

BLOOD PRESSURE SURVEY ON THE NAVAJO INDIAN RESERVATION

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The authors conducted blood pressure screening on the Navajo Indian reservation in northeastern Arizona and northwestern New Mexico. Six hundred forty Navajos over 19 years of age were surveyed at various sites. The mean systolic and diastolic blood pressures in Navajo men and women did not show as great increases with age as those seen among white and black Americans. Navajos also had generally lower blood pressures and lower prevalence of hypertension than white and black Americans. The authors were unable to demonstrate any association between degree of acculturation and blood pressure, but they did find that obesity in both men and women and alcohol use in men were associated with a higher prevalence of elevated pressure in the Navajos.

acculturation; hypertension; Indians, North American; obesity

In studies published in the last 42 years, hypertension has been reported to be relatively infrequent among the Indians of the southwestern US, including the Navajos (1-4). In 1963, Fulmer and Roberts (1) showed a prevalence of 4.7 per cent among adults in a Navajo community, defining hypertension as blood pressure (BP) greater than 160/95 mmHg. Earlier, in 1956, Darby et al. (2) reported the results of a study in which they found a prevalence of 7.1 per cent in one Navajo community and 4.2 per cent in another, defining hypertension as BP greater than 140/90 mmHg. Since these surveys, the Navajos have had increas-

ingly closer contact with the "white man's way," with resulting changes in their life-style. It is known that when people from societies with "traditional" life patterns adopt the Western way of life, hypertension becomes more common (5, 6), and recent clinical impressions (7) suggest that such a trend may be taking place in southwestern Indians. If the prevalence of hypertension among the Navajos is indeed increasing, this may be associated in the future with a greater incidence of clinical coronary heart disease.

We conducted a BP survey on the Navajo Indian Reservation to ascertain the distribution of BPs with respect to

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Abbreviations: BP, blood pressure; DBP, diastolic blood pressure; \overline{DBP} , mean diastolic blood pressure; SBP, systolic blood pressure; \overline{SBP} , mean systolic blood pressure; SD, standard deviation.

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sex and age, the prevalence of hypertension, and factors that may be associated with high BP.

MATERIALS AND METHODS

The Navajo Indian Reservation comprises about 65,000 sq km (25,000 sq mi) of semi-arid canyon and plateau country in northeast Arizona, northwest New Mexico, and south Utah. The Navajos, like the Apaches, derive from Athabaskan-speaking groups who entered the area from the northwest about 1300–1500 A.D. Traditionally herders and small-scale farmers, they live in widely scattered camps, each camp consisting of an extended family, usually matrilineal in nature. In recent years, "Anglo" institutions, such as schools, hospitals, and government offices, have provided the stimulus to develop "towns" on the Reservation, with frame houses and mobile homes, in which people increasingly adopt a nuclear family lifestyle. Nevertheless, because of their considerable isolation until the mid-twentieth century, the Navajos have retained their language and culture to a greater extent than some other Native American groups, such as the Plains Indians. Currently, about 150,000 Navajos live on the Reservation and in adjacent border towns.

The BP survey was conducted primarily in the Fort Defiance, Arizona, Service Unit, one of eight Indian Health Service subdivisions, during October and November, 1977. The Fort Defiance population (1975) was 14,669, with 46.3 per cent (6792) being age 20 years or over. Included among the persons surveyed were a) workers at Navajo Forest Products Industry and boarding school employees, b) volunteers at various Navajo tribal chapter meetings, and c) persons waiting in three medical clinics. Only Navajo people, age 20 years or over, were included in the analysis. One of the clinics, accounting for about 50 of the observations, was in another Service Unit, Crownpoint, New Mexico, which has a

population of 10,365 and is demographically and economically similar to Fort Defiance.

Casual BPs were taken in the sitting position, but were not standardized for arm. Observations were made by 15 nurses and by two medical students using standard mercury or aneroid sphygmomanometers. One of the authors (F. D.) measured approximately one-third of the BPs.

