ORIGINAL COMMUNICATIONS

RACE: AN EXPLANATION OF PATIENT COMPLIANCE—FACT OR FICTION?

Dennis E. Daniels, DrPH, Antonio A. René, PhD, and Vernie R. Daniels, BS, RPh
Galveston, Texas and New Orleans, Louisiana

This article describes a retrospective study that examines the relationship between patient compliance and race among diagnosed hypertensives in the National Health and Nutrition Examination Survey (NHANES II). The study reviewed and analyzed the compliance of 403 blacks diagnosed with hypertension. Patient compliance was measured using the frequency that patients took their hypertensive medicine. Bivariate analysis revealed a statistically significant relationship with patient compliance (dependent) and the independent variables (age, education, gender, and smoking). Multiple regression for the black population revealed that the age of the person accounted for the most explained variance. As age increased among blacks, so did compliance. The results may suggest the need to target school-aged blacks early in order to increase the awareness and importance of monitoring one's blood pressure. The results also may indicate that race is not a marker for other characteristics (income, education, etc) that might be used to explain the difference in the prevalence of hypertension among blacks compared with whites. (*J Natl Med Assoc.* 1994;86:20-25.)

Key words • hypertension • race • patient compliance

From the Department of Preventive Medicine and Community Health, the University of Texas Medical Branch, Galveston, Texas, and the Tulane University School of Public Health and Tropical Medicine, New Orleans, Louisiana. Requests for reprints should be addressed to Dr Dennis E. Daniels, Preventive Medicine and Community Health, University of Texas Medical Branch—Ewing Hall J-47, 700 Strand Rm 1.134, Galveston, TX 77550.

Hypertension is a massive problem in nearly all countries of the world.[1] Hypertension is a major determinant of coronary heart disease, which, in industrialized countries such as the United States, is the most common cause of death. As many as 58 million people in the United States have elevated blood pressure (systolic blood pressure $\geq$140 mm Hg or diastolic blood pressure $\geq$90 mm Hg) or are taking antihypertensive medication.[2] The prevalence rate of hypertension increases with age and is higher in blacks than in whites.[3]

Hypertension has been revealed to be the most important risk factor for the development of strokes. Individuals with hypertension suffer strokes four times as often when compared with persons with normal blood pressure.[4] Moreover, hypertension is a major cause of congestive heart failure.[5,6] Seventy-five percent of adults who develop congestive heart failure have a history of hypertension.[6]

Ghali et al[7] found that potential precipitating factors led to cardiac decompensation and subsequent hospital admission for heart failure. The factors were examined in 101 patients in a large hospital that predominantly served the working class of the minority population. Ninety-seven percent of the patients were black, their mean age was 59 $\pm$ 14 years, and on the average they were hospitalized three times in the preceding year for problems related to heart failure. Potential precipitating factors for decompensated heart failure were identified in 93% of the patients. Lack of adherence to the prescribed medical regimen was the most commonly identified causative factor and occurred in 64% of the cases, and noncompliance with diet was apparent in 22% of the cases. The major preventive measure necessary in at least two thirds of the patients centered around better adherence to their drug and diet regimen.

Thus, there is strong evidence that serious, potentially preventable disease is, at present, not being controlled because of patients' failure to adhere to an appropriate regimen.

Not only is hypertension a serious and preventable disease, it is a major health problem. An estimated 19.2 million or 18/100 civilian noninstitutionalized adults in the United States between the ages of 25 and 74 years in 1971-1975 had indefinite hypertension as determined from the three blood pressure measurement mean at the time of the survey (ie, either systolic blood pressure at 160 mm Hg or diastolic blood pressures of at least 95 mm Hg or both). The prevalence rate increases rapidly with age from 5.7/100 adults aged 25 to 34 years to 34.2/100 adults aged 65 to 74 years. In individuals aged 25 to 34 years, definite hypertension is more prevalent among men than among women.[8] However, by ages 65 to 74 years, the rates are slightly greater among women, although not statistically significant.[8]

This disease also impacts on various segments of the population differently. In 1985 and 1986, two cross-sectional surveys were conducted by Sprafka et al.[9] The authors' purpose was to measure the prevalence of coronary heart disease risk factors in blacks and whites. When controlled for age and education, systolic and diastolic blood pressure was 3 to 4 mm Hg higher in blacks compared with whites, and hypertension was more prevalent in blacks (44%) than whites (28%).

