated (Table 6). This estimate, limited to people 15 through 64 years old, was arrived at by multiplying the average annual number of deaths in each ten-year age interval by the difference between the central point of that interval and age 65. By this method, a total loss of 2,275 working years per 100,000 subjects was

Figure 1. The age distribution of deaths from all causes and deaths from Chagas' disease in the Federal District, 1977-1978.

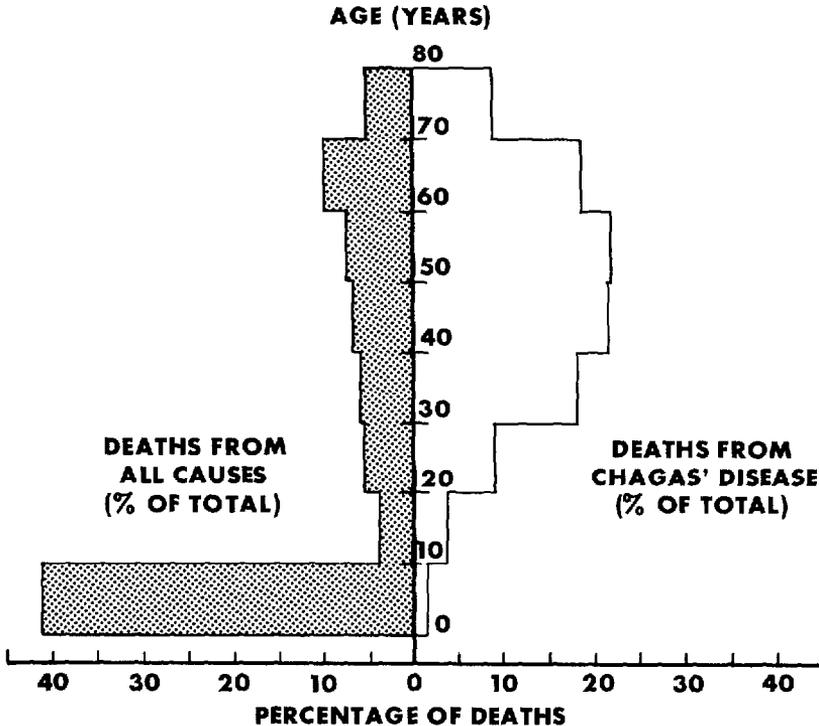


Table 5. Mortality from Chagas' disease and other selected causes among residents of the Federal District 15 through 64 years of age, by sex, 1977-1978.

| Selected causes | Category in the <i>International Classification of Diseases (#)</i> | Deaths per 100,000 population among: | |
|---|--|---|-------------------|
| | | Males | Females |
| Tuberculosis | (B5-6) | 6.8 | 4.9 |
| Chagas' disease | (A32) | 38.9 ^a | 26.2 ^a |
| Tumors | (B18-19) | 45.7 | 51.9 |
| Hypertensive, ischemic, and other heart diseases | (B27-29) | 56.2 ^a | 39.6 ^a |
| Cerebrovascular accidents | (B30) | 31.2 | 28.9 |
| Accidents, poisonings, and violence | (B47-50) | 164.9 ^a | 38.0 ^a |

^ap < 0.01.

Table 6. Years of work lost to death from Chagas' disease and other selected causes among residents of the Federal District 15 through 64 years of age, by sex, 1977-1978.

| Selected causes | Category in the <i>International Classification of Diseases (#)</i> | Years lost per 100,000 population among: | |
|---|--|---|---------|
| | | Males | Females |
| Tuberculosis | (B5-6) | 335 | 383 |
| Chagas' disease | (A32) | 2,275 | 1,363 |
| Tumors | (B18-19) | 2,120 | 2,498 |
| Hypertensive, ischemic, and other heart diseases | (B27-29) | 2,721 | 1,793 |
| Cerebrovascular accidents | (B30) | 1,523 | 1,470 |
| Accidents, poisonings, and violence | (B47-50) | 14,655 | 3,530 |

attributed to premature death from Chagas' disease among men, a male loss figure exceeded only by losses from heart diseases and external causes. The total Chagas' disease loss figure for women (1,363 working years) was lower; but female mortality from most causes was also lower than male mortality in this age range, and so the share of productive women's years lost to Chagas' disease mortality, as compared to other causes, was still relatively high.

Table 7 compares data on Chagas' disease mortality in the Federal District (1977-1978), São Paulo (1962-1964), and Ribeirão Preto (1962-1964). This comparison suggests that for most age groups the mortality attributable to Chagas' disease in Brasília (the Federal

District) was intermediate between Chagas' disease mortality in the other two cities, though somewhat closer to the Ribeirão Preto mortality figures than to the very low figures found for São Paulo. The death rates generally tended to be higher among men than among women in all age groups; but in Brasília they tended to keep rising with increasing age, while in the other cities they tended to decline notably in some of the older age groups.

