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Andrea Foote

John C. Erfurt

John R. Caldwell

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A screening, referral, and follow-up program for high blood pressure at Henry Ford Hospital: Part I. Results of screening

Andrea Foote, Ph.D.,* John C. Erfurt, B.A.,** and John R. Caldwell, M.D.***

Data are reported on the screening results from the Henry Ford Hospital screening, referral and follow-up program for high blood pressure. The report covers the period of March 27 through December 11, 1975, during which time 808 people were screened in the hospital lobby. Thirty-nine percent were found upon initial screening to have high blood pressure readings or previously diagnosed hypertension. Of these people, 70% were already under treatment for hypertension, but only 21% showed adequate blood pressure control (with readings below 140/90 mm Hg). Those with high readings were referred to their physicians. A paper on the results of follow-up is being prepared.

Relationships are presented between high blood pressure and age, sex, race, education, percent overweight, marital status, employment status, and history of cardiovascular disease. For diagnosed hypertensives, several aspects of treatment are related to adequacy of blood pressure control.

THE primary cause of death in the United States is cardiovascular disease, which accounts for more than half of all deaths annually. The proportion of deaths attributable to cardiovascular disease has risen steadily since 1900, when 80% of all deaths were due to other illnesses.¹ The primary causes of death at that time have now been largely controlled (eg, infectious diseases, infant mortality), and this has happened primarily through preventive measures.

There is much that can now be done to prevent cardiovascular disease. The Framingham study has demonstrated hypertension to be one of the key risk factors for cardiovascular disease.^{2,3} Our ability to treat hypertension has improved considerably in the past few years; many new medications have been tested and found effective at reducing blood pressure to normal levels. Most importantly, the Veterans Administration studies have demonstrated that medically controlling blood pressure is effective in reducing cardiovascular events.^{4,5}

As the effectiveness of available treatment has improved, however, it has become clear that the asymptomatic nature of hypertension will require additional health service delivery procedures, in order to identify the masses of people with high blood pressure, and insure that they begin and maintain the appropriate treatment.⁶ The adequate control of hypertension will require procedures analogous to those used in controlling infectious diseases. That is, we cannot rely only on people's visits to a physician.

The control of infectious diseases required broad public health measures, including

* Assistant research scientist and co-director, Worker Health Program, Institute of Labor and Industrial Relations, The University of Michigan.

** Associate research scientist and co-director, Worker Health Program, Institute of Labor and Industrial Relations, The University of Michigan.

*** Chief, Section on Hypertension, Henry Ford Hospital.

mass inoculations, purification of water supplies, and control of sewage and other public health hazards. Similarly, the control of hypertension will require mass screening, and systematic follow-up to insure that treatment is begun and maintained.⁷ In the absence of such health service delivery procedures, we must expect that hypertension will remain as poorly controlled as it is now, and that death rates due to cardiovascular disease will not be significantly reduced.

In response to this problem, Henry Ford Hospital began a program in March, 1975, to screen people for high blood pressure, refer those with high readings to sources of medical care, and follow-up with these people and their physicians to insure successful referral and maintenance of treatment. The program was begun in cooperation with the Hypertension Coordinating and Planning Council of Southeastern Michigan, also known as BLOOD PRESSURE CONTROL.

This paper reports on the screening results of that program, including epidemiological findings. A subsequent paper will report on the results of the program's referral and follow-up activities.

Screening procedures

The Henry Ford Hospital blood pressure screening procedures are carried out in the hospital lobby, and the service is offered to anyone coming through the lobby (eg, Hospital employees, outpatients, visitors). The screening was initially offered one morning a week, for three hours, and was later expanded to two mornings a week. The screening is carried out by volunteer nurses recruited by the Hospital, using the forms and procedures developed and tested by The University of Michigan's Worker Health Program.⁸

Three blood pressure readings are taken for each person, and each reading is classified as normal, borderline, or high (Figure 1). A reading is classified as normal only if the systolic pressure is below 140 mm Hg and

the diastolic pressure below 90. A reading is classified as high if the systolic is 160 or higher, and / or if the diastolic is 96 or higher. (Note that the manometer is calibrated in units of two mm Hg, so that an odd-numbered reading is impossible.)