Goldring and Chasis[10] acknowledged that research has shown that more advanced vascular disease is often associated with higher levels of blood pressure, but that there was no support for the contention that further increase in blood pressure level precedes and induces advancing vascular disease. Goldring and Chasis also concluded that more research was needed to provide proof of the clinical usefulness of antihypertensive drugs.

It was not until Hamilton et al[11] submitted their findings that the first sizable controlled, randomized, and prospective study regarding the effects of antihypertensive treatment in humans with high blood pressure occurred. Their study included 61 men and women with sustained diastolic pressures of 100 mm Hg who were divided randomly into treated and untreated groups. The follow-up period ranged from 2 to 6 years. Sixteen of the 31 untreated patients developed significant complications attributable to hypertension, while only 5 of the 30 treated did the same.

In 1967 and 1970, two important papers summarizing the studies conducted among US veterans by a cooperative group led by Dr Edward Freis reported a carefully controlled and randomized clinical trial of antihypertensive agents. The initial paper dealt with the results for patients with mean diastolic pressures between 115 and 129 mm Hg at the time of entry into the study. The beneficial effect of therapy was so marked that the study, originally designed to continue for 5 years, was terminated for these patients after an average of only 20.7 months of therapy for the active drug group and 15.7 months for the placebo group (who had a briefer period of follow-up because of the larger number of terminating agents).[12]

Blackwell and Guttman[13] suggest that there are three methods of defining compliance: quantitative (percentage of regimen adhered to), categorical (good, fair, or poor), and by means of an index (composite behavior combined in a single score). Regardless of the method of definition, it should be carefully defined and recognized that the criterion of "satisfactory" compliance will vary according to the outcome studied. However well defined, any single criterion may be an uncertain predictor of outcome in an individual patient because blood pressure is determined by a myriad of factors, and the bioavailability of drugs is individually variable. This notion becomes clearer when one considers that a patient who takes 100% of his or her medication may have poorly controlled blood pressure if he or she is overweight, under stress, absorbs the drug poorly, or metabolizes it rapidly.

For the purpose of defining compliance in this study, compliant behavior shall be delineated by using a variation of the categorical method. The National Health and Nutrition Examination Survey (NHANES II) asked the question: "How often do you take your medicine when you are supposed to?" Respondents were given four possible annswers: all the time, often, once in awhile, and never.

METHODOLOGY

This study explored whether patient compliance among hypertensives using a drug regimen to control their hypertension is affected independently by race or whether race is confounded by other intercorrelated variables. The following hypotheses were proposed:

- Compliance is related to the patient's age.
- Compliance is related to the patient's education.
- Compliance is related to the patient's sex.
- Compliance is related to the patient's income.
- Compliance is related to the patient's residence.
- Compliance is related to the patient's smoking status.
- Compliance is independently related to the patient's race.

- Compliance is independently related to the number of times blood pressure was taken.
- Compliance is independently related to the patient's marital status.
- Compliance is independently related to the number of times the patient talked with the doctor.
- Compliance is independently related to advice to lose weight due to hypertension.

The following statement regarding the source of data for the study was extrapolated from the Plan and Operations Manual of the Second National Health and Nutrition Examination Survey.

> The second National Health and Nutrition Examination Survey is another in a series of related programs carried out over the past 20 years by the National Center for Health Statistics. These programs, authorized by Congress under the National Health Survey Act of 1956, are characteristically national in scope based on probability sampling and used to collect a broad range of morbidity data and related health information. The essential differentiating characteristic of the health related data obtained only (or at least optimally) from specifically standardized direct medical examinations, including tests and other procedures used in clinical practice. Such examinations, given to persons selected in the scientific sample, permit estimates of the prevalence of specifically designed diseases in the US population, including cases not previously identified. They also permit estimation of the distribution within the population of a broad variety of health related measurements, including not only physical measurements such as height, weight, and various skinfolds, but also physiological measurements, such as diastolic blood pressure and serum cholesterol level and psychological measurements.

The general structure of the NHANES II sample design is similar to the design of NHANES I and the first of three health examination surveys conducted by the National Center for Health Statistics. The design is a stratified, multistage, probability cluster sample of households throughout the United States. The process of selecting a sample of persons to be examined is a cascading one that involves the selection of primary sampling units (PSUs is a county or small group of contiguous counties), census enumeration districts (Eds), segments (a segment is a cluster of households), households, eligible persons, and finally, sample persons. The major difference between the NHANES I and NHANES II designs is the use of a different set of definitions and stratification procedures for PSUs. The NHANES II sampling plan resulted in a total of 27 803 sample persons and 20 325 examined persons in 64 PSUs throughout the United States.

