Recent Changes in CVR Disease Mortality in California

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THE MAJORITY of deaths occurring annually in California and the nation are attributed to cardiovascular-renal diseases, as is well known. In 1960 these disease entities accounted for 53 percent of all deaths in California and 55 percent in the United States. What is not as well known, however, is that the mortality rate from cardiovascular-renal diseases has declined during the past decade, and that the pattern of mortality differs appreciably not only between sexes but also among races.

The mortality trends from cardiovascular-renal diseases in California by age, sex, and race, with particular emphasis on the changes that have occurred during the past decade, are presented here.

The category, cardiovascular-renal diseases, (CVR) is a broad heterogenous grouping of diseases of the heart and blood vessels, which includes entities with quite different physiopathological processes. Arteriosclerotic heart disease, including diseases of the coronary arteries (ISC 420), accounts for most of the deaths from CVR diseases. Other important components are hypertensive cardiovascular diseases (ISC 440–447) and cerebrovascular diseases (ISC 330–334). Altogether, these diseases account for the vast majority of the deaths from CVR diseases (table 1).

Since the cardiovascular-renal disease group is a composite of individual disease entities, a separate analysis of the various individual diseases would provide a clearer picture of mortality trends. However, during the past 35 years changes that have taken place in medical concepts, diagnostic skills, disease classification, and certification practices make it virtually impossible to reconstruct valid long-term trends for the components of CVR disease (1).

Based on an extensive study of the death certificates in Pennsylvania, Moriyama (2) concluded that only the total category of cardiovascular-renal diseases appears reliable enough to serve as the basis for interpretation of long-term mortality trends, and the study of mortality from the separate cardiovascular-renal diseases should be limited to short-term analysis. In this report, we have followed Moriyama's suggestion.

Methods and Materials

The data presented in this paper are from publications of the National Office of Vital Statistics (3, 4) and from records of the California State Department of Public Health. To stabilize the death rates, an average of 3-year mortality centered around the census years was used for all the rates shown for California. For simplicity, we refer to the 3-year average as the census year rate; for example, 1959–61 rates are referred to as the 1960 death rate. The rates are expressed as per 100,000 population.

In the analysis, only the death rates for persons 35–64 years of age, in 10-year age groups, are shown. Cardiovascular-renal deaths under age 35 are relatively few in number, and beyond the age of 65 the underlying cause of death becomes rather difficult to identify accurately.

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The restriction to the age group 35–64 is in keeping with that used in many recent publications.

For 1950 causes of death were coded according to the sixth revision of the International Statistical Classification of Diseases (5), adopted by the World Health Organization in July 1948 and used in the United States from 1949 to 1957. Starting in 1958, the seventh revision (6) was used to code the causes of death.

To gauge the degree of change brought about by adoption of the seventh revision, the National Office of Vital Statistics sampled 10 percent of the 1958 death certificates filed in the United States, and coded them by both the sixth and seventh revisions. The differences resulting from the use of the two classification schemes are expressed by a factor termed the comparability ratio (3). This ratio is the number of deaths assigned to a particular cause using the seventh revision divided by the number of deaths assigned to that cause by the sixth revision.

The comparability ratios for selected CVR diseases are shown in table 2. A comparability ratio of 1.00 indicates that the same number of deaths are assigned to a particular cause whether the new or old classification was used. However, a ratio of 1.00 does not necessarily mean that assignment of individual deaths to particular causes was not affected by changes in classification and coding procedures; the changes in assignment of cause may have compensated for one another (3). Furthermore, the ratios presented in table 2 are for all ages, and thus they cannot be applied with assurance to the age-specific death rates.

The comparability ratios (7) for the major components of cardiovascular-renal diseases for the three age groups, 35–44, 45–54, and 55–64, are shown in table 3. For arteriosclerotic heart disease including coronary arteries (ISC 420) the comparability ratio remains close to unity in the three age groups, whereas for the other components of CVR diseases the ratio changes with age, particularly the category "other hypertensive diseases" (444–447).

Trends in Mortality

The age-specific death rates from all causes in California and total cardiovascular-renal

Table 1. Mortality from arteriosclerotic heart disease, hypertensive heart disease, and vascular lesions affecting central nervous system expressed as percentages of total cardiovascular-renal disease mortality, by age, race, and sex, California, 1959–61

Age groups (years) and race	Arteriosclerotic heart disease (420)		Hypertensive heart disease (440–447)		Vascular lesions affecting central nervous system (330–334)		Sum of (420, 440–447, 330–334)	
	Percent							
	Male	Female	Male	Female	Male	Female	Male	Female
35–44								
White	68	26	3	7	8	23	79	56
Negro	45	17	24	29	11	25	80	71
Other	48	11	5	8	21	16	74	35
45–54								
White	72	39	4	10	8	23	84	72
Negro	49	30	18	29	16	22	83	81
Other	53	18	11	13	21	46	85	77
55–64								
White	69	51	5	10	10	19	84	80
Negro	46	34	16	21	19	24	81	79
Other	53	43	10	17	25	29	88	89

NOTE: Numbers in parentheses are from International Statistical Classification of Diseases, Injuries, and Causes of Death.

Table 2. Comparison of cause-of-death assignment for cardiovascular-renal diseases by seventh and sixth revisions of the International Classification of Diseases and comparability ratios, United States, 1958

Cause of death	Seventh revision (1955)	Sixth revision (1948)	Comparability ratio seventh to sixth [1]
Major cardiovascular-renal diseases	330–334 440–468 592–594	330–334 400–468 592–594	1. 01
Diseases of cardiovascular system	330–334 400–468	330–334 400–468	1. 01
Vascular lesions affecting central nervous system	330–334	330–334	1. 00
Rheumatic fever	400–402	400–402	. 92
Diseases of heart	410–443	410–443	1. 00
Hypertension without mention of heart	444–447	444–447	1. 33
General arteriosclerosis	450	450	1. 02
Other diseases of circulatory system	451–468	451–468	1. 04
Chronic and unspecified nephritis	592–594	592–594	1. 02

[1] Number of deaths assigned to a particular cause, using seventh revision divided by number of deaths assigned to that cause by sixth revision. Ratios are for all ages.

diseases in the United States (*4*) from 1920 to 1960 are given in figure 1 for white persons. Before 1949 the age-sex-race-specific death rates from CVR diseases were not available for California, and, therefore, in figure 1 the CVR death rates in California are shown only for 1950 and 1960. Since the 1950 and 1960 mortality rates for these diseases among the white population of California correspond so closely with those of the United States, it is reasonable to assume that the trend of mortality among white persons in California, during the past four decades, has not been too dissimilar from that of the United States. The age-specific death rates from all causes and total CVR diseases in California are shown in figure 2. The U.S. death rates for CVR diseases are not available for the Negro and other nonwhite persons and, therefore, in figure 2 only California death rates are shown.