Height and weight were also measured on the patients at the clinic. For the subjects screened at non-clinic sites, a verbal report of height and weight was recorded. A questionnaire was administered to these volunteers by the observer taking the BP. If the subject did not speak English, the questionnaire was administered by a Navajo translator (nurses in the clinics or community health representatives at the chapter meetings). The questionnaire included data on sex, age, residence, number of cigarettes smoked per day, alcohol use (yes or no), language spoken at home (Navajo only, English only, or both), type of employment (full-time, part-time, self-employed, housewife, unemployed), other illnesses (none, diabetes mellitus, cardiovascular disease, renal disease, other), previous history of hypertension, and whether or not on medication for hypertension at the time.

RESULTS

Six hundred forty Navajos were surveyed, including 311 men and 329 women. The mean systolic BPs ($\bar{S}B\bar{P}$ s) and mean diastolic BPs ($\bar{D}B\bar{P}$ s) according to sex and age are shown in table 1.

We analyzed the results and population make-up of subjects screened in the outpatient clinics and those screened at non-clinic sites. It was found that there were more females (151/236) in the clinic group and a preponderance of males (226/404) in the non-clinic group. Age distribution was the same in both groups. No

significant differences in $\bar{S}BP$ and $\bar{D}BP$ were found between clinic and non-clinic males. For clinic females, $\bar{D}BP$ was 72 mmHg, while for non-clinic females it was 75 mmHg ($t = 2.34$, $p < 0.05$). Similarly, $\bar{S}BP$ for clinic females was 114 mmHg, and for non-clinic females it was 118 mmHg ($t = 2.02$, $p < 0.05$). Thus, non-clinic females had statistically significant higher pressures than females surveyed in the clinics, although the differences were small.

There was also a trend in women toward increasing $\bar{S}BP$ with age (table 1). The regression equation for $\bar{S}BP$ on age was $Y = A + (B \times X)$, in which $A = 99.75$ and the slope $B = 0.39$. This slope was significantly different from zero ($F = 39.62$, df 1 and 59, $p < 0.01$), and the curve was linear. In the regression equation for $\bar{D}BP$ in women, $A = 69.30$ and $B = 0.10$, the increase with age was also statistically

significant, albeit very small ($F = 5.37$, df 1 and 59, $p < 0.05$). There was no significant increase of either $\bar{S}BP$ or $\bar{D}BP$ with age in men.

Table 2 shows the prevalence of elevated BP (defined by $DBP \geq 90$ mmHg and also by $DBP \geq 95$ mmHg) according to sex and age groups. It is evident that BP elevations are much more prevalent among men than women. Using $DBP \geq 95$ mmHg, we found no difference between men and women for those 60 years of age or more, but this may be because there were only 25 men in this age group. The prevalence of $DBP \geq 90$ mmHg or $DBP \geq 95$ mmHg was also compared between the clinic and non-clinic populations, and no significant difference was found in any of the age groups.

Of the 640 Navajos screened, 110 (17 per cent) had a DBP of ≥ 90 mmHg (24 per cent of men and 11 per cent of women)

TABLE 1

*SBP*s and *DBP*s* for 640 Navajo men and women at Fort Defiance, Arizona, and Crownpoint, New Mexico, Service Units of the Navajo Indian Reservation, 1977

Age (years)	Men					Women								
	No.	$\bar{S}BP$	\pm	SD^\dagger	$\bar{D}BP$	\pm	SD	No.	$\bar{S}BP$	\pm	SD	$\bar{D}BP$	\pm	SD
20-29	114	125		15	80		11	91	109		13	69		10
30-39	76	126		15	83		13	76	115		17	75		12
40-49	60	122		15	80		11	63	116		17	75		12
50-59	36	129		21	80		12	52	119		20	77		12
60-64	15	123		18	76		10	18	126		22	74		12
65 and older	10	130		16	80		9	29	129		20	73		12

* $\bar{S}BP$ = mean systolic blood pressure; $\bar{D}BP$ = mean diastolic blood pressure.