Systolic:	Diastolic		
	Up to 88	90-94	96 & higher
Up to 138	N	B	H
140-158	B	B	H
160 & higher	H	H	H

Figure 1

If two of the three readings (or all three) are classified as high, the nurse refers the person to his or her physician for further evaluation. Persons with readings in the borderline range are asked to return for a secondary screening, at which time three readings are again taken, and a determination is made whether the readings are high enough to warrant referral to a physician. All people referred to a physician, either at the initial or the secondary screening, were followed by the Hypertension Coordinating and Planning Council, to insure that they did see a physician, and that they followed any treatment the physician prescribed. (Beginning July, 1976, the follow-up activities have been taken over by Henry Ford Hospital staff.)

Figures in this report cover the period March 27 through December 11, 1975. During that period, 808 people were screened, and 315 (39%) were found to have high blood pressure at the initial screening. This includes 171 people with observed high readings, plus 144 people with normal or borderline readings who had been previously diagnosed as hypertensive and were under treatment. (NOTE: Throughout this paper, the term "high blood pressure" is meant to include both people with high blood pressure readings and people who are being treated for hypertension. "High blood pressure readings" is used when referring to only those people whose observed readings were in the high range.)

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Awareness and treatment of high blood pressure

The treatment status of the people identified as having high blood pressure was much better than that of Detroit area residents as a whole. Table I compares estimates from a study of Detroit in 1968-69 with the figures from the Henry Ford Hospital program.

In 1968-69 it was estimated that over half of the people in the Detroit area with high blood pressure were not aware of having it.⁹ In contrast, only 20% of the people found to have high blood pressure by the Henry Ford Hospital program did not know they had it. Only 9% of the Detroit area residents with high blood pressure were under adequate treatment for it (with blood pressure readings below 140/90), in comparison with 21% of the Henry Ford Hospital group (Table I).

Even so, it is clear that treatment for high blood pressure among this group was not adequate. Thirty percent were under no treatment for high blood pressure, and almost 50% were under inadequate treatment (25% with high readings and 24% with borderline readings).

TABLE I

	People with high blood pressure:	
	Henry Ford Hospital group	Detroit area residents*
% Unaware of having high blood pressure	20	51
% Aware but under no treatment	10	16
% Under inadequate treatment (BP still borderline or high)	49	24
% Under adequate treatment (BP was below 140/90)	21	9
	100%	100%

* SOURCE: Estimated by The University of Michigan's Program for Urban Health Research, from a 1968-69 survey of Detroit area residents, 25 to 60 years of age.

Availability / utilization of medical care

All persons screened were asked whether they had a physician whom they would see if they got sick, and also how long it had been since their last visit to a doctor or clinic. Over 80% said that they did have a doctor, and those having a doctor were somewhat less likely to have uncontrolled high blood pressure (readings 160/96 or higher) than those indicating no doctor (20% as opposed to 27%).

The frequency of visits to a physician showed a little more complicated relationship to prevalence of uncontrolled hypertension, as shown in Table II. People who had seen a physician *most* recently and *least* recently had the highest prevalence of uncontrolled high blood pressure. It is probable that the "most recent" group includes more people with hypertension that is resistant to therapy, while the "least recent" group includes more people who were never identified as hypertensive.

TABLE II

Last saw a physician:	N	% with high BP readings
Less than six months ago	445	23
6 to 11 months ago	128	15
1 to 2 years ago	133	17
Over 2 years ago	102	27
TOTAL	808	21%

Relationship of treatment variables to adequacy of control

Of the 222 people under treatment for hypertension, most were on both diet and medication. The effectiveness of treatment appears to be better for those on a diet only (Table III). However, people placed on a diet only are likely to be those with mild BP elevations that respond easily to mild forms of treatment.