The mortality from all causes has been declining steadily since 1920 (figs. 1 and 2). In 1920 among the white population of the U.S. Death Registration Area, 35–64 years of age, the death rates from CVR diseases were practically the same for both sexes (fig. 1). After 1920 a gradual increase occurred in the male death rates, reaching its peak in 1940 for the age group 35–44, and in 1950 for ages 45–64. Subsequently, the trend has reversed; a reduction has occurred in mortality among white men. Among the women, however, death rates from CVR diseases have decreased steadily since 1920, and at present they are only about one-third as high as the rates for men.

Throughout the past four decades, death rates from cardiovascular-renal diseases among white men have been steadily accounting for a larger proportion of the deaths from all causes. For example, in 1920 for the age group 45–54, deaths from CVR diseases constituted less than 30 percent of the total deaths, but by 1960 they accounted for more than 50 percent. Among white women, however, the proportionate mor-

Table 3. Comparability ratio seventh to sixth revision of International Classification of Diseases for selected cardiovascular-renal diseases, by age, United States, 1958

Age groups (years)	International Statistical Classification of Diseases code (ISC)				
	Arteriosclerotic heart disease (420)	Heart disease specified as involving coronary arteries (420.1)	Hypertensive heart disease (440–443)	Other hypertensive diseases (444–447)	Vascular lesions affecting central nervous system (330–334)
Total, all ages	0. 98	1. 03	1. 11	1. 33	1. 00
35–44	1. 01	1. 02	1. 05	1. 79	. 91
45–54	. 99	1. 01	1. 04	1. 50	. 98
55–64	. 99	1. 02	1. 09	1. 29	. 99

tality has changed only slightly since 1920. Further, at the present time, in the older age groups the white male death rate from CVR diseases is higher than the white female death rate from all causes.

Among the nonwhite population (fig. 2) the mortality trend has also been on the decline. There are, however, important differences between the Negroes and the other nonwhite groups. The Negro death rates from all causes and CVR diseases are appreciably higher than those of either the white or other nonwhite groups, as shown by comparison with the death rates presented in figure 1. The other nonwhite death rates are not only consistently lower than rates for the Negroes, but in 1960 they were also lower than the white death rates. The dissimilarity of the rates for Negro and other nonwhite groups indicates the importance of separating them in demographic analysis. This is especially relevant in California, since the composition of the nonwhite population has changed markedly since 1920. In 1920, for example, in the age group 45–54, only one of four

nonwhite males was a Negro, but by 1960 this ratio became two of three.

Race Differential

Many recent studies have emphasized the marked differences among the races in respect to morbidity and mortality from cardiovascular-renal diseases (8–10). Overall, the pattern presents a challenging paradox. Negro men and women have considerably higher death rates from hypertensive heart disease than white persons. In arteriosclerotic heart disease (ISC 420) the death rate for Negro men is lower than that for white men, but Negro women have a higher rate than white women. Berkson and associates (11), in a study of middle-aged persons, found that the other nonwhites (Chinese, Indians, and Japanese) exhibited a considerably lower coronary heart disease mortality rate than did the white group. For hypertensive heart disease, Berkson also showed that the other nonwhites had a slightly higher death rate than the white per-