Discussion

The foregoing results must be viewed in the light of certain limitations relating to the use of vital statistics in epidemiology. That is, no attempt was made in the course of the study to

Table 7. Chagas' disease mortality among residents of the Federal District, São Paulo, and Ribeirão Preto in various age groups, by sex.^a

| Age group (in years) | Annual deaths per 100,000 population among males in: | | | Annual deaths per 100,000 population among females in: | | |
|-------------------------|---|-----------------------------|------------------------------------|---|-----------------------------|------------------------------------|
| | Ribeirão Prêto (1962-1964) | São Paulo (1962-1964) | Federal District (1977-1978) | Ribeirão Prêto (1962-1964) | São Paulo (1962-1964) | Federal District (1977-1978) |
| 15-24 | 12.1 | 0.2 | 7.4 | 19.1 | 0.7 | 3.8 |
| 25-34 | 84.9 | 4.2 | 21.6 | 31.3 | 4.7 | 9.9 |
| 35-44 | 180.4 | 10.6 | 52.8 | 74.6 | 7.4 | 38.3 |
| 45-54 | 234.0 | 3.2 | 100.6 | 101.3 | 5.0 | 84.4 |
| 55-64 | 212.0 | 10.5 | 206.4 | 113.0 | 5.4 | 163.1 |
| 65-74 ^b | 164.0 | 1.6 | 393.0 | 88.0 | — | 237.8 |

^aSource of Ribeirão Preto and São Paulo data; R. R. Puffer and G. W. Griffith, *Patterns of Urban Mortality* (17).

^bFor the Federal District: ≥ 65 years.

confirm the diagnosed cause of death in each case. Instead, official records were supplied by the vital statistics system covering the entire (primarily urban) population, and these records were used to assess the numbers of deaths by cause, sex, and age group.

It should also be noted, however, that the local health infrastructure is extensive, that a large proportion of all deaths occur in hospitals, and that a substantial share of all deaths are autopsied—circumstances making it possible to generate statistics that would be difficult to obtain in other developing regions.

These considerations, plus the fact that the general quality of the data appears good, tend to affirm the worth of these diagnostic data on Chagas' disease in the Federal District. It is also true, of course, that the precise number of errors contained within these data (both incorrect positive and negative diagnoses on the recorded death certificates) could not be determined without performing epidemiologic surveys specifically addressing that question—a procedure that was not followed in connection with this study.

The findings presented indicate that Chagas' disease is an important cause of death in the Federal District, particularly among men, and that this mortality is especially high among young adults. Overall, it appears that mortality from infectious and parasitic dis-

eases would be one-quarter lower if the deaths due to Chagas' disease were excluded, and that such infectious and parasitic disease mortality would thus drop from the first to the fourth position—trailing cardiovascular disease mortality, mortality from external causes, and perinatal mortality (see Table 1).

In general, it appears that the high rate of immigration into the Federal District from other parts of Brazil endemic for Chagas' disease helps to explain the degree of Chagasic mortality observed, because this has placed a large number of people infected with *T. cruzi* among the district's residents. It has previously been noted that roughly one in five immigrants to the district comes from a rural area where Chagas' disease is endemic; what has not been stated is that a heavy migration to urban areas has been occurring throughout the country, which was about 32 per cent urban in 1940 as compared to 67 per cent urban in 1980. This means the disease is becoming urbanized, chiefly in terms of its economic and social consequences, and so we can expect that the Chagas' disease problem is going to become increasingly evident. In actual fact, of course, the population movement is simply making the health situation of the endemic rural areas more obvious.

At present there is no effective treatment for Chagas' disease; but primary preventive mea-

tures, when properly performed, yield good results. The great majority of people who get the disease are infected by the bites of the triatomid bugs that are the disease's natural vectors; and so it is primarily in rural areas that the problem must be confronted. Within this context, at least two kinds of measures can be applied for the purpose of controlling disease transmission. These are (1) upgrading of housing (combined with health education and reduction of rural poverty) and (2) application of insecticides to control the vector.

Regarding housing conditions, health education, and rural poverty, analysis of the natural history of Chagas' disease has shown that the main factors responsible for the ailment's endemicity are ones related to poor living conditions that favor contact between man and the insect vector. Therefore, in a general way, reduction of rural poverty would tend to markedly reduce the incidence of the disease. Also, in a more specific manner, construction of adequate housing to replace makeshift dwellings that favor the triatomid bugs' domiciliary life-cycle, together with health education drawing attention to the problem, could constitute effective and lasting measures to impede transmission (12). Nevertheless, the problem's magnitude and the difficulty of bringing about important changes in living patterns make it unrealistic to expect that effective control through such measures will occur soon.