† SD = standard deviation.

TABLE 2

*Prevalence of elevated DBP** in 640 Navajo men and women at Fort Defiance, Arizona, and Crownpoint, New Mexico, Service Units of the Navajo Indian Reservation, 1977

Age (years)	Men					Women				
	No.	No. with $DBP \geq 90$ mmHg	%	No. with $DBP \geq 95$ mmHg	%	No.	No. with $DBP \geq 90$ mmHg	%	No. with $DBP \geq 95$ mmHg	%
20-29	114	27	24	10	9	91	3	3	0	0
30-39	76	19	25	12	16	76	10	13	6	8
40-49	60	15	25	5	8	63	8	13	2	3
50-59	36	10	28	4	11	52	9	17	5	10
60 and older	25	4	16	0	0	47	5	11	2	4

* DBP = diastolic blood pressure.

and seven per cent had a DBP of ≥ 95 mmHg (11 per cent of men and five per cent of women). Fifty-eight persons reported previous knowledge of high BP, and of these, 33 (57 per cent) were on medication for BP. Of those on such medication, 80 per cent of the men (12/15) and 72 per cent of the women (13/18) had a DBP less than 95 mmHg. It should be noted, however, that the above prevalence data for "hypertension" were derived from just one casual BP measurement, and studies have shown that as many as 30 to 50 per cent of persons with an initial casual BP elevation will be found to be normotensive, or to have labile hypertension on follow-up evaluation (8-11). Thus, it is likely that sustained hypertension among the Navajos is less frequent than these figures indicate.

We also compared the height and weight data for the clinic group (measured heights and weights) and the non-clinic group (self-reported heights and weights). While we found no significant difference in the mean weights between the two groups for either sex, there was a significant difference in heights, with non-clinic Navajos being reported taller. Clinic men averaged 169.4 ± 7.9 cm (66.7

± 3.1 in), whereas non-clinic men averaged 171.7 ± 6.7 cm (67.6 ± 2.5 in) [$t = 2.50, p < 0.05$]. Clinic women averaged 155.4 ± 6.4 cm (61.2 ± 2.5 in), whereas non-clinic women averaged 160.0 ± 5.6 cm (62.2 ± 2.2 in) [$t = 4.17, p < 0.01$]. Of course, it may be that subjects reported they were somewhat taller than their actual height and, if so, the relative weight data presented below must be regarded as only rough approximations. Weights and heights were not measured on any non-clinic subjects to determine the accuracy of self-reporting.

An examination of overweight and BP revealed a significant association between the two. A subject was defined as overweight if he or she was more than 10 per cent above the upper limit of optimal weight for height according to the Metropolitan Life Insurance Company chart for large-framed persons (12). We found 73 of 302 men (24 per cent) and 156 of 307 women (51 per cent) were overweight by this definition. Interestingly, we found no subjects who were more than 20 per cent above the optimal weight for height. Table 3 shows the prevalence of elevated BP in normal weight and overweight persons. There is a highly significant greater prevalence of DBP

TABLE 3

Relationship of hypertension and overweight among 609 Navajo men and women observed at Fort Defiance, Arizona, and Crownpoint, New Mexico, Service Units of the Navajo Indian Reservation, 1977*

Age (years)	Men†				Women‡			
	Normal weight		Overweight		Normal weight		Overweight	
	DBP ≥ 90 mmHg§	% † BP	DBP ≥ 90 mmHg	% † BP	DBP ≥ 90 mmHg	% † BP	DBP ≥ 90 mmHg	% † BP
20-39	26	18	18	43	5	5	7	11
40-59	12	18	12	48	1	3	13	18
60 and older	3	17	1	17	1	4	4	20
Total	41	18	31	43	7	5	24	15

* Thirty-one subjects out of the total population of 640 were excluded from this table because they were too short for Metropolitan Life Tables (12); i.e., since the height was not given in the tables, there was no upper limit for weight.