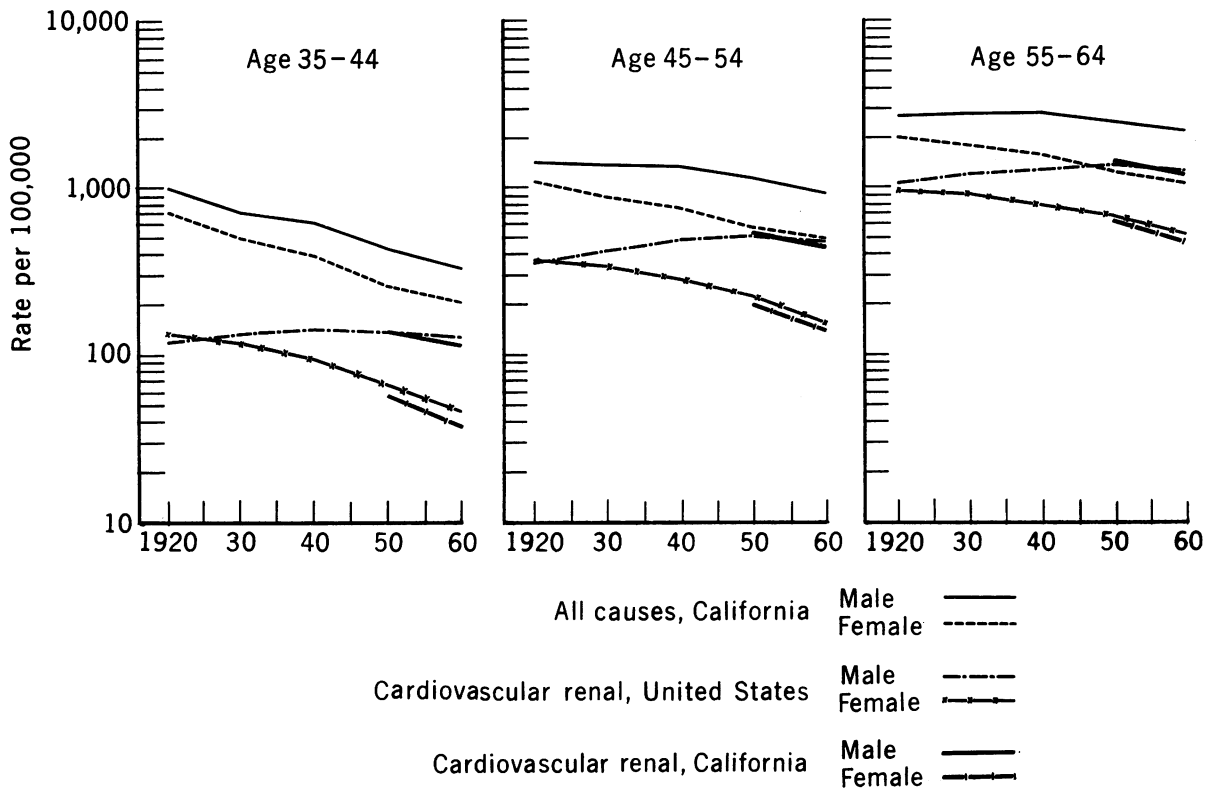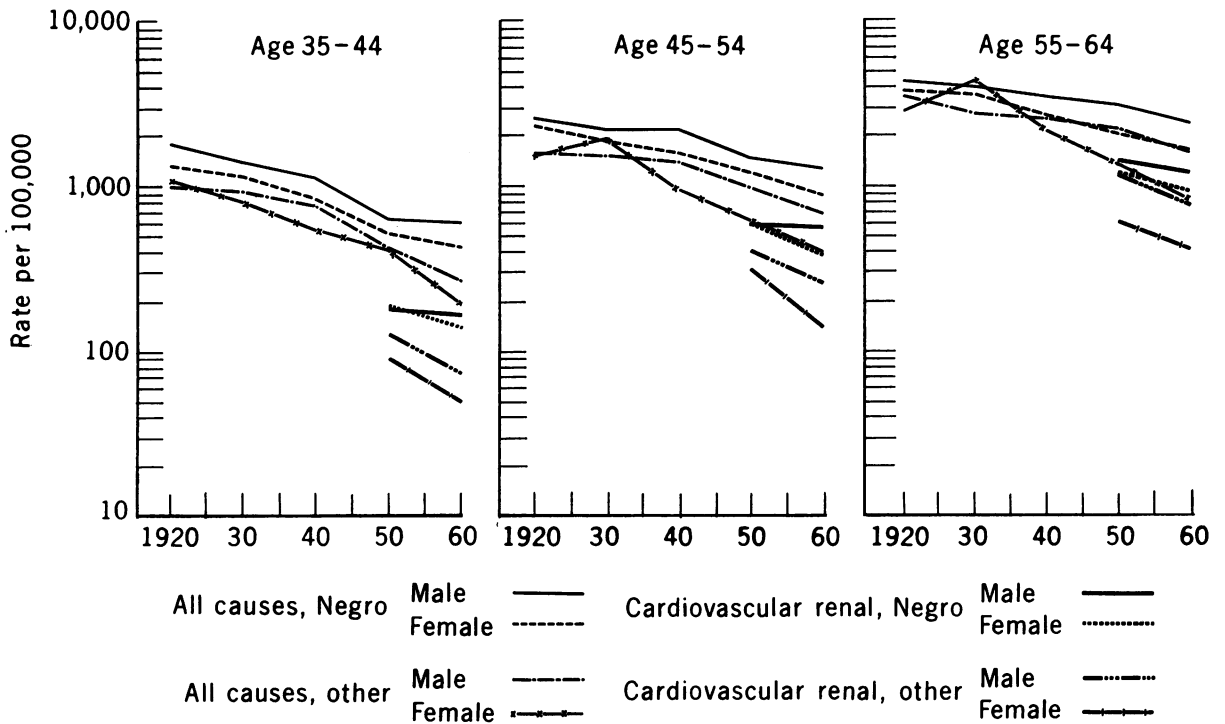**Figure 1. Death rates from all causes and cardiovascular-renal diseases (white population), 1920–60**

Age 35–44   Age 45–54   Age 55–64

Rate per 100,000

10,000

1,000

100

10

1920 30 40 50 60   1920 30 40 50 60   1920 30 40 50 60

All causes, California   Male ————
                                Female ———————

Cardiovascular renal, United States   Male —·——·—
                                      Female ·—·—·—

Cardiovascular renal, California   Male ————
                                   Female —·—·—·—

Figure 2. Death rates from all causes and cardiovascular-renal diseases (nonwhite population), California, 1920–60

All causes, Negro	Male ————
	Female --------
All causes, other	Male —·—·—
	Female ·—·—·—

Cardiovascular renal, Negro	Male ————
	Female ·············
Cardiovascular renal, other	Male —··—··—
	Female —+—+—

sons. The California data show essentially the same pattern.

The ratios of nonwhite to white mortality rates from the total and selected CVR diseases both for 1950 and 1960 are shown in table 4. For total CVR diseases (first two columns of table 4), Negroes (both sexes) had consistently higher death rates than the white men and women, both in 1950 and 1960. The other nonwhites, except women in the younger age group, had lower death rates in 1960 than the white group.

Negro men and women have considerably higher death rates from hypertensive heart disease than white men and women. In 1960, for instance, in the age group 45–54, the Negroes had death rates 5 to 8 times higher than the white group. The other nonwhites also showed slightly higher death rates from this cause than the white population.

For arteriosclerotic heart disease including coronary arteries (ISC 420), however, the pattern was markedly different. In 1960 the other nonwhites (both sexes) had rates only about half as high as the white death rates. Among

Negro men, the death rates were also lower than among white men, but among women the death rates were much higher for Negroes.

Sex Differential

That mortality rates are different between men and women is well documented (12–14). Women seem to withstand the forces of mortality much better than men. In 1959 the U.S. life expectancy at birth was 73.0 years for women and 66.5 for men. Yerushalmy (15) and others have noted that the sex difference in mortality has become increasingly larger as the death rates for women decreased more rapidly than those for men.

This phenomenon of excess male mortality is also evident in California. In 1920 the death rates from CVR diseases in the U.S. Death Registration Area, were approximately the same for both men and women; subsequently, however, women experienced a rapid decline in mortality, whereas the death rates for men increased (fig. 1). By 1960 mortality among men was roughly three times higher than among

women. However, the phenomenon of excess male mortality differs appreciably in various countries, with time and age. For instance, while the excess male mortality has been increasing in most Western countries, in Sweden (*12*) the excess male mortality has declined in the past 100 years.

The male-to-female mortality ratio, 1950 and 1960, for total and selected CVR diseases is shown in table 5. Among the white population, men in the several age groups experienced from 2.3 to 2.7 times greater mortality from CVR diseases in 1950 than women, and from 2.6 to 3.2 times greater in 1960. On the other hand, among Negroes in 1960 mortality in men was only about 20–50 percent higher than among women. For the other nonwhite persons the excess in male mortality was in between that of the white and Negro population. In general, the excess male mortality increased between 1950 and 1960 (table 5).