TABLE III

Type of treatment	N	% with high BP readings
Diet only	24	29
Medication only	81	37
Both diet and medication	117	35
TOTAL	222	35%

The frequency with which the antihypertensive medication is to be taken (for those on medication) varies in a similar way (Table IV). People who are supposed to take their medication the *most* frequently (more than once a day) had the *least* well-controlled blood pressure (41% with high readings). There are two possible explanations for this. First, stronger forms of therapy are more often prescribed for people with hypertension that is resistant to therapy. And second, other studies have indicated that people find it easier to comply with a once-a-day regimen than with a more frequent or less frequent regimen. Since the least frequent regimen in Table IV is associated with the highest degree of control (although not significantly different from the once-a-day regimen), the argument tends to favor the first explanation. However, it is possible that both explanations may have some validity. In any case, it is notable that the therapy is least effective for the people who presumably need it most (ie, those under the most frequent medication regimen).

TABLE IV

Prescribed frequency of medication:	N	% with high BP readings
More than once a day	99	41
Once a day	71	31
Less than once a day	26	27
TOTAL	196*	36 %

* Frequency was not ascertained for two people.

All persons for whom antihypertensive medication had been prescribed were asked whether they knew what kind of medication they were on (either the name of the medication or its action, eg, water pills). It was found that most of them did know the medication, but more importantly, it was found that those who knew their medication had much better blood pressure control than those who did not. Of those who knew their medication, 32% had high BP readings, while of those who did not know it, 46% had high readings. This may be an indication that the better a person understands his treatment, the more likely he is to follow it.

Each person on medication was also asked whether or not he/she had been following the treatment as prescribed. Approximately three-fourths answered yes, and their control was significantly better than that of those who said they had *not* been following the therapy. Of those who answered yes, 31% had high readings, while of those who answered no, 49% had high readings.

Age and blood pressure

The rate of high blood pressure found in the Henry Ford Hospital group (39%) was higher than would be expected from a random sample of the population. National figures indicate that about 15% of the adult population has high blood pressure, but the prevalence is higher among black people and older people. Therefore, if the people screened by the Henry Ford Hospital program are older than the population as a whole, this would explain at least part of the reason for the higher rate of high blood pressure in this group. Table V shows the rate of high blood pressure within age groups for the group screened at Henry Ford Hospital and for the population as a whole.

It can be seen that the group screened at Henry Ford Hospital was indeed older than the population as a whole; the largest age group was those 65-74 years of age. But

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TABLE V

Age group:	Number in each age group (HFH)	Percent with high BP (HFH)	Percent with high BP (Nat'l estimates)*
13-17 years old	6	0	—
18-24 years old	40	12	2
25-34 years old	57	10	4
35-44 years old	87	28	11
45-54 years old	136	37	18
55-64 years old	205	42	27
65-74 years old	213	48	39***
75-79 years old	40	60	
80-87 years old	20	75	
TOTAL	804**	39%	15%

* SOURCE: National Center for Health Statistics. Non-institutionalized population, ages 18 to 79 years, 1960-1962.

** Age was not ascertained for four people.

*** Estimate for people ages 65 and older.

Table V shows that within each age group, the prevalence of high blood pressure was higher than national estimates. In the next section we will explore whether this can be attributed to racial composition.

Sex, race and blood pressure

National figures indicate that overall, men and women have about the same rate of high blood pressure, but that black people have about twice the rate of high blood pressure as white people. In the group screened at Henry Ford Hospital, men and women had the same rate of high blood pressure (39%), but blacks and whites also had the same rate (also 39%). Both figures are higher than national estimates, but the figure for whites is more than twice as high as expected. The second column of Table VI shows the percent found to have high blood pressure at Henry Ford Hospital for each race/sex group, and the fourth column shows the percent found in the general population.

