Hypertension Control in a Rural Community

An Assessment of Community-Oriented Primary Care

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To determine the effectiveness of a community-oriented primary care approach for the detection, treatment, and control of hypertension, data were analyzed from a survey of all 3094 adults living in a geographically well-defined rural community. Among the 2939 (96.1%) persons who completed the survey, 587 (20%) were found to meet study criteria for the diagnosis of hypertension.

Hypertensive adults who identified a neighborhood health center with a community-oriented primary care philosophy as their source of care were more likely to have their disease detected, treated, and controlled than were hypertensive adults who identified other sources of care. The improved control was most evident for men and for blacks, but in every race-sex stratum, hypertensive patients of the neighborhood health center were more likely to be under control. Even when controlling in logistic models for age, race, and sex, identification of the neighborhood health center was associated with better control of hypertension ($\beta = 0.591$, $P = .004$). In this rural community, community-oriented primary care delivered through a neighborhood health center appears to be associated with increased likelihood of detection, treatment, and control of hypertension. **J Fam Pract 1990; 30:420-424.**

Present estimates are that as many as 58 million Americans are at risk of morbidity or premature mortality associated with high blood pressure and warrant some kind of monitoring or therapy.[1,2] In some population strata, a significant proportion of those with hypertension remains unidentified. Of those who are identified, a significant proportion remains untreated or uncontrolled. Perhaps the most difficult of all groups to reach and control are men with hypertension, particularly blacks.

Because of the vast magnitude of the hypertension problem in this country, providers of primary care have developed innovative ways of identifying, treating, and controlling hypertension in the populations of patients that they serve. There is some evidence that community health education[3–6] and a community-oriented primary care approach to the problem may result in better control of hypertension on a community basis. Recent studies also indicate that better control may be achieved by reducing economic barriers to care.[7–8] There is a need, however, for additional controlled data to document whether community-oriented primary care is associated with rates of identification, treatment, and control of hypertension that are comparable to the outcomes obtained with more traditional primary care services.

Here data are presented that permit comparison of the effectiveness of a community-oriented primary care model of care with other sources of care in controlling hypertension in a geographically well-defined rural community. The data were collected in 1976 and have been reported in part already.[9–12] Because of increasing interest in the efficacy of community-oriented primary care,[13,14] however, additional analyses are presented in this paper to evaluate the association of patients' source of care with their hypertension control status.

METHODS

This investigation was carried out in a well-defined biracial rural community in North Carolina consisting of two

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adjacent townships. In 1976, residents of these townships had two sources of primary care services locally available. One source was a neighborhood health center. Here patients were seen by either a physician or a nurse practitioner, and economic access, health education, and outreach services were emphasized. Other sources of care were several private practices and two major medical centers that were located within one hour's drive. The physicians who practiced at these other sources of care were heterogeneous in their training and style of practice.

The study design was that of a cross-sectional survey, and data collection was done by means of structured interviews using precoded questionnaires administered by trained interviewers in the homes. All adults living in this defined geographic community aged 18 years or older of both sexes and both races were surveyed. The methods employed in the study and the data-collection methods have been well described in previous published reports.[9–12] Of particular importance to the investigation reported here is that each subject identified his or her regular source of medical care in response to the following questions: "Who do you go to see when you are sick or need advice about your health?" If a particular subject provided the names of more than one physician or clinic in response to this question, a further question was asked: "Which of your doctors should we tell about your blood pressure and the medicines you are taking?" All subjects provided the name of a regular source of medical care in response to these questions. The source of care data were confirmed by analysis of a subsample of medical charts and found to be accurate.

During the administration of a structured questionnaire, the trained interviewers took two sitting blood pressure measurements with a mercury sphygmomanometer approximately 10 to 30 minutes apart. The first and fifth Korotkoff sounds indicated systolic and diastolic pressures, respectively.[10]

Sampling Frame and Subject Selection

A special study census was conducted in the defined geographic communities, and 3094 adults living in the community in the summer of 1976 were identified. The interviewers conducted the survey during a lull in the seasonal farming cycle and were able to enter complete interview data on 2939 subjects, or 96.1% of all adults in the community. The response rate for every age, race, and sex stratum identified in the analysis was greater than 89%.

Variable Definition and Measurement

In this study the main independent variable of interest is the identified source of medical care services. Subjects who completed the interview were classified into two comparison groups. One group was composed of all subjects who identified a neighborhood health center as their regular source of medical care; the other group comprised all subjects who identified any other provider of care as their regular source of care.