The sex ratio varies considerably in the several individual CVR diseases. The difference between male and female mortality from the CVR diseases as a whole is principally attributable to the excess in male mortality from arteriosclerotic heart disease (ISC 420). Among white persons the male-to-female mortality ratios for the latter cause were 7.7, 6.0, and 3.4 for the three age groups in 1950, and 8.1, 5.9, and 3.5 for the three age groups in 1960. As in the case of total CVR diseases, the male-to-female ratio in mortality from arteriosclerotic heart disease (420) was much lower among the Negro than among the white population; among other nonwhites it was also lower than for white persons, but higher than for Negroes. For hypertensive heart disease (ISC 440–447) in 1960, white men had about 40 percent excess mortality; while among Negroes and other nonwhites there was no consistent difference between the sexes.

Recent Changes

The age-sex-race-specific death rates in California and the relative changes from 1950 to 1960 from the total and the major components of CVR diseases are shown in table 6. The

Table 4. Negro to white, and other nonwhite to white mortality ratios from selected cardiovascular-renal diseases, by age and sex, California, 1949–51 and 1959–61

Age groups (years)	Nonwhite to white ratio	Total cardiovascular-renal diseases		Arteriosclerotic heart disease (420)		Hypertensive heart disease (440–447)		Vascular lesions affecting central nervous system (330–334)	
		Male	Female	Male	Female	Male	Female	Male	Female
		1949–51							
35–44	Negro to white_____	1. 3	3. 4	0. 7	1. 9	5. 6	9. 5	2. 0	4. 1
	Other nonwhite to white__	. 9	1. 6	. 6	1. 0	1. 9	1. 6	2. 9	2. 2
45–54	Negro to white_____	1. 1	2. 9	. 6	2. 3	3. 2	5. 5	2. 2	3. 0
	Other nonwhite to white__	. 7	1. 5	. 5	1. 2	1. 4	2. 5	1. 8	1. 9
55–64	Negro to white_____	1. 0	1. 9	. 7	1. 3	2. 5	4. 1	1. 2	1. 9
	Other nonwhite to white__	. 8	. 9	. 5	. 6	1. 8	1. 7	1. 5	1. 1
		1959–61							
35–44	Negro to white_____	1. 5	3. 6	1. 0	2. 4	10. 7	15. 1	2. 0	4. 0
	Other nonwhite to white__	. 6	1. 3	. 5	. 5	1. 0	1. 5	1. 6	. 9
45–54	Negro to white_____	1. 2	2. 7	. 8	2. 1	5. 3	7. 8	2. 5	2. 6
	Other nonwhite to white__	. 5	. 9	. 4	. 4	1. 4	1. 2	1. 5	1. 9
55–64	Negro to white_____	1. 0	2. 0	. 7	1. 3	3. 1	4. 3	1. 9	2. 5
	Other nonwhite to white__	. 6	. 9	. 5	. 7	1. 2	1. 6	1. 6	1. 3

Table 5. Male-to-female mortality ratio from selected cardiovascular-renal diseases, by age and race, California, 1949–51 and 1959–61

Age groups (years) and race	Total cardio-vascular-renal diseases	Arteriosclerotic heart disease (420)	Hypertensive heart disease (440–447)	Vascular lesions affecting central nervous system (330–334)
	1949–51			
35–44				
White	2.5	7.7	1.3	0.9
Negro	.9	2.7	.7	.4
Other nonwhite	1.4	4.4	1.5	1.2
45–54				
White	2.7	6.0	1.3	1.0
Negro	1.0	1.6	.8	.7
Other nonwhite	1.3	2.5	.7	.9
55–64				
White	2.3	3.4	1.4	1.2
Negro	1.2	1.8	.9	.8
Other nonwhite	2.0	2.8	1.5	1.6
	1959–61			
35–44				
White	3.1	8.1	1.4	1.1
Negro	1.2	3.3	1.0	.6
Other nonwhite	1.5	6.9	.9	1.9
45–54				
White	3.2	5.9	1.4	1.1
Negro	1.5	2.4	.9	1.0
Other nonwhite	1.9	5.7	1.6	.9
55–64				
White	2.6	3.5	1.4	1.4
Negro	1.3	1.8	1.0	1.1
Other nonwhite	1.9	2.3	1.0	1.6

adjusted percentage changes were obtained by applying the comparability ratio shown in table 3 for the appropriate age to the 1950 rates, and expressing the change from 1950 to 1960 as a percentage of the adjusted 1950 rates. These percentage changes are also shown in figures 3, 4, and 5. As shown in these figures and also table 6, there has been a pronounced decline in the mortality from CVR diseases during the past decade.

Overall, the rate of decline during the past decade has been much greater among women than among men. Among the racial groups, the other nonwhites showed the greatest relative decrease, and Negroes the least. In the age group 45–54 the decrease in mortality from total CVR diseases among white men was 17 percent, 6 percent for Negro men, and 38 percent for other nonwhite men. Among Negro women, the rates decreased to the same extent as for white women, about 30–35 percent, whereas the mortality from CVR diseases for other nonwhite women decreased 56 percent. The pattern is similar in the other age groups.

Among the major components of the cardiovascular-renal diseases, the greatest relative reduction in mortality from 1950 to 1960 occurred in hypertensive cardiovascular disease (440–447). The pattern of the change in mortality from this cause is greatly different among the sexes and the three racial groups (table 6). Not only do the Negroes have much higher absolute death rates, but also their relative decline in mortality from 1950 to 1960 is substantially less than that of the other two racial groups. In the age group 45–54, a reduction of 60 percent occurred among white men, 57 percent among other nonwhites, but only 33 per-

cent among Negroes. Negro women also experienced less reduction in mortality from hypertensive heart disease—60 percent among white women, 79 percent among other nonwhite women, and only 43 percent among Negroes. This differential among the races is important for demographic analysis. It has been customary to combine the Negroes and other nonwhites and refer to them as "nonwhites." Such a grouping tends to mask the basic differences in mortality and mortality trends that exist among the nonwhite races.

The reduction in hypertensive heart disease mortality during the past decade constitutes a substantial and significant change, probably reflecting, at least in part, recent improvements in the therapeutic management of hypertensive patients, including the new antihypertensive drugs.

Mortality attributed to arteriosclerotic heart disease, including disease of the coronary arteries (ISC 420), also declined from 1950 to 1960 for most of the age-sex-race categories. The changes in mortality from this disease during the past decade again differed markedly among the age-sex-race groups. Among persons aged 35–44, white men and women showed a decrease of 9 and 14 percent respectively; among the other nonwhites the reduction was much greater, 32 percent for men and 56 percent for women. On the other hand, Negroes of this age group experienced an increase in mortality of 30 percent for men and 7 percent for women.

