

III. MORTALITY STUDY AMONG VETERANS ADMINISTRATION PATIENTS WITH CORONARY ARTERY DISEASE*

THIS report presents the results of a study of the records of a number of Veterans Administration hospital patients with regard to specific factors affecting the prognosis of coronary artery disease. In this study, coronary artery disease is taken to include all the conditions listed under the International Classification of Diseases Code 420 (Seventh Revision), such as arteriosclerotic heart disease; heart diseases specified as involving the coronary arteries, including myocardial infarction and ischemic heart disease; and angina pectoris.

Because of the possibility of long-term follow-up through the records of the Veterans Administration, the study was limited to veterans who were admitted to certain VA hospitals for treatment of coronary artery disease. The study was further limited to white male veterans and includes only veterans who were admitted during calendar years 1957-67, observed from the date of admission to year end 1972. The calendar ages at admission (i.e., calendar year of admission less calendar year of birth) of the veterans included in the study were from 20 to 65.

Only those records relating to *first* coronary admissions of 1957 and later were included in this study. Veterans who died during the hospital stay that resulted from such admission, as well as those whose clinical examination revealed significant medical complications (see selected list below), were excluded from the study.

SIGNIFICANT MEDICAL COMPLICATIONS

Anemia, excluding secondary	Cirrhosis of the liver	Lung diseases, chronic
Aneurysm, aortic, cerebral	Colitis, severe ulcerative	Nephritis, chronic
Arthritis, severe rheumatoid	Diabetes, severe	Paralysis agitans
Asthma, severe	Drug addiction	Paraplegia
Cancer, Hodgkin's disease, leukemia	Epilepsy, grand mal	Syphilis, tertiary
Cerebrovascular accidents	Goiter, toxic	Tuberculosis, active
	Heart disease (other than coronary artery disease), chronic, except arteriosclerotic	

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The initial planning and specifications for this study were done by Edward A. Lew, F.S.A., and John J. Hutchinson, M.D. The final phases of the study were completed under the direction of Thomas R. Huber, F.S.A.

Of the 2,906 statistical abstracts prepared from clinical and summary records maintained at the selected VA hospitals on the patients to be included in this study, 1,751 were eliminated from the study for one or more of the following reasons: the claim number was missing, the date of birth was missing, the patient revealed significant medical complications, the patient did not meet the eligibility requirements of age at admission, year of admission, and so on, the data were clearly erroneous, or the case was a duplicate. This left 1,155 cases that satisfied all criteria and were judged usable. The data were obtained from VA hospitals in the following locations:

Boston, Mass.	Milwaukee, Wis.
Bronx, N.Y.	Minneapolis, Minn.
Brooklyn, N.Y.	Nashville, Tenn.
Cincinnati, Ohio	New York, N.Y.
Hines, Ill.	Philadelphia, Pa.
Houston, Tex.	Richmond, Va.
Indianapolis, Ind.	Washington, D.C.
Los Angeles, Calif.	Wood, Wis.

Codes were devised to transfer the information from the 1,155 abstracts to IBM punch cards. Preliminary statistics for various categories of the abstracted data were then prepared. There was one such category for each "predisposing factor," that is, factors that are suspected of leading to coronary artery disease or are generally believed to have an impact on mortality. In this study the factors were age, occupation, presence of congestive failure, previous history of hypertension, previous history of angina pectoris, smoking habits, elevated blood cholesterol, family history of vascular disease, build, and alcohol habits.

A duplicate set of those punch cards was sent to the Veterans Administration in Washington, D.C., in order to obtain the current status (whether living or dead, as well as date of death) of each veteran as of December 31, 1972. Only fourteen cases had to be deleted from the study because they could not be located by the Veterans Administration in its BIRLS (Beneficiary Identification and Records Locator Subsystem) Index.

The data from the remaining 1,141 cases were tabulated to show admissions, deaths, and survivors (i.e., those found still living at the end of the observation period) by age at admission and duration since admission. Admissions were assumed to occur only at duration 0, deaths were tabulated by calendar duration (i.e., calendar year of death less calendar

year of admission), and survivors were tabulated by next duration (i.e., 1973 less calendar year of admission).