We saw in the previous section that the Henry Ford Hospital group was older than

average. In order to control for this age difference, we have computed an expected percent with high blood pressure, for each race/sex group, based on the age distribution of the people screened, ie, the percent that would be found in the Henry Ford Hospital groups if they had the same age-specific rates of hypertension as are found nationally (by race and sex). This is shown in the third column of Table VI. The difference between the expected percent (column 3) and the actual percent (column 2) is the difference *not* explained by the older mean age of the Henry Ford Hospital group, since the effects of age have been taken out. Conversely, the difference between the expected percent (column 3) and the population percent (column 4) is caused totally by the older age distribution of the people screened at Henry Ford Hospital, by definition.

For the black males, the older average age is the primary reason for the higher rate of hypertension among the Henry Ford Hospital group as compared with black males in the population as a whole. That is, the black males screened at Henry Ford Hospital had

TABLE VI

Race / sex group*	(1) N	(2) % high BP, HFH groups	(3) Expected % high BP,** based on age dist.	(4) % high BP U.S. population***
Black males	91	38%	37%	27%
Black females	157	39%	33%	27%
White males	217	39%	23%	13%
White females	342	39%	30%	15%

* Race was not ascertained for one person.

** Percent that would be expected in the Henry Ford Hospital groups, if they had the same age-specific rates of hypertension as are found nationally. This was computed by multiplying the age-specific rates of high blood pressure estimated by the National Center for Health Statistics, within each race / sex group separately, times the age distribution of the people in that group screened at Henry Ford Hospital, and summing the results. This process results in indirect standardization for age.

*** SOURCE: National Center for Health Statistics. Non-institutionalized population, ages 18 to 79 years, 1960-1962.

about the same rate of hypertension (38%) as would a random group of black men of comparable age (37%).

However, this was not true for the other three race / sex groups. Older mean age explained much of the difference, but not all. Among the black women, age explained about half of the discrepancy between the rate of high blood pressure in the hospital group and in the population as a whole (ie, the difference between columns 3 and 4, divided by the difference between columns 2 and 4). Among white men, age explained 38% of the difference; and among white women, age explained 62% of the difference.

The unexplained difference between the rate of hypertension found in the Henry Ford Hospital groups and the rate expected is evidence of the fact that people screened there were not a random sample of the population. Many of them were there for health reasons, and it should not be surprising to find a higher rate of hypertension among them. It is somewhat surprising, however, to note that the rate of high blood pressure was not proportionately elevated for all four race / sex groups. The rate for black males was scarcely elevated above expectation, while the rate for white males was considerably elevated above expecta-

tion. The rate for white females was also somewhat more elevated than the rate for black females, although the discrepancy was not nearly so great as for the men.

These findings appear to support findings from other screening programs which have shown that the difference in rate of hypertension between blacks and whites is not nearly so large as population figures indicate, at least for small, geographically defined subgroups. Further analysis of these findings is underway.

Weight and Blood Pressure

The two variables that have consistently shown the strongest relationship to high blood pressure are age and weight, or more precisely, percent overweight. Ideal weight, of course, varies according to sex and height. For each height, separately for men and women, there is an approximate ideal weight. For each person screened at Henry Ford Hospital, we divided his or her actual weight by the ideal weight. Table VII shows the results. It can be seen that the more a person is above his or her ideal weight, the greater are the chances of having elevated blood pressure.

Moreover, it has been argued that the ideal weight charts are too high, and that

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TABLE VII

Weight:	N	% High BP
70-90% of ideal weight	58	26
91-100% of ideal weight	131	34
1-10% above ideal weight	175	38
11-20% above ideal weight	169	40
21-30% above ideal weight	109	45
31-40% above ideal weight	66	46
41-60% above ideal weight	53	45
Over 60% above ideal weight	36	50
TOTAL	797*	39%

* Eleven people did not report their height or weight.