In the age group 45–54, the greatest reduction in mortality from arteriosclerotic heart disease (ISC 420) was also in the other nonwhite groups, 26 percent among men and 68 percent among women. The death rates among white men decreased by 13 percent and among women by 12 percent. Negro men experienced an increase in mortality of 21 percent, while the rate for Negro women decreased by 20 percent.

In the oldest age group, 55–65 years, the pattern of change was more uniform among the sexes and the racial groups.

Discussion

In recent years significant advances have occurred in the diagnosis and therapy of CVR diseases. With respect to hypertensive heart dis-

Figure 3. Percentage change in death rates from 1949–51 to 1959–61 for selected cardiovascular diseases in California, age group 35–44 years
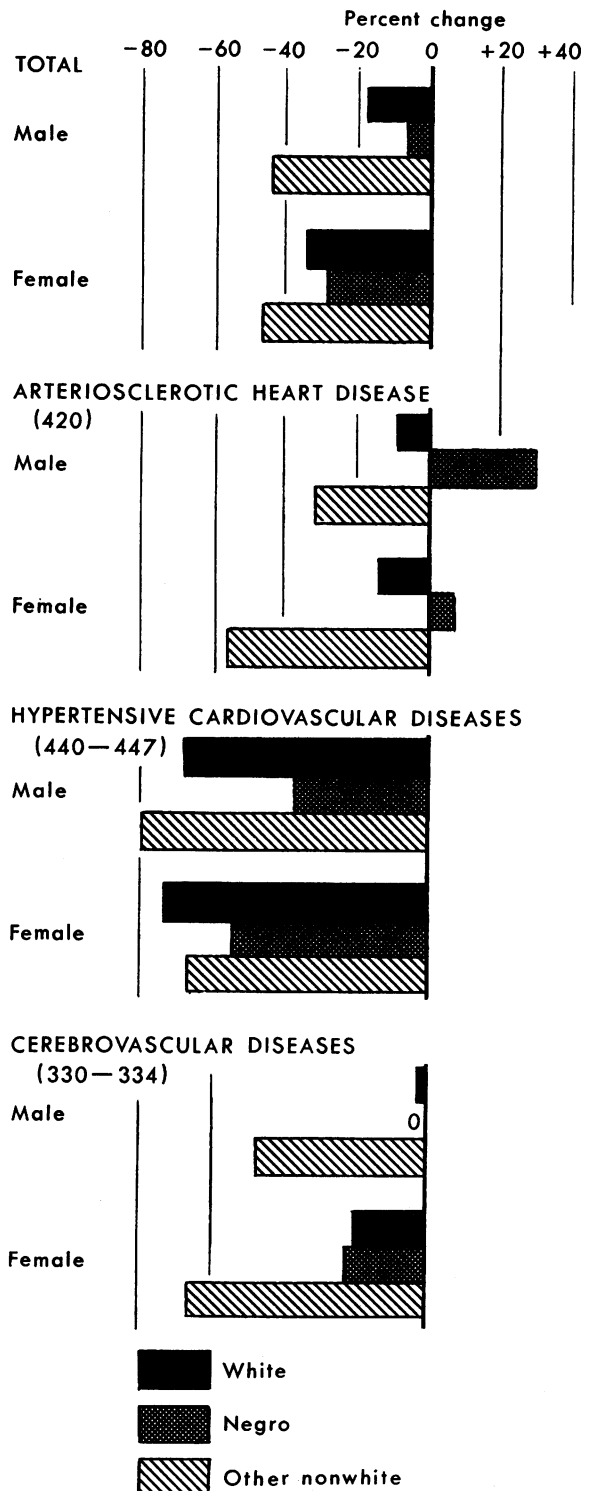
Figure 4. Percentage change in death rates from 1949–51 to 1959–61 for selected cardiovascular diseases in California, age group 45–54 years
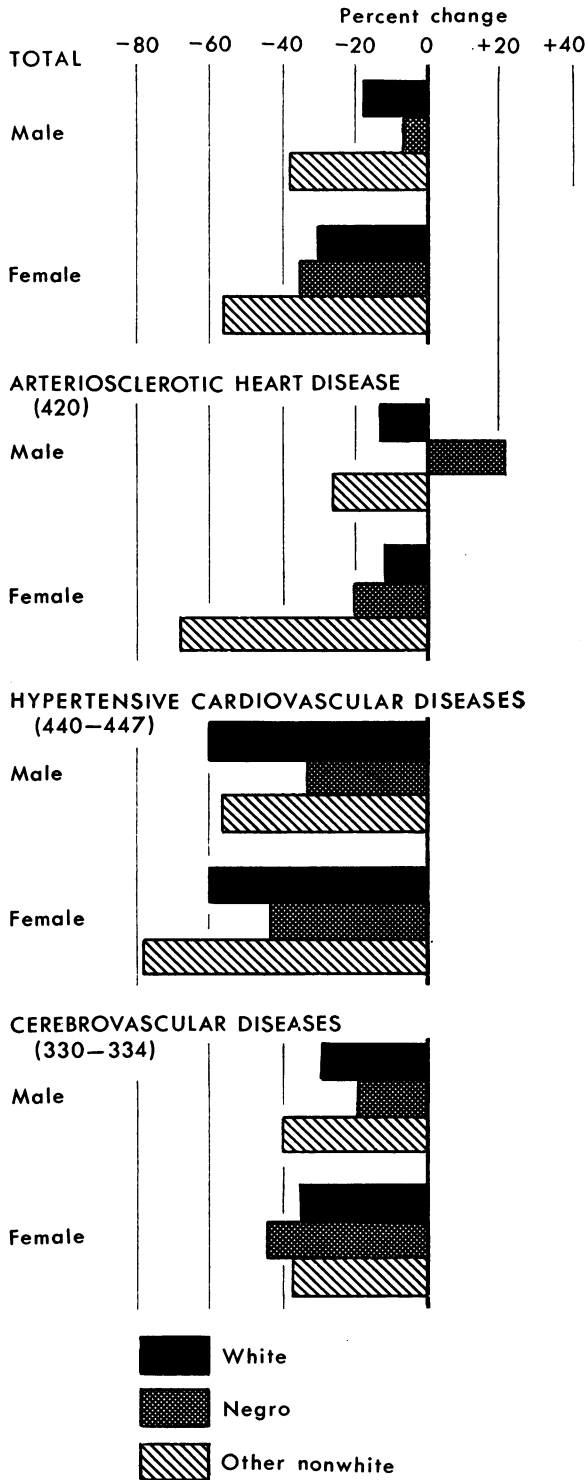
Figure 5. Percentage change in death rates from 1949–51 to 1959–61 for selected cardiovascular diseases in California, age group 55–64 years