† $\chi^2 = 25.8, 6df, p \geq 0.005$.

‡ $\chi^2 = 7.3$ not significant for 6 df.

§ DBP = diastolic blood pressure.

≥90 mmHg among overweight men than among normal weight men ($\chi^2 = 25.8$, 6 df, $p < 0.005$). There were fewer women with elevated BPs but if age groups are combined, five per cent (7/151) of normal weight women and 15 per cent (24/156) of overweight women have DBP ≥90 mmHg ($\chi^2 = 9.34$, 1 df, $p < 0.005$). Thus, it can be concluded that excess weight is a significant risk factor for hypertension for both men and women.

Alcohol use was also found to be associated with high BP. Because of the difficulty in obtaining an accurate assessment of average alcohol consumption, our questionnaire contained a simple yes or no question regarding use of alcoholic beverages. Consequently, persons found to be alcohol users in our survey range from those who drink alcoholic beverages only occasionally in social situations to chronic alcohol abusers. Fifty-two per cent of men and only 16 per cent of women admitted to at least occasional alcohol use. Alcohol use was greatest in the 20–39 year age group, where 43 per cent said they used alcohol, whereas only 22 per cent of those 40 years or older admitted to alcohol use. Table 4 shows that among men there is a significantly greater prevalence of DBP ≥90 mmHg among alcohol users than among non-users ($\chi^2 = 7.11$, 1 df, $p < 0.01$).

Other factors were examined to determine if they could be related to increased

prevalence of hypertension, but no significant associations were found. One of these factors was cigarette smoking, although it should be noted that very few Navajos smoke (13 per cent), and those who do, smoke relatively little (94 per cent of smokers smoke less than one pack per day). The various chapters of residence were graded according to degree of "modernization" (see Appendix), but no significant difference in prevalence of hypertension according to "modernization" was noted. There was also no difference in prevalence of DBP ≥90 mmHg by language spoken at home, or among the various employment categories, except that accounted for by sex differences.

An "acculturation" index was calculated for each subject (see Appendix). It was found that the males surveyed were more acculturated than females, and, not surprisingly, the younger people were more acculturated than older people. Table 5 shows the $\bar{S}BP$ s and $\bar{D}BP$ s for each acculturation group. There is no consistent pattern of change in BP with acculturation group, except for $\bar{S}BP$ in women, which decreases with increasing degree of acculturation. $\bar{S}BP$ and $\bar{D}BP$ in the least acculturated males appear to be substantially lower than for the other acculturation groups, but there are only 11 subjects in this group. The $\bar{S}BP$ s and $\bar{D}BP$ s in the most acculturated females appear to be lower than in the other

TABLE 4

Relationship of alcohol use and hypertension among 638 Navajo men and women observed at Fort Defiance, Arizona, and Crownpoint, New Mexico, Service Units of the Navajo Indian Reservation, 1977*

DBP‡	Men†		Women‡	
	Alcohol used	Alcohol not used	Alcohol used	Alcohol not used
<90 mmHg	113	123	48	245
≥90 mmHg	48	26	5	30
% with DBP ≥90 mmHg	30	17	9	11

* Information on alcohol usage was not available for two subjects (one male, one female) out of the total study population of 640.

† $\chi^2 = 7.11$, 1 df, $p < 0.01$.

‡ Not significant.

§ DBP = diastolic blood pressure.

TABLE 5

*SBP*s and *DBP*s* according to acculturation group† among 640 Navajo volunteers observed at Fort Defiance, Arizona, and Crownpoint, New Mexico, Service Units of the Navajo Indian Reservation, 1977

Acculturation group†	Men					Women								
	No.	SBP	±	SD‡	DBP	±	SD	No.	SBP	±	SD	DBP	±	SD
1 (least)	11	118		12	74		12	93	119		19	75		11
2	121	127		19	82		12	158	115		19	73		12
3	121	124		15	79		11	62	114		14	74		12
4 (most)	58	126		12	83		10	16	109		8	69		9

* *SBP* = mean systolic blood pressure; *DBP* = mean diastolic blood pressure.