Calculations were then made to determine the number of life years exposed to risk, which was according to a formula reflecting the effect of the admissions, deaths, and survivors at each given age at admission or duration. Expected deaths were obtained by applying the 1959-61 United States Life Table mortality rates for the white male population against the number of life years exposed to risk. Ratios of actual to expected deaths (mortality ratios) and the number of extra deaths per 1,000 life years exposed to risk were calculated for all durations combined for age-at-admission groups 20-39, 40-49, 50-59, 60-65, and 20-65, and for all ages combined for duration groups 1-2, 3-5, 6-10, 11-15, and 1-15. (Throughout this report, durations are expressed in years.)

Ten tables of findings were then prepared for inclusion in this report. Table 1 shows the mortality experience by age at admission and duration since admission for all of the 1,141 veterans included in the study. Tables 2-10 consist of distributions of the aggregate data by type of predisposing factor, namely: occupation (strenuous, sedentary), presence of congestive failure (yes, no), previous history of hypertension (yes, no), previous history of angina pectoris (yes, no), smoking habits (current smokers, past smokers, nonsmokers), elevated blood cholesterol (yes, no), family history of vascular disease (two or more in family, less than two in family), build (markedly overweight, moderately overweight, slightly overweight, not overweight), alcohol habits (heavy drinkers, moderate and light drinkers, nondrinkers). A description of the method used to classify each record into the preceding categories is summarized in the Appendix of this report.

TABLE 1
ALL DATA COMBINED
EXPERIENCE BY AGE AT ADMISSION AND DURATION SINCE ADMISSION

AGE AT ADMISSION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000	DURATION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000
		Actual	Expected					Actual	Expected		
20-39	1,008	51	3.97	1,285%	47	1-2	2,229	135	29.98	450%	47
40-49	3,458	176	32.45	542	42	3-5	2,825	171	45.10	379	45
50-59	2,781	171	59.33	288	40	6-10	3,213	197	68.28	289	40
60-65	2,036	177	80.18	221	48	11-15	1,016	72	32.57	221	39
20-65	9,283	575	175.93	327%	43	1-15	9,283	575	175.93	327%	43

All findings are presented in the following tables. In addition, a brief discussion of the underlying data and some of the more significant characteristics of the mortality experience is provided. Table 11 summarizes the results in Tables 1-10.

The mean and median ages at admission were calculated to be 50.9 and 50, respectively. About 90 per cent of the total life years exposed were for those aged 40 and over at admission. This predominance of higher adult ages should be kept in mind when the results of this investigation are interpreted. Age is, of course, believed to be one of many predisposing factors to coronary artery disease.

As shown in Table 1, the overall mortality ratio was 327 per cent for all ages and durations combined, and the excess death rate was 43 per 1,000. There were 575 actual deaths, over 50 per cent of the 1,141 cases that entered the study. For all durations combined, the highest mortality ratio occurred for ages at admission 35-39. Because the data were limited, no significant conclusion could be drawn for ages below 35. For ages 40-44 the mortality was also relatively high, particularly at durations 1-4 since admission. The mortality ratios for all durations combined decreased with advancing age at admission, ranging from 1,285 per cent at ages 20-39 to 221 per cent for ages 60-65. However, the extra deaths per 1,000 showed relatively little variation by age at admission. For all ages combined, the mortality ratios decreased from 450 to 221 per cent with increasing duration group, and the extra deaths per 1,000 also decreased, from 47 to 39 per 1,000.

In reviewing the data by occupation (Table 2), it was found that in all but one case the occupation was stated. Cases with strenuous occupations constituted approximately two-thirds of the exposure, the balance being those whose occupations were sedentary. In each group about 90 per cent of the admissions were at ages 40 and over.

By December 31, 1972, 51.5 per cent of all cases with sedentary occupations had died, while 49.9 per cent of those with strenuous occupations had died. The mortality ratios did not differ significantly between the strenuous and sedentary occupation groups. However, cases with sedentary occupations had extra deaths per 1,000 that were constant at 42 per 1,000 for durations up to ten years and a higher rate of 52 per 1,000 for durations 11-15. This is contrary to the downward trend in extra deaths per 1,000 for those cases with strenuous occupations, ranging from 50 per 1,000 for duration 1-2 to 31 per 1,000 for durations 11-15.