Percent change

-80   -60   -40   -20   0   +20   +40

TOTAL

Male

Female

ARTERIOSCLEROTIC HEART DISEASE
(420)

Male

Female

HYPERTENSIVE CARDIOVASCULAR DISEASES
(440—447)

Male

Female

CEREBROVASCULAR DISEASES
(330—334)

Male

Female

■ White

▓ Negro

▨ Other nonwhite

Percent change

-80   -60   -40   -20   0   +20   +40

TOTAL

Male

Female

ARTERIOSCLEROTIC HEART DISEASE
(420)

Male

Female

0

HYPERTENSIVE CARDIOVASCULAR DISEASES
(440—447)

Male

Female

CEREBROVASCULAR DISEASES
(330—334)

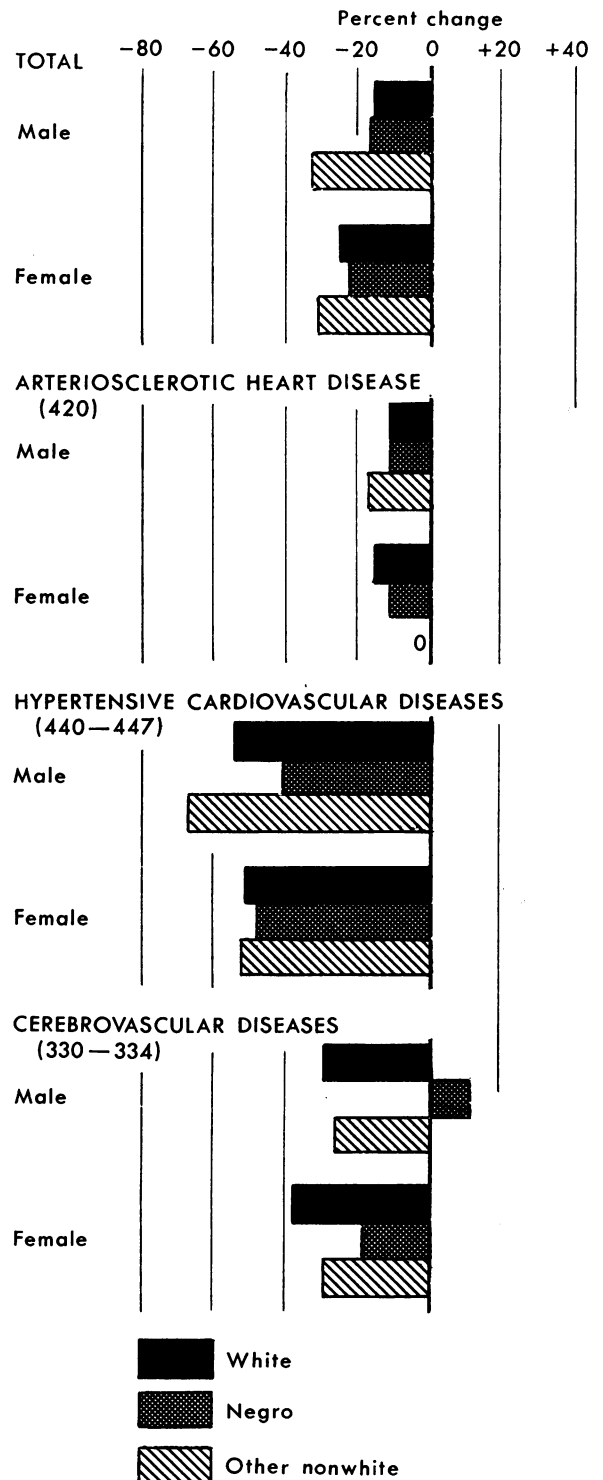Male

Female

■ White

▓ Negro

▨ Other nonwhite

Table 6. Death rates from selected cardiovascular diseases, by age, sex, and race,

Age groups (years), sex, and race	Total cardiovascular-renal diseases			Arteriosclerotic heart disease (420)			Heart disease specified as involving coronary arteries (420.1)		
	1950	1960	Adjusted percent change [2]	1950	1960	Adjusted percent change [2]	1950	1960	Adjusted percent change [2]
35–44									
Male:									
White	139. 7	114. 0	−18	84. 2	77. 8	−9	75. 6	62. 2	−19
Negro	180. 4	168. 3	−7	57. 5	75. 7	30	51. 0	63. 2	22
Other nonwhite	129. 8	73. 0	−44	50. 5	35. 2	−32	48. 2	24. 7	−50
Female:									
White	56. 4	37. 2	−34	11. 0	9. 6	−14	9. 5	7. 4	−24
Negro	191. 0	135. 2	−29	21. 0	22. 6	7	16. 9	18. 6	8
Other nonwhite	91. 0	48. 0	−47	11. 4	5. 1	−56	11. 4	3. 9	−67
45–54									
Male:									
White	540. 0	444. 9	−17	374. 4	321. 8	−13	319. 7	241. 4	−25
Negro	576. 6	540. 7	−6	222. 0	266. 6	21	173. 3	198. 6	13
Other nonwhite	392. 0	244. 5	−38	178. 1	129. 7	−26	157. 9	96. 0	−40
Female:									
White	198. 5	138. 8	−30	62. 3	54. 6	−42	52. 1	40. 2	−24
Negro	571. 3	372. 4	−35	142. 8	112. 6	−20	93. 7	81. 7	−14
Other nonwhite	296. 6	129. 4	−56	72. 5	22. 8	−68	61. 5	11. 3	−82
55–64									
Male:									
White	1, 420. 1	1, 206. 6	−15	944. 2	832. 8	−11	736. 6	570. 2	−24
Negro	1, 423. 2	1, 202. 1	−16	631. 1	556. 5	−11	413. 3	336. 5	−20
Other nonwhite	1, 149. 6	768. 9	−33	496. 9	406. 4	−17	329. 3	265. 0	−21
Female:									
White	618. 4	464. 4	−25	280. 7	235. 7	−15	202. 1	152. 7	−26
Negro	1, 188. 9	924. 8	−22	360. 0	317. 1	−11	229. 8	185. 0	−21
Other nonwhite	582. 9	404. 5	−31	174. 9	173. 7	0	140. 7	93. 7	−35

[1] For 440–447, the age comparability ratios were applied separately to 440–443 and 444–447 and then combined. For nonwhite, the rates for 1950 are by place of occurrence.

