Prevalence of Type A Behavior in Untreated Hypertensive Individuals

Jane Irvine, David M. Garner, Heather M. Craig, and Alexander G. Logan

Type A behavior has been associated with coronary heart disease as well as high cholesterol and smoking, major risk factors for coronary heart disease, but the data indicating a similar association with hypertension are inconsistent. Since past studies have usually based hypertension on a single blood pressure assessment or have often included treated hypertensive patients, this inconsistency is not surprising. The current study compared the prevalence of Type A behavior (assessed by Rosenman's structured interview) between 109 untreated hypertensive subjects and 109 age-, sex-, ethnic-, and occupation-matched normotensive subjects. Hypertension status was based on five repeated assessments over a 5-month period. Results indicated that Type A behavior is more prevalent in untreated, mildly hypertensive employed individuals than occupationally matched normotensive subjects. Type A component analysis confirmed the importance of hostility and certain vigorous voice stylistics in predicting cardiovascular conditions. These findings, taken together with the evidence linking Type A behavior with high cholesterol and cigarette smoking, further support the view that this behavior pattern is associated with increased risk of coronary heart disease. (Hypertension 1991;18:72-78)

Several studies have indicated that Type A behavior is an independent risk factor for coronary heart disease. In addition, certain coronary heart disease risk factors, including high cholesterol and cigarette smoking, appear to be associated with Type A behavior. Conversely, the data indicating a similar association between Type A behavior and hypertension are inconsistent. The inconsistency is not surprising since in most instances hypertension status is based on a single measurement, which is inadequate to reliably establish hypertension. Misclassification errors could readily account for the negative results of some studies. Furthermore, a Type A–blood pressure reactivity effect rather than the chronic blood pressure effects of Type A behavior might explain the positive findings in some subgroups. The results of many studies are also confounded by the use of antihypertensive medications, β-Adrenergic blocking drugs appear to reduce the vigorous voice stylistics and hostility of those with the Type A pattern without influencing the content of their responses. Therefore, studies with treated hypertensive patients may mask a Type A–hypertension association. The one study that avoided these problems in study design found no association between Type A behavior and hypertension. They, however, used the students' version of the Jenkins Activity Survey, a self-report questionnaire for the assessment of Type A behavior in students that was modified for their study population and not validated before use in the study. Therefore, the scale may not have accurately distinguished Type A behavior in this population.

Accordingly, the present study was undertaken to further investigate the hypothesis that Type A behavior is associated with hypertension when blood pressure status is more validly assessed and the potential confounding effects of antihypertensive drugs are avoided. In view of the recent research indicating that certain components of the Type A behavior pattern are more strongly related than others to coronary heart disease events and severity of coronary atherosclerosis, we also sought to determine if some Type A components were more strongly associated with hypertension than others.
Methods

Subject Recruitment and Procedures

Men and women aged 25–64 years who were employed at 18 Toronto work sites were invited to attend blood pressure screening held at their work sites. The work sites were primarily white collar and included banking, manufacturing, radio, newspaper, and government employees. Participants with a diastolic blood pressure greater than or equal to 90 mm Hg (phase V) at the first screening procedure and who did not meet any of the exclusion criteria were invited to attend four additional blood pressure screenings over a 5-month period. At the second through fifth blood pressure screenings, four blood pressure readings were obtained, and a diagnosis of hypertension was based on the mean of the diastolic blood pressure readings over all five screenings. The first blood pressure reading at each screening was always excluded. Hypertension was diagnosed if the mean diastolic blood pressure was greater than 89 mm Hg (phase V).

Once the established hypertensive individuals had been identified, approximately 1 week after the fifth blood pressure screening, they were asked to undergo the structured interview assessment of Type A behavior. The interviews were videotaped for subsequent ratings of Type A behavior. Based on previous work, we estimated that 122 hypertensive and an equal number of matched normotensive individuals would provide sufficient statistical power to detect personality differences ($\alpha < 0.01$ and $\beta < 0.10$) between these two groups of individuals. Because the work site screening program generated more hypertensive individuals than needed for this study, the structured interview assessment was done on the first 122 hypertensive subjects and their matched normotensive subjects who met the eligibility criteria.