TABLE VIII

Ever Had:	YES		NO	
	N	HBP	N	HBP
Diabetes	66	58	741	37
Kidney disease/trouble	74	41	734	39
Stroke	12	42	796	39
Heart disease/trouble	132	61	676	35

ideal weight should be even lower. In terms of blood pressure, there is some support for this in Table VII, since the people who were at least 10% *below* their "ideal" weight had a lower rate of high blood pressure. In fact, the largest increment appears between the group that was 70-90% of ideal weight and the group that was 91-100% of ideal weight. The next largest increment comes between 11-20% and 21-30% above ideal weight, and the percent with high blood pressure remained relatively constant for people between 21% and 60% above ideal weight.

History of cardiovascular disease

Forty-five percent of the group screened indicated a history of high blood pressure, ie, had been told at some time in their life that they had high blood pressure. Of this group 16% now had normal blood pressure (and were not under treatment for hypertension), and another 11% had borderline readings. The remaining 73% had high readings or

were under treatment for high blood pressure. Of all the people identified as having high blood pressure, 85% had been told at some time that they had it, and 80% were aware of having it now.

Each person screened was also asked whether he or she had ever had diabetes, kidney trouble, a stroke, or heart trouble. Table VIII shows the percent having high blood pressure, by history of those four types of disease.

Having high blood pressure was significantly related to a history of diabetes and of heart trouble, but not stroke or kidney trouble. However, the number of people having experienced a stroke was too small to be reliable. With regard to kidney disease, other studies have noted that bladder infections are frequently referred to as kidney trouble, and it is possible that only a few of the people answering "yes" to the kidney disease question had actually had kidney disease.

Marital status, employment status, and blood pressure

It has often been suggested in the literature that various attributes of life style or life stress are related to development of hypertension. Marital and employment status are major attributes of life style, and their relationship to blood pressure is shown in Tables IX and X.

TABLE IX

Marital Status	N	% High BP
Married	533	38
Single	110	25
Separated	16	62
Divorced	44	34
Widowed	105	54
TOTAL	808	39%

While it is understandable that the single people have the lowest rate of hypertension (being the youngest), and that the widowed have one of the highest rates (being the oldest), it is notable in Table IX that the separated people had the highest rate, 62%. While there were very few people in this group, this finding has appeared among other groups of people screened for high blood pressure, suggesting that the state of being separated is more stressful than that of being either married or divorced, and appears to lead to a greater likelihood of high blood pressure. Once the state of being separated is resolved in either direction, we might expect to see a natural reduction in blood pressure.

Table X shows some interesting figures regarding employment status and prevalence of high blood pressure. Some of these figures may be spurious, in that we have again not controlled for age in this table. The people who were employed at the time of screening had the lowest prevalence of high blood pressure. But it is possible that this was also the youngest group. People who were unemployed had the same rate of hypertension as those who were retired or disabled,

but the retired would most likely be the oldest group, suggesting that the status of unemployment is a particularly stressful status, and may result in elevated blood pressure readings that will return to normal once employment is found.

TABLE X

Employment Status	N	% High BP
Employed	270	28
Unemployed/laid off	48	48
Retired/disabled	227	48
Housewife	240	41
Other	21	33
TOTAL	806*	39%

* Employment status was not ascertained for two people.

Education and blood pressure

There does not appear to be a linear relationship between socioeconomic status and prevalence of high blood pressure, according to figures found in the literature. Table XI, showing the rate of high blood pressure by educational level, reflects this. There is, of course, a negative correlation between age and education, among adults; the mean number of years of schooling has risen slowly over past decades, so that older people in general have fewer years of schooling than younger ones. This is reflected in Table XI; the people with nine years of education or less are on the average older than the other groups of people (data not shown), and therefore have a higher prevalence of high blood pressure.

TABLE XI

Years of education	N	% High BP
6 years or less	49	49
7-9 years	147	43
10-11 years	146	34
High school diploma	263	37
1-3 years college	111	41
College degree	91	38
TOTAL	807*	39%

* Education was not ascertained for one person.

