Hypertension and Economic Activities in São Paulo, Brazil

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SUMMARY A study of the prevalence of hypertension was undertaken among workers in 10 subsectors of the economy in São Paulo, a major urban-industrial area of Brazil. Included in the study were 5500 subjects 15–65 years of age, employed in 57 randomly selected firms. Hypertension rates (DBP ≥ 90 mm Hg) were higher among males up to 44 years of age. There was a decreasing gradient from mild to moderate and severe forms in all groups. Severity tended to increase with age in all groups. Black males showed higher rates than whites (29.2% vs 16.7%, p < 0.05), the excess being partially accounted for by moderate and severe forms (40% vs 20%). Subjects who overworked showed a trend toward higher hypertension rates. Higher rates in four subsectors (metallurgy, finance, transport, and journalism), aside from the distribution of known risk factors and job selection, may reflect a variety of work-related stressors.

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of its employees. The 1976 report of the law provided the sampling universe for the present study. Firms were classified by number of employees as small (50-99 employees), medium (100-499), and large (≥ 500 employees). The number of firms in the sample frame totalled 3122, from which 1601 were small, 1289 medium, and 232 large firms and included an estimated population of 760,000 workers.

In each of the three strata, 20 firms were randomly selected. The sample was further stratified according to subsector of the economy. In each subsector, six firms were selected: two small, two medium, and two large. In addition to the list of randomly selected firms, a replacement list following the same procedures included one firm for each subsector. There were 57 of the 60 planned firms included in the sample: 17 small, 21 medium, and 19 large. Three firms were not included in the study due to time-table constraints.

Each firm selected for the study was visited by a member of the medical team, in order to obtain the consent and participation of the management. Once given the consent, an updated list of workers was obtained. The number of subjects to be examined in each firm varied according to its size: 50 to 80 subjects were random selected to make up for possible absences; an additional list of 10% of the number of employees was used for that purpose. Absentees random selected for the study using a table of random numbers; 5500 subjects of both sexes aged 15 to 65 years were included. Selected employees seldom refused to participate (10 subjects). Replacements were random selected to make up for possible absences; an additional list of 10% of the number of employees was used for that purpose. Absentees included not only those currently working at the firm and not present at the visit, but also people who had been dismissed or had resigned.

Project interviewers (doctors and medical students) were trained to administer survey questionnaires. The training time included closed sessions with the supervisor, field visits to two firms, and comparison of blood pressure measurements of hospitalized patients taken by the interviewers and recordings from an Arteriosonde instrument (Roche Instruments). Information was gathered on age, sex, ethnicity, and weekly working hours. Subjects were kept in the sitting position for 10 minutes, and blood pressure was measured by the team doctor with a mercury sphygmomanometer on three consecutive times. Phases I and V of Korotkoff sounds were recorded. Cuff dimensions were 13 × 30 cm. Blood pressure measurements were taken by 11 interviewers.

Hypertension was considered to be present when the mean of the three diastolic blood pressure readings was equal to or greater than 90 mm Hg. The dependent variable was further refined into three degrees of severity: mild (90-104 mm Hg), moderate (105-119 mm Hg), and severe (≥ 120 mm Hg). Results are also expressed as mean diastolic blood pressure, and χ² tests and normal difference test between proportions were used to assess statistical significance.

### Results

The mean of diastolic blood pressure levels and sample composition according to age group and sex is shown in table 1. Male subjects constituted the majority of our studied sample (76%). Younger age-groups were overrepresented: 86.6% of males and 95.6% of females were less than 45 years of age.

The prevalence of hypertension (table 2) was 18.1% for males and 6.6% for females. Differences between the sexes were significant up to 44 years of age (p < 0.001). For both sexes, hypertension rates increased with age. These increments were significant for all groups except for women 45 years and over.

**Table 1. Mean Diastolic Blood Pressure (DBP) According to Age and Sex**

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>DBP (mm Hg)</td>
<td>SD</td>
<td>n</td>
</tr>
<tr>
<td>15-24</td>
<td>71.4</td>
<td>11.4</td>
</tr>
<tr>
<td>25-34</td>
<td>78.0</td>
<td>12.4</td>
</tr>
<tr>
<td>35-44</td>
<td>84.0</td>
<td>14.0</td>
</tr>
<tr>
<td>45-64</td>
<td>86.0</td>
<td>13.7</td>
</tr>
<tr>
<td>55+</td>
<td>90.5</td>
<td>15.5</td>
</tr>
</tbody>
</table>

Total sample = 5470 (4013 males and 1457 females) SD = standard deviation; n = number of observations.