[2] These changes were obtained by applying the appropriate age comparability ratio to the 1950 rates and expressing the difference between 1960 and 1950 as a percent of the 1950 rates.

ease, considerable progress has been made in identifying various types of hypertension amenable to specific therapy. Perhaps most dramatic of all recent medical achievements in CVR disease research is the development of a series of new pharmacologic agents for more effective treatment and control of elevated blood pressure. Since the development of such new drugs as Rauwolfia preparations, hydralazine, chlorothiazides, ganglionic blocking agents, guanethidine, and others, improvement has occurred in the control of mild and even severe hypertension.

Many investigators, in recent years, have reported medically and surgically treated patients with hypertensive heart disease experience lower mortality rates than patients with no treatment (*16–18*). For example, Kinsey and associates studied the 5-year mortality rates of some 3,000 hypertensive patients observed over the 10-year period of 1944 through 1954. These investigators selected the years 1944 through 1954 because this allowed the best comparison of 5-year mortality rates of hypertensive patients followed before and after the introduction of modern antihypertensive agents (*16*). Comparing the mortality rates of 1944–49 with mortality rates of 1950–54, they found a statistically significant reduction in mortality among patients treated after 1950, with the exception of women with advanced hypertensive cardiovascular disease. The reduction in mortality rates of the medically treated hypertensive patients since 1950 was attributed by Kinsey and associates to "the introduction of newer antihypertensive drugs."

Hypertensive heart disease (440–447) [1]			Vascular lesions affecting central nervous system (330–334)		
1950	1960	Adjusted percent change [2]	1950	1960	Adjusted percent change [2]
9.0	3.7	−69	10.7	9.5	−2
50.2	39.7	−37	21.1	19.1	0
17.0	3.6	−80	30.7	15.2	−46
7.2	2.6	−74	11.9	8.6	−20
68.4	39.2	−55	48.2	34.2	−22
11.4	3.9	−67	26.2	7.8	−67
41.6	18.8	−60	49.4	34.3	−29
133.1	98.8	−33	106.4	84.5	−19
58.2	27.1	−57	87.1	51.5	−40
30.9	13.7	−60	50.0	31.7	−35
170.9	106.9	−43	150.4	82.3	−44
77.9	16.9	−79	95.7	59.2	−37
114.2	60.0	−54	174.2	121.9	−29
287.5	188.5	−41	212.7	232.0	10
200.5	73.3	−67	258.6	189.9	−26
80.8	44.3	−51	145.8	89.2	−38
331.9	192.7	−48	269.8	219.6	−18
134.7	70.2	−52	166.8	117.4	−29

The mortality from hypertensive heart disease (ISC 440–447) in California has dropped 33 to 80 percent since 1950 among various age, sex, and race groups. From reports of the positive and sustained association between elevated systolic and diastolic blood pressure on the one hand and increased risk of dying from coronary heart disease on the other (19,20), one may postulate also the possible effect that improvement in therapeutic management of hypertensive disease might have had on coronary heart disease mortality during the past decade. Thus, the downward trend observed in coronary heart disease mortality among white middle-aged men may be explained partially by more successful clinical management of patients with arterial hypertension during the past decade.

The observed decline in age-specific mortality from arteriosclerotic heart disease including coronary artery disease (ISC 420) in California is in sharp contrast to other recently published mortality statistics. A recent publication (21), based on data from the National Office of Vital Statistics, states that among the white population of the United States in the past decade, "arteriosclerotic heart disease (including coronary disease) by far the leading type, recorded a marked increase in mortality, while almost all other forms of the disease showed a downward trend" (21).

The pattern of mortality from arteriosclerotic heart disease (ISC 420) during the past decade in California is clearly different. In California there was a reduction in mortality among the white population (both men and women) between 1950 and 1960 of 9 to 15 percent, whereas the U.S. data, as reported by the Metropolitan Life Insurance Company, indicated an increase in mortality among white men and a relative decrease of less than 5 percent in two of the three age groups for white women (21).

One possible explanation for this lack of agreement may be discrepancies in coding. Arteriosclerotic heart disease (ISC 420) represents, for coding procedures, a combination of three subcategories: (a) arteriosclerotic heart disease so described (ISC 420.0), (b) heart disease specified as involving coronary arteries (ISC 420.1), and (c) angina pectoris without mention of coronary heart disease (ISC 420.2).

Recently among physicians, there has been a growing recognition of the importance of arteriosclerosis (ISC 450) in the etiology of CVR diseases, especially among older persons. This may result in assigning the underlying cause of death to "arteriosclerotic heart disease so described" instead of "arteriosclerosis." Hence, such a death certificate may be coded as 420.0 instead of 450. This could produce an artificial increase in mortality rates in the subcategory of 420.0 which, in turn, will affect the mortality rates from the total category of ISC 420 which, as mentioned before, is the combination of 420.0, 420.1, and 420.2. Such practice, perhaps varying considerably in different parts of the United States, may be a possible explanation for the difference between the California data and that of the United States collected by

the National Office of Vital Statistics and reported by the Metropolitan Life Insurance Company.

Changes in physicians' practice and training as well as changes in terminology must be considered as possible explanations for the reduction in mortality from CVR diseases observed in California during the past decade. However, the observed changes cannot be completely explained by these factors. The possibility that physicians in California may sometimes call a disease cerebral hemorrhage rather than hypertensive heart disease or arteriosclerotic heart disease cannot account for the large changes in mortality.

The reduction in CVR disease mortality in California, during the past decade, has been both in the major component diseases and in CVR diseases as a whole (table 6). Furthermore, there is no reason to believe that a change in medical practice in California would classify cardiovascular-renal diseases into other major categories of disease (for example, chronic respiratory disease).

Changes in classification and coding (sixth revision of ISC and seventh revision of ISC) of death certificates filed in California between 1950 and 1960 may be another possible explanation, but this is quite unlikely. Coding might affect assignment within CVR diseases, but could not account for the substantial and general decline observed in mortality from total CVR diseases (table 6). Furthermore, we handled the changes in classification and coding between 1950 and 1960 by applying the appropriate age-specific comparability ratio shown in table 3 to the 1950 rates and compared such adjusted 1950 rates to 1960 rates.