It is also true, however, that triatomid bugs infesting houses can be temporarily eliminated as a public health problem through appropriate application of insecticides inside homes and subsequent inspection (12-14). São Paulo has achieved considerable progress in this manner (15). However, a systematic national campaign against Chagas' disease that was initiated by the Ministry of Health in 1950 has yet to achieve any significant change in the disease picture. As described by Motta in 1975 (11), over the course of 25 years a total of 11.5 million house exterminations were conducted, the annual average being 465,000. Nevertheless, the number of these actions

varied greatly from year to year, ranging from 53,000 in 1950 to 1,282,000 in 1967, the main determinant of the level of activity being available resources (11). Today the disease is still a serious public health problem in all the formerly endemic areas except the state of São Paulo, and the situation is deteriorating in some places as the agricultural frontier is extended (16).

These circumstances point up the fact that if Chagas' disease continues to prevail in rural areas, along with large-scale migrations to the cities, then the health implications of the disease in urban areas could become even greater than they are at present. Moreover, because city occupations tend to be less demanding physically than work done on the land, and because there is generally better access to health services in the cities, people with Chagas' disease tend to survive longer in urban settings. For this as well as the other aforementioned reasons, the number of infected people coming to use urban health services is increasing, even though these services can do relatively little because there is no effective treatment.

Besides these consequences of heavy urban (as well as rural) mortality and stepped-up but ineffective use of medical services, the disease has a number of other undesirable effects. These include heightened risk of infection through blood transfusion, increased Social Security costs incurred by early retirement, reduced employment opportunities for people with positive Chagas' disease serologies, and the impact upon the victims' families of prolonged illness or early death (12). This simple account of the disease's major implications, bereft of detailed attention to humanitarian considerations, demonstrates why allocation of greater resources for its control is both justified and badly needed.

In conclusion, it seems reasonable to point out that Chagas' disease is a symptom of rural Latin America's underdevelopment—an illness that persists in many rural areas because those areas lack the resources needed to combat it and to promote, protect, and encourage

the recovery of human health. It thus seems obvious, in view of the present worldwide effort to expand health service coverage and to achieve "health for all by the year 2000," that firm measures to control Chagas' disease must become an integral part of basic health service activities in those areas where the disease is endemic. There is every indication that these measures will need to be carried out on a national or even a hemispheric scale in order for

intradomiciliary transmission of the disease in rural regions to be halted—a circumstance that calls for high-level decision-making, allocation of adequate resources, and continuity of effort. But it also seems clear that such measures, if implemented by properly trained and supported personnel and backed by widespread community participation, could do a great deal to reduce transmission of the disease and help bring this persistent peril to an end.

SUMMARY

Because of evidence implicating Chagas' disease as an important cause of death, a review was conducted of death certificates issued for 1977-1978 in Brazil's Federal District. This review showed that 4.3 per cent of all 1977-1978 deaths in the district were attributable to Chagas' disease, which thus appears to have accounted for a significant share of the deaths due to infectious and parasitic diseases. It should be noted, however, that the disease had relatively little impact upon infant and young child mortality, while its impact on adult mortality was pronounced. Overall, the data reviewed indicate that Chagas' disease was directly associated with about one death in ten among people between 25 and 64 years old.

The findings also indicate that Chagas' disease mortality was higher among men than among women in the Federal District; that the disease accounted for fewer deaths than "external" causes (accidents, poisonings, and violence) in the 15-64 year age group of Federal District residents; that it appeared roughly on a par with cancer, heart disease, and stroke as a cause of death; that it caused far more deaths than tuberculosis; and that it appeared to cause a level of mortality intermediate between those found by a previous study (4) in the cities of Ribeirão Preto and São Paulo.

In view of these data, it is worth noting that natural transmission of the disease within the

Federal District by the bite of triatomid bugs is virtually nonexistent. The disease is generally contracted outside the district in endemic rural areas, and is then brought in by people coming to the district, mainly to seek work.

Such urban migration has been particularly pronounced in the Federal District, but it is also part of a national pattern that has transformed Brazil's population from predominantly rural to predominantly urban over the last four decades. Therefore, the disease is becoming urbanized, chiefly in terms of its economic and social consequences, and so the results of what used to be a primarily rural problem have become more obvious.

At present there is no effective treatment for Chagas' disease; but primary preventive measures such as application of insecticides, provision of adequate housing, health education, and elimination of squalid living conditions yield good results. It therefore seems reasonable to note that Chagas' disease is a symptom of rural Latin America's underdevelopment; that effective long-term national and hemispheric efforts to combat it are both justified and badly needed; and that in view of the present worldwide campaign to expand health service coverage and achieve "health for all by the year 2000," firm measures to prevent Chagas' disease must become an integral part of basic health service activities in those areas where the disease is endemic.

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