† See Appendix for method used to formulate acculturation index.

‡ *SD* = standard deviation.

groups, but again there are only 16 subjects in this group and thus the significance is questionable. There was no difference in the prevalence of hypertension (*DBP* ≥ 90 mmHg or *DBP* ≥ 95 mmHg) among the four acculturation groups for either men or women.

Overall, male sex, being overweight, and use of alcohol were the factors associated with elevated BPs in this surveyed group of Navajos. If we assign relative risk to the sex and weight factors and we give normal weight females a value of 1.0, then overweight females have a relative risk of 3.0, normal weight males, 3.6, and overweight males, 9.0. These values only consider people under age 60 years, since we had so few subjects in the older age group.

DISCUSSION

Are the BPs of Navajos higher now than they were 20 years ago? Most of the early studies are record reviews conducted at hospitals in the southwestern US, and thus their data are not directly comparable with our survey data. In 1937, Salsbury (3) reported that he found only four cases of hypertension among 4826 Navajos admitted over a five-year period to an Arizona mission hospital (a prevalence of 0.08 per cent). Darby et al. (2) found the prevalence of mean BP greater than 140/90 to be 7.1 per cent in Ganado and 4.2 per cent in Pinon. In 1967, sur-

veying a small group of well adults at Lower Greasewood (271 persons), Reisinger (13) found the prevalence of *DBP* ≥ 100 mmHg to be 4.2 per cent among women and 8.5 per cent among men.

Fulmer and Roberts (1) conducted a study of coronary artery disease and hypertension in the Many Farms-Rough Rock area between 1956-1962. Their BP data were obtained by surveying 87.8 per cent of the population 30 years of age or older (446 persons) using a single casual BP measurement. Figure 1 compares *DBP*s according to age and sex in Fulmer's study and in the present data. The *DBP*s are essentially the same for females, but *DBP*s in males in the present study are slightly higher than those reported by Fulmer (80 mmHg vs. 77 mmHg for men between 30 and 60 years of age). Fulmer found the prevalence of BP 160/95 mmHg or greater to be 4.8 per cent overall, 6.2 per cent in men, and 3.4 per cent in women. For comparable age ranges, we found the prevalence of *DBP* 95 mmHg or greater to be 12 per cent in men and five per cent in women.

It appears, then, that in approximately 20 years, *DBP*s and prevalence of elevated pressures have remained essentially the same for women, but for men there has been a slight rise in both parameters. However, these differences must be interpreted with caution because the present survey was done on a group of volunteers,

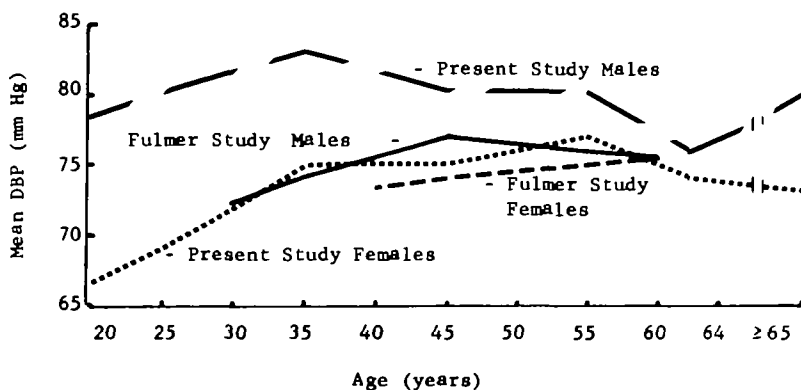


FIGURE 1. Comparison of Navajo mean diastolic blood pressures (\bar{DBP} s) in present study (640 subjects) with Fulmer and Roberts' study (1) at Many Farms (446 subjects), 1956–1962.

whereas Fulmer's study involved a large majority of the residents in a specific area.