Normotensive controls were selected from the pool of individuals who attended the first blood pressure screening. Normotensive individuals, who were matched to each potential hypertensive subject by age, sex, ethnicity, and work site, were contacted by telephone and, if they did not meet any of the exclusion criteria, were asked to participate in the personality assessment. Normotensive individuals who agreed were asked to attend a second blood pressure screening; they were administered the structured interview assessment of Type A behavior after the 5-month period if their matched hypertensive subject was assessed with the structured interview.

Written consent to participate in the personality assessment was obtained at the second blood pressure screening. This study was approved by the University of Toronto Human Subjects Ethics Committee.

Exclusion Criteria

The potential hypertensive subjects were excluded if 1) at the first screening their systolic pressure was 200 mm Hg or more; 2) at any screening their diastolic blood pressure was 120 mm Hg or more; 3) they reported having suffered myocardial infarction, congestive heart failure, stroke, or angina pectoris; 4) they were currently treated with antihypertensive, antidepressant, or antipsychotic medications; or 5) they were pregnant or taking a contraceptive pill. The normotensive subjects were excluded on the aforementioned criteria and additionally if their diastolic blood pressure was more than 80 mm Hg at the first or more than 84 mm Hg at the second screening.

Blood Pressure Measurement

Because of the anticipated large volume of individuals attending the first screening, the initial blood pressure reading was obtained by a digital blood pressure device (Astro Pulse 90, Marshall Medical Division of Marshall Electronics, Inc., Lincolnshire, Ill.). If the initial diastolic blood pressure reading was more than 84 mm Hg, two more blood pressure readings were obtained by sphygmomanometry. The Hawksley random-zero sphygmomanometer was used for the blood pressure readings obtained at the second through fifth blood pressure screenings. Technicians, who were trained according to the criteria used by the Chicago Heart Association, performed the blood pressure screening.

Personality Measures

Type A behavior was assessed by the structured interview. Two interviewers who were trained in the structured interview method at the Stanford Research Institute, conducted the structured interviews and rated the videotaped interviews for Type A behaviors. The participants’ blood pressure status was unknown to the interviewers. Following Rosenman’s criteria, four classifications were made: extreme Type A (A1), moderate Type A (A2), Type B with a preponderance of non-Type A characteristics, and an indeterminant behavior pattern (X) with an equal number of Type A and non-Type A characteristics. Our between-rater agreement rate of 72% for the four categories and 84% for the two categories (i.e., Type A or Type B) compares well with those reported by others. Disagreements were resolved by reviewing the interviews jointly and arriving at a consensus rating. Test-retest reliability of the structured interview has been tested in a sample of 1,000 men from the Western Collaborative Group Study. With a retest interval ranging from 12 to 20 months, the reliability of the dichotomous Type A–Type B classification was very good (tetrachoric correlation coefficient = 0.82).

The Type A components were rated by one person following the method developed by Dembroski and MacDougall. Briefly, four verbal stylistics (loud voice, explosiveness of speech, rapid-accelerated speech, and response latency) and three attitudinal-behavioral dimensions (potential for hostility, anger-in, and verbal competitiveness) are rated from the video Type A structured interviews on a five-point scale, ranging from 1 (low) to 5 (high). Previously reported between-rater agreement for the compo-
Hypertension

such as treatment with antihypertensive therapy by study (16%), or met one or more exclusion criteria.

The remainder of the 835 individuals did not complete the second through fifth screenings, did not agree to participate in the personality study, or met one or more exclusion criteria (45%).

FIGURE 1. Schematic diagram shows sample selection process.

Statistical Analyses

The frequency of Type A personality in the hypertensive and normotensive groups is compared by the \( \chi^2 \) test of independence. To determine whether certain Type A components are more strongly associated with hypertension than others, stepwise discriminant function analysis is used. This procedure identifies the linear combination of variables that best discriminates between the diagnostic groups. The criterion for selecting variables for entry into the discriminant function equation was to minimize Wilk's \( \Lambda \). After selecting the variable that accounted for the largest amount of variance in discriminating hypertensive and normotensive individuals, stepwise discriminant function included each subsequent variable only if it significantly improved discrimination between groups. The SPSS-PC statistical software package was used for all analyses.