The analysis was restricted to hypertensive individuals. The definition of hypertension used in this study was either (1) a mean diastolic blood pressure $\geq$ 95 mm Hg, or (2) a mean diastolic blood pressure $<$ 95 mm Hg, with the subject having taken an antihypertensive medication within the previous week. The dependent variable of interest, control of hypertension, was defined as a mean diastolic blood pressure below 95 mm Hg.

Analysis

Logistic regression analysis was used to assess the impact of independent variables on blood pressure control among hypertensive subjects. In the main analysis, the dependent variable was defined as "control vs noncontrol of hypertension." Independent variables included age, sex, race, and source of medical care. Interaction terms were considered in the model, following the methods of Kleinbaum et al,[15] and covariate-adjusted percentages of controlled hypertensive subjects were reported.

RESULTS

Five hundred eighty-seven subjects met study criteria for being hypertensive and were able to identify a usual source of care. Of these 587 hypertensive subjects, 56% were treated and controlled, 13% were treated but not controlled, 13% were known but untreated, and 18% were undetected before the survey.

Among the 191 hypertensive subjects who identified the neighborhood health center as their usual source of care, 65% were treated and controlled, 14% were treated but not controlled, 9% were not treated, and 12% were undetected before this survey. Among the 396 hypertensive subjects who identified other sources of care, 52% were treated and controlled, 11% were treated but not controlled, 15% were not treated, and 21% were undetected before this survey. The distributions of detected, treated, and controlled hypertensive subjects are shown by race-sex strata in Table 1. The largest differences by source of care are seen among blacks, particularly black men.

Multivariable logistic regression modeling of the data was then done. A full model was constructed using control of hypertension as the dependent variable; age, sex, race, and source of care as independent variables; and including source of care by age, source of care by sex, and

TABLE 1. PERCENTAGE OF HYPERTENSIVE SUBJECTS WHO HAD HYPERTENSION DIAGNOSED, TREATED, AND CONTROLLED (diastolic blood pressure < 95 mm Hg), BY RACE, SEX, AND USUAL SOURCE OF CARE

Characteristic	White Men		White Women		Black Men		Black Women	
	NHC	OSC	NHC	OSC	NHC	OSC	NHC	OSC
Number of subjects	21	93	28	115	65	95	77	93
Hypertension diagnosed	76	78	100	90	78	61	96	85
Treated	71	60	82	81	68	39	88	68
Blood pressure < 95 mm Hg	62	47	75	70	55	28	70	59

NHC—neighborhood health center (n = 191); OSC—other sources of care (n = 396).

source of care by race interaction terms. This full model was compared with the same model without the interaction terms, and it was noted that the interaction terms did not contribute individually or in aggregate in a statistically significant way to the model. The interaction terms were therefore deleted, and the final logistic regression model derived is described in Table 2.

For the 587 hypertensive study subjects, older age ($\beta = 0.043$, $P<.001$), female sex ($\beta = -0.815$, $P<.001$), and identification of the neighborhood health center as the usual source of care ($\beta = 0.591$, $P = .004$) were associated with a greater probability of control of hypertension. The variable race ($\beta = -0.368$, $P = .056$) was of borderline significance in this model.

The logistic model was used to estimate age-adjusted proportions of controlled hypertensive patients by source of care. To permit comparisons with the race-sex specific values in Table 1, the full logistic model was employed. The unadjusted and adjusted proportions are shown by race-sex strata in Table 3 and indicate minimal confounding by age. In every race-sex stratum, hypertensive patients of the neighborhood health center (NHC) were more likely to be under control.

TABLE 2. THE ASSOCIATION OF AGE, SEX, RACE, AND SOURCE OF CARE WITH THE CONTROL OF HYPERTENSION AMONG 587 HYPERTENSIVE STUDY SUBJECTS; LOGISTIC REGRESSION RESULTS

Variable	β	Standard Error	P
Age	0.043	.006	<.001
Sex (man=1, woman=0)	−0.815	.182	<.001
Race (black=1, white=0)	−0.368	.193	.056
Source (NHC-1, OSC-0)	0.591	.203	.004

NHC—neighborhood health center; OSC—other source of care.
−2logL = 704.27.

DISCUSSION

These data support the conclusion that subjects who identified the neighborhood health center as their usual source of care were more likely to have diastolic blood pressures below 95 mm Hg than those who identified other sources of care. This association was observed consistently across several race-age-sex strata. The association was somewhat more pronounced for older individuals, men, and blacks, but none of the interaction terms combining these variables with source of care reached statistical significance.