The 590 Fort Defiance subjects constituted less than nine per cent of the service unit residents age 20 years and over. An attempt was made to survey a large number of people representing different points on the spectrum from traditional to acculturated. The traditional Navajos do not ordinarily gather in large groups accessible to survey although many do attend tribal chapter (local government) meetings and we therefore surveyed them there. By contrast, the Navajos we surveyed at the Navajo Forest Products Industry and the boarding schools hold Anglo-style jobs and tend to be more acculturated. Clinic patients (and their families, who often accompany them) include both traditional and acculturated Navajos, there apparently being no bias among the more traditional Navajos against the use of Anglo medicine (14). Except for rodeos and ceremonies, the places we surveyed are the current gathering places of the Navajos, and we have reason to believe that our subjects were typical.

One might expect a paucity of the most traditional people in such a survey. However, the percentage of our subjects who

spoke Navajo at home to the exclusion of English was rather high (44 per cent), and the percentage was consistent with estimates for the adult population in the areas surveyed.

It is also interesting to compare the BPs of present-day Navajos with those of white and black Americans. There are several recent reports on BP distribution and prevalence of hypertension in whites and blacks (9–11, 15, 16), but the screen of one million Americans reported by Stamler et al. (8) is most comparable to our present study because it involved multiple sites, volunteer subjects, and casual sitting pressures performed by trained health personnel. Figures 2 and 3 compare our findings with those of Stamler et al. Navajo male \bar{SBP} s remain stable with increasing age, whereas \bar{SBP} s increase with age in whites and blacks. This is also true for \bar{DBP} s, except that in whites and blacks \bar{DBP} s plateau at about age 55 years. The BPs of Navajo women do show some increase with age, but both \bar{SBP} and \bar{DBP} start out lower and remain lower than in white or black Americans. Figure 4 compares the prevalence of elevated pressure using the definition $DBP \geq 90$ mmHg. Again, whites and blacks show an increasing prevalence of hypertension with age, whereas the Navajos do

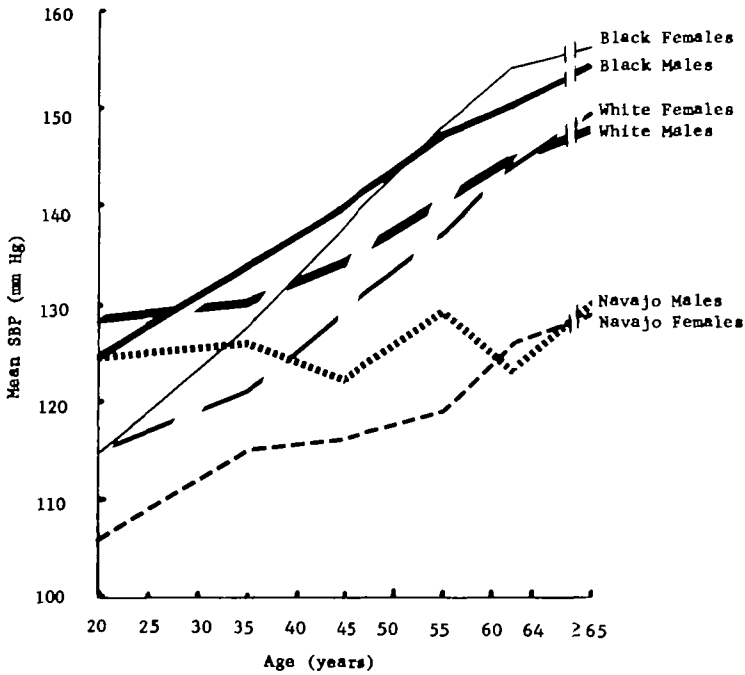


FIGURE 2. Comparison of mean systolic blood pressures (\bar{SBP} s) of 640 Navajos in present study and whites and blacks in a survey of one million Americans, 1973-1975 (8).

not. Young Navajo males have a prevalence of elevated pressures greater than or equal to young black males and young white males.