Results

Blood Pressure Screening

Figure 1 illustrates the procedure for selecting hypertensive participants for this study. Of the 835 eligible individuals who had an elevated diastolic blood pressure at the initial screening and agreed to follow-up screening, 380 agreed to participate in the personality study, 162 had persistent hypertension, which was defined as an average diastolic blood pressure of 90 mm Hg or higher. Of these hypertensive individuals, the first 122 and their matched normotensive participants were administered the structured interview assessment of Type A behavior. On later verification of the blood pressure data, 12 of the hypertensive subjects were classified as borderline hypertensive (i.e., mean diastolic blood pressure less than 90 mm Hg). Therefore, structured interviews were obtained on 110 hypertensive and 110 matched normotensive subjects. Two structured interviews, one from each group, could not be rated because of poor technical quality.

The demographic characteristics of the hypertensive and normotensive participants who were administered the structured interview for Type A ratings are displayed in Table 1. The sample was predominantly white middle-aged men who were married and who had completed college or university. The hypertensive and normotensive participants were similar on all demographic variables except for self-reported history of hypertension in the parents or siblings (\( \chi^2=8.90, p<0.01 \)). A similar proportion of hypertensive and normotensive participants reported that they were currently smoking cigarettes or had previously smoked cigarettes.

Personality Results

Table 2 shows the percentage of hypertensive and normotensive participants who were classified as Type A1, A2, or Type B by the structured interview. In keeping with the practice of many other investigators, \( \chi^2=8.11, p<0.02 \). Collapsing

### Table 1. Selected Demographic Characteristics of the Study Sample

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Hypertensive</th>
<th>Normotensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males/females</td>
<td>88/21</td>
<td>88/21</td>
</tr>
<tr>
<td>Age (mean±SD)</td>
<td>45.8±8.1</td>
<td>45.8±8.0</td>
</tr>
<tr>
<td>Mean SBP</td>
<td>136.5±8.4</td>
<td>118.7±11.2</td>
</tr>
<tr>
<td>Mean DBP</td>
<td>93.7±2.7</td>
<td>75.5±6.4</td>
</tr>
<tr>
<td>White (%)</td>
<td>83</td>
<td>83</td>
</tr>
<tr>
<td>Married (%)</td>
<td>83</td>
<td>77</td>
</tr>
<tr>
<td>College or greater (%)</td>
<td>67</td>
<td>72</td>
</tr>
<tr>
<td>Family history of hypertension (%)</td>
<td>54</td>
<td>36</td>
</tr>
<tr>
<td>Current cigarette smoking (%)</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Past history of cigarette smoking (%)</td>
<td>46</td>
<td>47</td>
</tr>
</tbody>
</table>

SBP, systolic blood pressure; DBP, diastolic blood pressure.

*Results scores ranges from 0.69 for response latency to 0.87 for explosiveness.*

Statistical Analyses

The frequency of Type A personality in the hypertensive and normotensive groups is compared by the \( \chi^2 \) test of independence. To determine whether certain Type A components are more strongly associated with hypertension than others, stepwise discriminant function analysis is used. This procedure identifies the linear combination of variables that best discriminates between the diagnostic groups. The criterion for selecting variables for entry into the discriminant function equation was to minimize Wilk's \( \Lambda \). After selecting the variable that accounted for the largest amount of variance in discriminating hypertensive and normotensive individuals, stepwise discriminant function included each subsequent variable only if it significantly improved discrimination between groups. The SPSS-PC statistical software package was used for all analyses.
the Type A1 and A2 categories, 78% of the hypertensive subjects were classified as Type A versus 60% of the normotensive subjects ($x^2 = 7.15, p < 0.01$). Because being labeled as hypertensive has been associated with adverse psychological consequences, the Type A data were reanalyzed with the hypertensive subjects subdivided into previously aware and unaware subgroups (Table 3). The prevalence of Type A personalities in the two hypertensive subgroups was similar, and both groups included significantly more Type A personalities than the normotensive group ($p < 0.05$).