The data collection for NHANES II was through questionnaires (household questionnaires, medical history questionnaires, food frequency interview, medication and vitamin usage, and behavior questionnaire), physical examination by physician, and by special clinical procedures and test.

RESULTS

Descriptive

The NHANES II identified 18 447 hypertensives. The racial breakdown was 16 206 whites and 2241 blacks. The number of female hypertensives was 9802, and the number of male hypertensives was 8645. Of the 18 447 hypertensives, 4370 persons reported having been diagnosed with high blood pressure by a physician, and 310 reported having been diagnosed as hypertensive by a physician. Of those diagnosed patients, 3941 were white and 739 were black. Analysis was performed on the 2414 individuals diagnosed with high blood pressure; 1956 were excluded from analysis because they were nonresponders. Nonresponders were reported as missing cases. Of the 2414 persons (responders) included in the analysis, 2001 were white and 403 were black. These 403 black responders comprised the group used for this study.

The age distribution of blacks included in the NHANES II sample ranged from 12 to 74 years of age. For purposes of analysis of our study group, five age categories were created as follows: 12 to 24 years, 25 to 35 years, 36 to 46 years, 47 to 57 years, and 58 to 74 years. The results for blacks in this study were 1.2% in the 12- to 24-year-old age group, 4.7% in the 25- to 35-year-old group, 10.4% in the 36- to 46-year-old group, 18.9% in the 47- to 57-year-old group, and 64.8% in the 58- to 74-year-old group. The gender distribution was 31.3% males and 68.7% females.

The marital status of blacks in the study group revealed that 47.4% of the respondents were married, 29.1% were widowed, 6% divorced, 10.5% separated, and 7% single. The educational level showed that 2.2% of the persons received no formal education, 45.2% received, at most, an 8th grade education, 25.6% completed grades 9-11 of high school, 16.6% of the persons received a 12th grade education, and 10.4% received at least 1 year of college. Breakdown of the study group by income level was 50.6% of the persons earned $6999 or less, 31.3% earned $7000-$14 999, and 18.1% earned $15 000-$24 999.

Regarding smoking status, 58.1% of the respondents

indicated that they were current smokers, and 41.9% of the respondents indicated that they were not current smokers. The majority (91.3%) of the study respondents identified themselves as urban dwellers with a small percentage (8.7%) identifying themselves as rural dwellers.

An analysis of the use of dietary methods as an alternative to drug therapy in the control of hypertension among blacks who composed the study group resulted in 54% of the respondents saying that they were advised to lose weight because of their hypertension, and 46% stating that they were not advised to lose weight because of their hypertension.

The number of times that the blood pressure is taken during the year among blacks who composed the study group resulted in 6.6% of those who responded stating that they had not had their blood pressure taken 1 to 5 times during the year, 17.7% had their blood pressure taken 6 to 10 times during the year, 22.2% had their blood pressure taken 11 to 15 times during the year, and 9.3% had their blood pressure taken 16 or more times.

An analysis of the number of times that blacks talked with a doctor about high school pressure during the year revealed that 6.6% of the study group stated they had not spoken to a physician regarding high blood pressure. Fifty-five percent stated that they spoke with a physician about high blood pressure 1 to 5 times during the year, 14.6% spoke with a physician 6 to 10 times, 18.2% spoke with a physician 11 to 15 times during the year, and 5.3% spoke with a physician 16 or more times during the year about high blood pressure.

Regarding compliance, 83.9% indicated that they took their prescribed medicine for the treatment of hypertension as directed all the time, 9.2% stated that they took their prescribed medicine for the treatment of hypertension as directed often, 5% stated that they took their prescribed medicine for the treatment of hypertension as directed once in awhile, and 0.5% stated that they never took their prescribed medicine for the treatment of hypertension as directed.

Bivariate Findings

The initial investigation of association consisted of bivariate crosstabulations. Findings demonstrated significant relationships between compliance and several of the independent variables. The bivariate analysis included the responders to the specific questions that were included in the study. Nonresponders were reported as missing cases.

The variable "age" of blacks included in the study group demonstrated a significant relationship ($P<.05$) to patient compliance among hypertensives. Within age groups, compliance was not uniform and varied with age. Proportionally, persons were more compliant as age increased (<25 years = 20% compared with 88% for persons 58 years of age). The relationship between patient compliance and age of black hypertensives was highly significant ($P=.000$).