Blood pressures have been reported lower among various "primitive" peoples

than among Americans and Europeans (17). An attractive hypothesis is that the Navajos had such a low prevalence of hypertension and lower mean pressures because of their traditional life style, but since they have been adapting to a

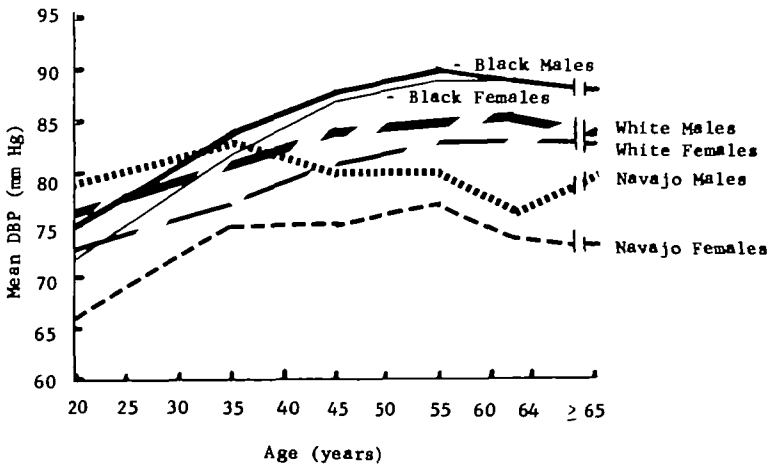


FIGURE 3. Comparison of mean diastolic blood pressures (\bar{DBP} s) of 640 Navajos in present study and whites and blacks in a survey of one million Americans 1973-1975 (8).

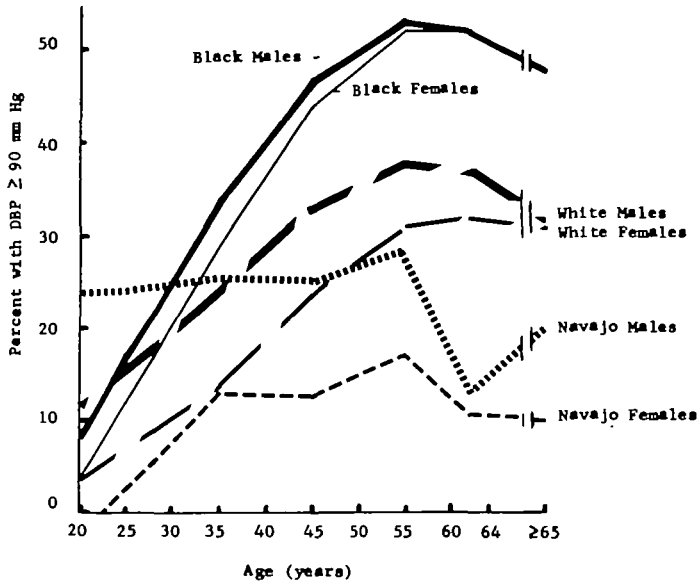


FIGURE 4. Comparison of prevalence of diastolic blood pressures (DBPs) ≥ 90 mmHg among 640 Navajos in present study and whites and blacks in a survey of one million Americans, 1973-1975 (8).

more modern life style, BP has been increasing. This hypothesis is supported by reports that hypertension occurs more frequently among off-Reservation Indians with fewer traditional customs than Indians who have remained on the Reservation (5, 7). The parameters of "acculturation" we examined, however, do not directly support this hypothesis (see Table 5).