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Summary

The blood pressure screening program instituted by Henry Ford Hospital is characterized by an unusually high prevalence of high blood pressure (39%) among the people screened, as compared with that found in the population as a whole (15%). This is in part attributable to an older average age among the group screened than in the adult population as a whole. This may be a reflection of the older average age of people residing in Detroit's central city. It may also be true, however, that younger people tend to use the services of a hospital less often than older people.

Age did not entirely explain the higher rate of high blood pressure, however, especially among the white people screened. While we might expect a somewhat higher prevalence of hypertension in a hospital screening site than in a nonmedical site, the Henry Ford Hospital data are similar to data from other screening sites in suggesting that the rates of hypertension among blacks and whites in a specified sub-population are not so different as population statistics indicate. These data lend some support for environmental causes of hypertension; further analysis is in progress.

The majority of the people found to be hypertensive were already under treatment for the disease (70%), but only 21% were under adequate treatment (ie, had readings below 140/90). Approximately one fourth of the hypertensive group were on treatment but had high readings (160/96 or higher), and one fourth were on treatment and had borderline readings. (Some of the people in this latter group may have been considered by the attending physician to be adequately controlled, given the person's health status. However, for purposes of definition, borderline readings were considered by the program to be "uncontrolled.")

The remaining 30% of the hypertensive group had high readings (160/96 or higher) and were not under any treatment for hyper-

tension. All people with high readings (whether they were on treatment or not) were referred to their physician for further evaluation.

For the people who were already being treated for hypertension, several treatment variables were described. It appeared that people on more aggressive treatment regimens were less likely to have their blood pressure under control than those on milder regimens. This may be attributable to the fact that moderate and severe hypertension are more difficult to control than mild hypertension. In addition, it may be easier for people to comply with simple treatment regimens. This finding should have some relevance for the argument about whether mild hypertension should be treated.

In addition, it was found that people under treatment who knew what kind of medication they were taking were more likely to be under control than those who did not know their medication. And, of course, those who indicated compliance with the treatment regimen were under better control than those who said they were not complying.

The two variables that in other studies have shown the most consistent relationship to high blood pressure also showed strong relationships in the group screened at Henry Ford Hospital—age and percent overweight. In addition, people with a history of diabetes or a history of heart trouble were more likely to have high blood pressure than people without such a history.

Three additional demographic variables were included in the report—marital status, employment status, and educational level. With regard to marital status, people who were single showed the lowest rate of high blood pressure (25%), and people who were widowed showed the second highest rate (54%). These differential rates are no doubt attributable to age differences, with the single people tending to be younger, and widowed people tending to be older. However, it is notable that people who were separated

had the highest rate of high blood pressure (62%). While this group is very small, and the rate is thus not very stable, it suggests that the state of being separated is particularly stressful, and may cause a temporary (or permanent) rise in blood pressure.

The employment status variable showed very similar results. That is, the oldest group (the retired) was tied with the group under most stress (the unemployed or laid-off) for the highest rate of high blood pressure (48%). Those people who were employed had the lowest rate of high blood pressure (28%).

There was no clear relationship found between educational level and prevalence of high blood pressure. People with nine years of education or less had the highest rates of high blood pressure, but this is probably attributable to age differences (ie, people in this group tend to be older, on the average, than people with higher educational levels). People with a high school education (10-12 years of school) had slightly lower rates of high blood pressure than those who had completed one or more years of college, but these differences were not significant.

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The program is coordinated by Velma Theisen, R.N., M.S.N., Health Nurse Clinician in Hypertension at Henry Ford Hospital, who now supervises the program's screening and follow-up activities; and Betty Vander Roest, who is in charge of the volunteer program at Henry Ford Hospital, assisted by Ann Tittingung.

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Editor's note:

The preceding report is the first of two articles on this program.

The second article will present the results of referral and follow-up

Address correspondence and reprint requests to Dr. John R. Caldwell at Henry Ford Hospital, 2799 West Grand Boulevard, Detroit MI 48202.