The influx of "healthy" persons to California during recent years may be considered a factor responsible for the observed reduction in mortality from heart disease during the past decade. The possible effect of such an influx of "healthy" people on the observed reduction in mortality in California is presently under investigation. It does not seem to us, however, that this phenomenon could explain the entire picture.

The evidence, therefore, suggests that the decline in mortality from CVR diseases in California during the past decade is real. One can

reason that if the absolute magnitude of the decline in cardiovascular mortality between 1950 and 1960 is equal or less than the absolute magnitude of the decline in mortality from all causes, this would be consistent with the hypothesis that the decline in cardiovascular mortality during the past decade is real. The data presented in this report indicate that indeed this is the case. For example, among white men aged 45–54, the cardiovascular mortality declined during the past decade by 100 deaths per 100,000 population; whereas the mortality from all causes declined by 200 deaths per 100,000 population.

For all age-race-sex groups, the decline in CVR disease mortality was less than that of the mortality from all causes. The sharpest reduction in mortality was observed in hypertensive heart disease and next in vascular lesions affecting central nervous system and arteriosclerotic heart disease. The introduction of new antihypertensive drugs and recent developments in the treatment of coronary and cerebral thrombosis are possible explanations. This explanation is consistent with our data— the greatest decline in hypertensive heart disease and a carryover to vascular lesions affecting central nervous system and arteriosclerotic heart disease.

Besides specific therapy, changes in the condition of life as a factor in mortality trends should also be considered. We have observed a sharp difference in mortality between sexes. Men and women, in 1920, experienced the same CVR disease mortality rates. Subsequently, women experienced a rapid decline in mortality whereas death rates for men in the age group 35–64 increased (fig. 1). Now men are also beginning to experience a decline. It appears that men may be following women by 30 to 40 years in being favorably influenced by whatever factors caused the impressive decline in mortality among women in the 1920's. It will be interesting to study the decline in mortality from CVR diseases among men during the next few decades. The excess male mortality, presently observed in California and the United States, may decline over the course of the next few decades, as it has in Sweden for the past century.

We have observed much higher death rates

from coronary heart disease among white men aged 35–64 than among white women. On the other hand, among the nonwhite population, such a sharp sex differential does not exist. Furthermore, the difference in mortality between white and nonwhite persons deserves particular attention. Middle-aged Negro men experienced a rise in mortality from arteriosclerotic heart disease during the past decade, in the face of decline for white and other nonwhite men. Despite increases in mortality from arteriosclerotic heart disease among Negro men aged 35–54, their absolute death rates continue to be lower than those of white men at the same age. The rise in arteriosclerotic heart disease mortality among Negro men, when hypertensive heart disease is declining, is obviously a paradox which needs explanation.

The rise in mortality, during the past decade, among Negro men appears to parallel the experience of white men in the United States from 1920 to 1950. Perhaps this rise is associated with similar occupational and other social advances. The substantially more favored position of the other nonwhite groups in respect to total CVR and arteriosclerotic heart diseases, and particularly the dramatic decline in their mortality from arteriosclerotic heart disease in one decade, 1950–60, supports the hypothesis of change in conditions of life, rather than biological or artifact explanations.

As to prevention and control of coronary heart disease, it is important to recognize these changes and particularly to consider the association between such factors as elevated blood pressure, excessive cigarette smoking, and elevated serum cholesterol (19), and their association with the increased risk of dying from coronary heart disease. Although we do not know the etiology of coronary heart disease, the association of these factors with the increased risk of dying from this disease stands out clearly in epidemiologic studies. The data indicate that in California during the past decade the mortality from hypertensive heart disease in the age group 35–64 has decreased by 33 to 80 percent. This, in turn, we believe, has sharply reduced the mortality from coronary heart disease. Rigorous and systematic treatment of hypertension and probably other abnormal factors which are associated with higher mortality from coronary heart disease may further reduce the mortality from coronary heart disease during the next decade.

Summary

Death rates from cardiovascular-renal diseases have declined in California during the past decade, and the pattern of mortality has changed considerably between sexes and among races.

Among the white population in the United States Death Registration Area in 1920, death rates from cardiovascular-renal diseases were the same for both sexes. After 1920 a gradual increase occurred in mortality for men, reached its peak about 1950, and subsequently began to decline. For women, however, death rates have declined steadily since 1920.

Throughout the past four decades deaths from cardiovascular-renal diseases among white men have contributed to a rising proportion of deaths from all causes. Among white women, the proportionate mortality has changed only slightly.

In the age group 35–54 years, Negro men and women suffered higher death rates from cardiovascular-renal diseases than white men and women. "Other nonwhites" (mostly Chinese and Japanese), with only two exceptions, had less mortality than white persons. For hypertensive disease, Negroes had higher death rates. But for arteriosclerotic heart disease Negro men had lower rates than white men, and Negro women had higher rates than white women.

Negro men aged 35–54 years showed a reduction in mortality from hypertensive heart disease, but an increase in mortality from arteriosclerotic heart disease.

Among the white population, men experienced about three times greater mortality from cardiovascular-renal diseases than women. Among Negroes, the excess mortality for men is only 20–50 percent. Among "other nonwhites," the excess mortality for men was between that for the white and Negro populations.

The greatest reduction in CVR disease mortality has occurred in hypertensive heart disease, and next in vascular lesions affecting central nervous system and arteriosclerotic heart disease including coronary heart disease.

The data suggest that the decline in mortality from cardiovascular-renal diseases during the past decade is real. Besides specific therapeutic management as a cause of the observed decline in mortality, changes in the condition of life and environment may be contributing factors to this phenomenon.

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PHS Surgical Teams in South Vietnam

Surgical teams on duty in South Vietnam for the past year have included 20 Public Health Service surgeons, anesthesiologists, nurses, and medical technologists. The teams are in provincial hospitals in the cities of Can Tho, Nha Trang, and Da Nang.

Dr. Henry C. Savage, chief of surgery of the Seattle Hospital, recently joined the team in Da Nang for a 90-day assignment, and another surgeon and two Public Health Service nurses will arrive in South Vietnam soon. Additional assignments of all types of Public Health Service personnel will be made in the coming months.

Information on the teams may be obtained from Dr. Leo J. Gehrig, deputy chief, Bureau of Medical Services.