The variable "sex" demonstrated a significant relationship to patient compliance among hypertensives in the study population. Among gender groups, men (89.7%) were proportionally more compliant with drug therapy for treatment of hypertension compared with women (81.2%). The relationship between patient compliance and the sex of black hypertensives was significant ($P=.032$).

The variable "marital status" did not demonstrate a significant relationship ($P=.609$) to patient compliance among those diagnosed as hypertensive in the study group. Likewise, the variable "residence (urban versus rural)" did not demonstrate a significant relationship ($P=.756$) to patient compliance among those diagnosed as hypertensive.

The variable "advised to lose weight due to hypertension" among blacks included in the study group did not demonstrate a significant ($P=.135$) relationship to patient compliance among hypertensives. Proportionally, black hypertensives who were not advised to lose weight were more compliant (87%) with treatment for hypertension when compared with persons who were advised to lose weight (81.5%) due to hypertension.

The variable "number of times blood pressure taken" among blacks included in the study group did not demonstrate a significant relationship ($P=.384$) to patient compliance among those diagnosed as hypertensive.

The variable "education" among blacks included in the study group did demonstrate a significant relationship to patient compliance among hypertensives. Proportionally, black hypertensives who received 1 or more years of college were less compliant (69%) with their drug therapy for the treatment of hypertension when compared with the rest of the study group. It is important to note that the relationship, although significant, was not strong ($P=.05$).

The variable "income" among blacks included in the study group did not demonstrate a significant relationship ($P=.258$) to patient compliance among those diagnosed as hypertensive.

The variable "smoking" among blacks included in the study group did demonstrate a significant relation-

TABLE. MULTIPLE REGRESSION ANALYSIS OF BLACKS IN STUDY GROUP

Variable	Coefficient	Standard Error	*P* Value
Initial Equation of Backward Regression			
All Variables in Equation			
Gender	−.063830	.076644	.4060
Age	.093711	.042173	.0275
Smoking	.124774	.078504	.1136
Education	.040253	.038506	.2972
Equation of Stepwise Regression			
Step One			
Age of person	.087658	.039001	.0257
Final Equation of Backward Regression			
Age	.077867	.039273	.0488
Smoking	.129132	.077940	.0992

ship to patient compliance among hypertensives. Proportionally, black hypertensives who did not smoke were more compliant (90.3%) when compared with those who did smoke (78%). The relationship between patient compliance and smoking was appreciably significant ($P = .024$).

The variable "times talked with doctor about hypertension" did not demonstrate a significant relationship ($P = .169$) to patient compliance among black hypertensives in the study group. Proportionally, compliance was greater among persons who had 11 to 15 visits (87.5%) and 6 to 10 visits (86%) when compared with persons who had no visits (69%).

REGRESSION ANALYSIS

Multivariate regression analysis was used to take several variables into account simultaneously. Factors related to the independent or dependent variables were included in multivariate analysis. The variables selected for regression in the black study population were education, smoking, age, gender, and frequency that medicine was taken as directed (dependent variable). The variables selected for regression in the nonblack population were times talked with doctor, age, number of times blood pressure taken, and frequency that medicine was taken as directed (dependent variable).

Stepwise regression for the black study population revealed the age of the person accounted for the most explained variance (5.051). The variables education, smoking, and gender were nonsignificant (Table).

The variable age of the sampled person was consistently significant throughout the stepwise regression analysis and accounted for the most explained variance. The variable "times talked with a doctor about high blood pressure" was nonsignificant for blacks.

CONCLUSION

This study sought to test the importance of race as an independent variable when examining patient compliance. This population did not demonstrate that race was a significant explanation of variance.[14] However, race may be confounded by markers such as age and the number of times a person speaks with a doctor about hypertension.

Age was important when explaining the variance of compliance among blacks. As age increased among blacks, so did compliance.[15] Age was the single, significant explanation of variance when examining patient compliance during multiple regression. This may suggest that hypertensive control programs should be aimed at younger blacks. Hypertensive control programs may need to target school-aged blacks in order to make them aware of the importance of monitoring one's blood pressure.

Persons identified as hypertensives through screening programs should receive follow-up examinations within the context of a stable clinic environment. Special clinic days or specialty clinics for hypertensives may prove to be helpful additions to hypertensive control programs. Special clinic days or specialty clinics for hypertensives may decrease appointment delays, foster a better patient-provider relationship, and improve patient compliance.

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The deadline for applications is February 14, 1994. For further information and an application package, please contact: FHSR, 1350 Connecticut Ave, NW, Ste 1100, Washington, DC 20036; (202) 223-2477.