**Table 2. Prevalence of Hypertension by Age and Sex (90% Confidence Intervals, CI)**

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>(90% CI)</td>
<td>%</td>
</tr>
<tr>
<td>15-24</td>
<td>5.3</td>
<td>(4.3-6.3)*</td>
</tr>
<tr>
<td>25-34</td>
<td>15.7</td>
<td>(14.2-17.2)**</td>
</tr>
<tr>
<td>35-44</td>
<td>29.5</td>
<td>(26.9-32.1)*</td>
</tr>
<tr>
<td>45-54</td>
<td>33.6</td>
<td>(29.8-37.4)NS</td>
</tr>
<tr>
<td>55+</td>
<td>46.7</td>
<td>(39.7-53.7)NS</td>
</tr>
</tbody>
</table>

Total 18.1 | (17.1-19.1)** | 6.6 | (5.6-7.6) |

*p < 0.01; **p < 0.001. NS = not significant (males vs females for normal difference in each age group).
In each particular age group, for both men and women, we compared the hypertension rates of those working more than the median weekly hours (men = 48.0 hours and women = 42.3 hours) to those working less than that median; we observed that for all groups except for men 25-34 years) the prevalence of hypertension was greater in those subjects working more than the median. In none of the groups, however, did the differences between rates reach statistical significance. Nevertheless, a borderline significance was observed in women of 45 years and over ($\chi^2 = 2.06, 1$) (fig. 4).

Age-sex standardized rates (indirect method) by subsector of the economy are shown in table 3. In four subsectors (metallurgy, insurance loans and finance transportation, and advertising and journalism) the rates were higher than the overall figure for the population studied (15.0%).

Discussion

The Metropolitan area of São Paulo, with a population of approximately 13 million (11% of the country's population), is the main urban and industrial center in

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FIGURE 1. Hypertension rates for males, by age groups and degree of severity. Mild (Mi) = 90-104 mm Hg; moderate (Mo) = 105-119 mm Hg; severe (Se) = ≥ 120 mm Hg.

FIGURE 2. Hypertension rates for females by age groups and degree of severity. Mild (Mi) = 90-104 mm Hg; moderate (Mo) = 105-119 mm Hg; severe (Se) = ≥ 120 mm Hg.

FIGURE 3. Hypertension rates (DBP ≥ 90 mm Hg) according to ethnicity in males and females.

FIGURE 4. Age-sex specific hypertension rates in subjects working more (straight line), or less (broken line) than median values of weekly working hours. Median values = 48.0 hours for males and 42.3 hours for females.
In regard to ethnicity, the higher rates observed among black males agree with those derived from blood pressure studies in the U.S. and the Bahamas showing that by age 20, blacks already have higher blood pressure than whites. It is noteworthy that the excess hypertension in black males in our sample is partially accounted for by moderate and severe forms (40% in black males vs 20% in white males). Black females show an increased prevalence when compared to whites, although significance levels were not reached, possibly due to the small number of black women in the sample.

A central concern in our present study was to search for an association between hypertension and the number of working hours. The observed trend, in all groups, of an increased prevalence of hypertension among those who overwork certainly deserves further attention. Although apparently large differences in rates for women 45 years and over were observed, the number of women in this group was small and significance was not reached. In the present analysis, body mass index was not taken into account. The available data on the Quetelet index for males shows that it increases with income whereas the opposite direction is found among females. On the other hand, the correlation between income and blood pressure among females is very small (r = −0.03 for females and 0.18 for males). Given the complex interrelations among body mass index, income, and working hours, it is possible that the association between working hours and blood pressure levels among women may be reduced when control for body mass is introduced. Due to the cross-sectional nature of the present study and its limited knowledge of the time-order of the two variables, the data might still suggest that overwork may render certain individuals more vulnerable to hypertension. Older women in the sample represent a special group that often accumulates social roles such as head of household, housewife, and wage worker. Conflicting demands in the job as well as in private and community life, coupled with increasing age and biological change, might help to explain increased blood pressure levels in those who overwork. At any rate, the hypothesis is worth testing in specially designed studies.

Four of the 10 selected economic activities, namely, metallurgy, insurance and finance, transportation, and journalism showed higher than average rates of hypertension. Observed differences in rates might be due to the tendency of some interviewers to read blood pressure higher or lower than others. Analysis of available data on blood pressure measurements (obtained in the pilot study and from hospitalized patients), however, did not reveal any systematic interobserver variation. Thus, it is unlikely that differences among interviewers might account for the observed differences. A possible confounding variable that might explain differences in the prevalence of hypertension is represented by body mass index. Analysis of mean Quetelet index, controlled for age and sex, however, showed that differences in the index can account for only a small part of the variation in hypertension.
It is noteworthy that transportation, communication, and financial services reflect growing material production and are pivotal to the modernization process. Higher rates in these subsectors, aside from the distribution of known risk factors and job selection, may reflect a variety of environmental stressors.

These findings are difficult to compare with those of other studies since morbidity surveys have been based on the general population or relatively homogeneous segments of it in terms of economic activity. However, it is tempting to speculate that physical agents such as heat and noise (metallurgy), time-pressure and highly competitive work (journalism), socially controlled activities (finance), and the disparity between growing demand and limited availability of certain services in the metropolitan area (transportation) may represent, among other factors, important sources of socially induced stress.

References
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