**Type A Component Analyses**

Stepwise discriminant function analysis was performed twice. The first discriminant function analysis included the global Type A score and the component scores to determine if certain Type A component scores were better discriminators of hypertension status than the global Type A score. In this analysis three variables were significantly associated with hypertension status at the univariate level: global Type A ($p < 0.02$), response latency ($p < 0.02$), and potential for hostility ($p < 0.04$). As the $F$ test was marginally more significant for the global Type A score, this variable was selected for entry at step 1. Two component scores, loud voice and response latency, also contributed unique variance after global Type A had been entered into the discriminant function equation. Two of the coefficients were positive, indicating that greater Type A behavior and shorter latencies in response to the interview questions were associated with hypertension. The coefficient for loud voice in the discriminant function equation incorporating global Type A, response latency, and loud voice correctly classified 60% of the sample as hypertensive or normotensive.

Because the global Type A score comprises information from each of the component scores, a second discriminant function analysis, excluding the global Type A score, was performed to determine which of the Type A component scores largely accounted for the discrimination between hypertensive and normotensive participants. In this second analysis (Table 5), response latency accounted for the largest proportion of the variance with only loud voice and potential for hostility contributing additional unique variance in defining hypertension. Hypertensive subjects were characterized as having shorter latencies in response to the interviewer's questions and they spoke in a softer voice compared with normotensive subjects. The coefficient for hostility was positive, indicating that hypertensive subjects were also rated as having a greater potential for hostility. Sixty-two percent of the sample were correctly classified as hypertensive or normotensive on the basis of these three component scores, indicating marginally better classification than using the classification equation that included the global Type A score.

**Discussion**

Results from the current study indicated that the Type A behavior pattern as measured by the structured interview was significantly more prevalent in hypertensive (78%) than in normotensive (60%) subjects. Further analyses revealed that there were no differences in the prevalence of the Type A behavior pattern between those who had been diagnosed as hypertensive before screening (previously aware

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**Table 2. Percentage of Type A and Type B Personalities in the Hypertensive and Normotensive Groups**

<table>
<thead>
<tr>
<th>Behavior pattern</th>
<th>Hypertensive* (n=101)</th>
<th>Normotensive (n=105)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type A (%)</td>
<td>35</td>
<td>25</td>
</tr>
<tr>
<td>Type A2 (%)</td>
<td>44</td>
<td>35</td>
</tr>
<tr>
<td>Type B (%)</td>
<td>22</td>
<td>40</td>
</tr>
</tbody>
</table>

$x^2 = 8.11, p < 0.02$.

**Table 3. Percentage of Aware and Unaware Hypertensive Subjects Who Were Classified as Type A or Type B**

<table>
<thead>
<tr>
<th>Behavior pattern</th>
<th>Hypertensive (%)</th>
<th>Normotensive (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aware (n=41)</td>
<td>Unaware (n=60)</td>
</tr>
<tr>
<td>Type A</td>
<td>80</td>
<td>77</td>
</tr>
<tr>
<td>Type B</td>
<td>20</td>
<td>23</td>
</tr>
</tbody>
</table>

Comparison between aware hypertensive and normotensive subjects, $x^2 = 4.62, p < 0.05$.

Comparison between unaware hypertensive and normotensive subjects, $x^2 = 4.02, p < 0.05$.

Comparison between aware and unaware hypertensive subjects, $x^2 = 0.04, p < 0.83$.

**Table 4. Analysis of Type A Global Score and Component Scores**

<table>
<thead>
<tr>
<th>Order of entry</th>
<th>Variables</th>
<th>Cumulative Wilk's $A$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Global Type A</td>
<td>0.969</td>
</tr>
<tr>
<td>2</td>
<td>Loud voice</td>
<td>0.958</td>
</tr>
<tr>
<td>3</td>
<td>Response latency</td>
<td>0.945</td>
</tr>
</tbody>
</table>

$x^2 = 11.38, p < 0.01$.