Among Papago Indians in southern Arizona, Strotz and Shorr (19) found that 19.8 per cent of those over age 15 years had at least one BP greater than 160/95 recorded in a clinic or hospital during a three and one-half year period. These were unstandardized pressures entered during medical care, and 4440 people (61 per cent of those with medical records) had a BP observation. In males, 31 per cent of those age 30-34 years were considered hypertensive, and 30-40 per cent of those in almost all of the older age groups were in that category. In females, there was an increase in hypertension up to the 50-54 age group (44 per cent), and this percentage tended to drop slightly in

older groups. Only a small percentage of older men or women in our Navajo study had DBP ≥ 95 mmHg (table 2). There are many differences in technique between the two studies (e.g., small number of observers, 61 per cent non-clinic, short time period in our survey). However, there are also differences in the genetic background (Uto-Aztec vs. Athabascan), environment (desert vs. steppe-like plateau), and probably in levels of acculturation between the two peoples. The latter has not been quantified, but the Papagos are a comparatively small tribe much closer to centers of Anglo population in southern Arizona. Strotz and Shorr (19) speculate that the high prevalence of hypertension among the Papago may be caused by changing culture and diet, particularly an increase in salt intake since World War II.

We have identified certain factors that are definitely associated with an increased risk of hypertension. First, males had DBP ≥ 90 mmHg approximately twice as often as females. Second, there is a pronounced excess of elevated pressures

among overweight Navajos (table 3). Fulmer and Roberts (1) reported similar findings, and several studies have found the same association in whites and blacks (16, 17, 19-22). Furthermore, some studies have shown this association of overweight and hypertension to be real and not just the result of falsely high BP measurements secondary to increased arm circumference (19, 21). Lastly, we found a definite association between alcohol use and elevated pressure in Navajo men (table 4). This finding agrees with the findings of a few other studies in white and black Americans that have reported an increased prevalence of hypertension among alcohol users (17, 18).

Both obesity and alcohol usage are thought to be associated with the "acculturated" life style. Likewise, it is reasonable to assume that young men are the group most involved in "Anglo" culture and conflicts, through employment (or lack of employment) and military service. This group does have the highest prevalence of DBP ≥ 90 mmHg even when considered independently of obesity and alcohol usage. Thus, the early BP peak among this cohort is probably a transitional phenomenon. It may be that as the cohort grows older, more and more hypertensives will be identified, and younger cohorts will also have the "acculturation" response. Consequently, the prevalence curve for DBP ≥ 90 mmHg will more nearly approach that of white or black Americans (figure 4). On the other hand, we were unable to discern any more specific acculturation factors, using an index including language, employment, area of residence, and cigarette smoking. Although index values were distributed as expected among age and sex groups, they failed to distinguish people with high pressures within groups.

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APPENDIX

A. "Modernization" scores of places of residence of Navajos

The various Navajo chapters were classified according to degrees of "modernization" in the following manner:

- 1) *Most modernized*. Contain tribal offices, major industry, PHS hospital, public schools, grocery stores, cafés, motels, major highways, and a significant "urban" population. This category includes Fort Defiance, St. Michael's and Red Lake chapters.
- 2) *Moderately modernized*. Contain a BIA boarding school and/or PHS hospital or clinic plus an "urban" population around these facilities; includes Ganado, Crownpoint, Keams Canyon, Oak Springs and Chinle.
- 3) *Least modernized*. Remote, rural areas without any of the above facilities or any area of significant population density. This group includes the remaining 31 chapters represented in the survey.

B. Acculturation index

An acculturation index (i.e., a measure of how much a subject's lifestyle is similar to the lifestyle of modern, white Americans) was formulated as follows:

- 1) Scores were given in five basic categories:
 - a) *Residence*—least modern chapters = 0; moderately modern chapters = 1; most modern chapters = 2.
 - b) *Language spoken at home*—Navajo only = 0; both Navajo and English = 1; English only = 2.
 - c) *Employment*—full time = 1; other = 0.
 - d) *Alcohol use*—no = 0; yes = 1.
 - e) *Smoking*—no = 0; yes = 1.
- 2) The above scores were summed for each subject and he or she was then assigned to one of four possible acculturation groups:
 1. (least acculturated) = sum of 0 or 1.
 2. = sum of 2 or 3.
 3. = sum of 4 or 5.
 4. (most acculturated) = sum of 6 or 7.