The results reported here are derived from a cross-sectional study and therefore are subject to a number of potential sources of bias. Prominent among these would be selection bias. Because patients self-selected their

TABLE 3. THE PROPORTION OF HYPERTENSIVE SUBJECTS WHOSE DIASTOLIC BLOOD PRESSURE WAS LESS THAN 95 MM HG, BY SEX-RACE STRATA AND SOURCE OF CARE (N=587)

Sex-Race Strata	Diastolic Blood Pressure < 95 mm Hg			
	Unadjusted		Adjusted*	
	NHC	OSC	NHC	OSC
White men	.62	.47	.59	.46
White women	.75	.70	.73	.68
Black men	.55	.28	.55	.36
Black women	.70	.59	.70	.57

NHC—neighborhood health center; OSC—other source of care.
**For age, by logistic regression.*

source of care, it was theoretically possible that hypertensive patients who were more difficult to control or who had more long-standing disease or complicated disease could be unequally distributed among the comparison groups. Although there is no empiric evidence that such an unequal distribution occurred, this possibility must be considered in the evaluation of the observed results.

It is well known that cross-sectional studies may overestimate the prevalence of hypertension by 20% or more. Setting the threshold for the definition of hypertension at 95 mm Hg rather than 90 mm Hg should have reduced this problem in these data. Bias in the collection of data is unlikely, although the quality of the data might have been improved by using random zero sphygmomanometers. The possibility of nonresponse bias affecting the results seems slim because there was such a high rate of response to the survey, and the analysis of the nonrespondents failed to show any obvious differences that distinguished them from the responding group.

Certain potentially confounding factors that may be associated with hypertension or its control could have been unevenly distributed between the two comparison groups. Obesity and self-reported compliance with medications were analyzed separately in the data set and were found to be evenly distributed between the two groups. No data were collected in the cross-sectional survey on alcohol intake, salt intake, stress, exercise, or comorbidity variables that might have affected hypertension outcome and may have been unequally distributed between the groups. The effects of these variables would be expected to be small compared with the effect of the major variables age, race, and sex, which were evaluated in the multivariate analysis.

It is tempting to speculate as to why identification of the neighborhood health center as the usual source of care was associated with greater likelihood of hypertension being controlled. Several recent trials provide data that are helpful in interpreting these data. In the Health Insurance Experiment, Keller et al[7] report that reducing economic barriers to care was associated with greater reduction in blood pressure for hypertensive patients. They attributed their improved outcomes to better detection and treatment of hypertension because of increased numbers of visits with physicians. Hypertensive patients of lower income benefited the most from reduced economic barriers to care.

The Hypertension Detection and Follow-up Program[2] has shown that an aggressive stepped-care approach to the management of hypertension can yield better control than routine care. It is interesting to note that the neighborhood health center also espoused a stepped-care protocol for care of hypertension, and, as in the Hypertension Detection and Follow-up Program, utilized some physician extenders as caregivers.

The neighborhood health center also shared a philosophy now described as "community-oriented primary care." The neighborhood health center had reduced economic barriers to care, utilized outreach services, and was involved in community health education. Programs and services were designed with perceived community health problems in mind, and a clinical team model was used, with physician extenders playing an active role. This model of care is appropriately described as a variety of community-oriented primary care. The data presented here suggest that identification of the community-oriented primary care practice as the usual source of care was associated with greater likelihood of control of hypertension in this defined community. The neighborhood health center was also associated with better detection of hypertension in patients who identified it as their source of care, suggesting better access to care for patients who identified the neighborhood health center as their source of care. The community-oriented primary care philosophy, clearly elucidated by Nutting et al[13] and by Connor and Mullan,[14] has been shown in other settings[6] to result in effective cardiovascular risk factor reduction.

The implications of the results of this study, especially in light of the Hypertension Detection and Follow-up Program[2,8] and Health Insurance Experiment[7] data, are quite intriguing, in terms of both clinical and public policy relevance. Experimental study designs might further establish the hierarchy of importance and cost effectiveness of different factors that have been associated in these studies with improved patient outcomes: better economic access to care, utilization of structured diagnostic and treatment protocols, employment of physician extenders and outreach nurses, and a community-oriented primary care philosophy. Additional data to assess the efficacy of community-oriented primary care in achieving desired health outcomes in defined communities would also be useful.

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