**Table 5. Analysis of Type A Component Scores**

<table>
<thead>
<tr>
<th>Order of entry</th>
<th>Variables</th>
<th>Cumulative Wilk's $A$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Response latency</td>
<td>0.972</td>
</tr>
<tr>
<td>2</td>
<td>Loud voice</td>
<td>0.959</td>
</tr>
<tr>
<td>3</td>
<td>Potential for hostility</td>
<td>0.949</td>
</tr>
</tbody>
</table>

$x^2 = 10.57, p < 0.02$.
The prevalence of Type A behavior in our hypertensive and normotensive groups paralleled the prevalence of Type A behavior observed in other similar samples of white-collar, middle-aged men. For example, the rate of Type A behavior in the normotensive group (60%) was similar to the rate of Type A behavior found by Howard et al. in a sample of healthy, middle-aged Canadian businessmen (58%). Both samples were only somewhat higher than the 50% prevalence rate of Type A personalities found in the Western Collaborative Group Study, which also comprised white-collar, healthy men. The prevalence of Type A personalities in our hypertensive group (78%), on the other hand, was similar to the prevalence of Type A personalities in the Multiple Risk Factor Intervention Trial (MRFIT) sample (74%). The MRFIT sample comprised men who had hypertension or other coronary heart disease risk factors that have also been associated with the Type A behavior pattern, namely, high plasma cholesterol and cigarette smoking.

The finding of an association between Type A behavior and hypertension in the current study is contrary to past findings. Most previous studies have used inadequate methods to diagnose hypertension and have included treated hypertensive patients in the sample, both of which could undermine the test of a Type A-hypertension association. The one study that used a similar methodology to the current study did not find a Type A-hypertension association. The discrepant finding may be related to the type of method used to assess Type A behavior. In the study of Steptoe et al., Type A behavior was classified by a self-report questionnaire, whereas we used the structured interview assessment. Several investigators report disagreements between the classification of Type A behavior by the structured interview method, the reference standard, and by self-report methods. Furthermore, the structured interview classification of Type A behavior is more strongly related to coronary heart disease than self-report measures, suggesting an increased sensitivity of this instrument to detect Type A behavior.

The results of the Type A component analysis indicated that none of the component scores discriminated better than the global Type A score between hypertensive and normotensive participants, although discrimination was just as successful with a combination of three of the Type A components as it was when including the global Type A score. The three components that discriminated hypertensive and normotensive subjects were a shorter response latency, a softer voice, and greater potential for hostility.

Our finding of greater structured interview-defined hostility in association with hypertension is consistent with the research demonstrating an association between structured interview-defined hostility and coronary heart disease events, severity of coronary atherosclerosis, and laboratory blood pressure reactivity. However, in these other studies hostility was usually found to be more strongly associated with the cardiovascular variables than the global Type A score. In our sample, global Type A was only marginally more strongly related to hypertension than potential for hostility. Given the marginal difference in the strength of association and the very similar classification result when hostility was substituted for global Type A (62% versus 60%, respectively), it is impossible to determine on the basis of the present study if certain Type components are better predictors of hypertension than the global Type A score. Nevertheless, the results corroborate the importance of the hostility component of the Type A behavior pattern in predicting cardiovascular conditions.

Our finding that hypertensive subjects were characterized by shorter response latencies is also consistent with the evidence relating this voice stylistic with the incidence of coronary heart disease. Hypertensive subjects, on the other hand, were characterized by a softer voice rather than the loud voice typical of Type A personalities. The loudness of voice stylistic has not emerged as a significant predictor of coronary heart disease end points in past studies. Given that this is the first study to investigate the structured interview-Type A components in relation to hypertension, it is uncertain whether this unexpected finding is specific to hypertension.

We cannot exclude the possibility that, in the present study, the unequal number of blood pressure assessments in the two groups and the attrition of hypertensive subjects over the blood pressure screening period might account for the observed differences between normotensive and hypertensive groups. It could be argued that if Type A characteristics influenced participation in screening such that fewer Type B individuals continued with screening, then this would have resulted in a higher-than-actual rate of Type A personalities in the hypertensive group. Nonetheless, it is equally plausible, or possibly more so, that the time-pressed Type A personalities would be more likely to discontinue blood pressure screening than the less hurried Type B personalities.

In conclusion, results from the current study indicate that Type A behavior is more prevalent in unmedicated, mildly hypertensive employed individuals. This finding, taken together with the evidence linking Type A behavior with elevated cholesterol and cigarette smoking, further supports the view that this behavior pattern is associated with increased risk of coronary heart disease.
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**KEY WORDS** • type A personality • essential hypertension
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