The presence or absence of congestive failure at time of admission was indicated in 859 of the 1,141 cases studied (Table 3). Of these cases, those without congestive failure were about five times as numerous as

TABLE 2
OCCUPATION
EXPERIENCE BY AGE AT ADMISSION AND DURATION SINCE ADMISSION

AGE AT ADMISSION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000	DURATION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000
		Actual	Expected					Actual	Expected		
Those Who Had Strenuous Occupations* (738 Cases)											
20-39	633	34	2.49	1,365%	50	1-2	1,438	91	19.02	478%	50
40-49	2,243	115	21.03	547	42	3-5	1,813	112	28.51	393	46
50-59	1,830	116	38.63	300	42	6-10	2,063	124	43.56	285	39
60-65	1,255	103	49.61	208	43	11-15	647	41	20.67	198	31
20-65	5,961	368	111.76	329%	43	1-15	5,961	368	111.76	329%	43
Those Who Had Sedentary Occupations* (402 Cases)											
20-39	375	17	1.42	1,197%	42	1-2	789	44	10.93	403%	42
40-49	1,215	61	11.38	536	41	3-5	1,009	59	16.47	358	42
50-59	939	55	20.38	270	37	6-10	1,145	73	24.61	297	42
60-65	781	74	30.58	242	56	11-15	367	31	11.75	264	52
20-65	3,310	207	63.76	325%	43	1-15	3,310	207	63.76	325%	43

* See Appendix for definitions of strenuous and sedentary occupations.

TABLE 3
CONGESTIVE FAILURE AT TIME OF ADMISSION
EXPERIENCE BY AGE AT ADMISSION AND DURATION SINCE ADMISSION

AGE AT ADMISSION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000	DURATION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000
		Actual	Expected					Actual	Expected		
Having Congestive Failure (141 Cases)											
20-39	19	5	0.07	7,143%	259	1-2	268	37	4.80	771%	120
40-49	199	21	1.81	1,160	96	3-5	274	32	6.01	532	95
50-59	326	32	7.26	441	76	6-10	277	24	8.25	291	57
60-65	378	42	14.84	283	72	11-15	103	7	4.92	142	20
20-65	922	100	23.98	417%	82	1-15	922	100	23.98	417%	82
Not Having Congestive Failure (718 Cases)											
20-39	794	36	3.24	1,111%	41	1-2	1,401	73	18.08	404%	39
40-49	2,243	110	21.22	518	40	3-5	1,836	92	28.29	325	35
50-59	1,845	103	39.45	261	34	6-10	2,137	130	43.83	297	40
60-65	1,180	94	46.23	203	40	11-15	688	48	19.94	241	41
20-65	6,062	343	110.14	311%	38	1-15	6,062	343	110.14	311%	38

those with congestive failure. For those cases that had congestive failure, 74 per cent were at ages 50 and over, and for those cases that did not have congestive failure, 53 per cent were at ages 50 and over.

As of December 31, 1972, 71 per cent of those cases with known congestive failure were dead, as compared with 48 per cent of those without known congestive failure. In comparison with the overall mortality ratio of 327 per cent for the total experience (see Table 1), which includes cases not included in Table 3, the ratio for those cases with congestive failure was 90 percentage points higher, while the ratio for those without congestive failure was 16 percentage points lower. For those cases with congestive failure, the 82 extra deaths per 1,000 were 39 higher than the 43 extra deaths per 1,000 for all data combined (see Table 1); for those without congestive failure, the 38 extra deaths per 1,000 were 5 lower than the 43 extra deaths per 1,000 for all data combined. Excess mortality was especially high for cases with congestive failure at ages at admission under 50 (all durations combined) and at durations 1-5 (all ages combined).

TABLE 4
HYPERTENSION
EXPERIENCE BY AGE AT ADMISSION AND DURATION SINCE ADMISSION

AGE AT ADMISSION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000	DURATION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000
		Actual	Expected					Actual	Expected		
History of Hypertension (170 Cases)											
20-39	79	7	0.28	2,500%	85	1-2	331	29	4.75	611%	73
40-49	432	31	4.01	773	62	3-5	384	32	6.48	494	66
50-59	403	36	8.30	434	69	6-10	399	35	9.07	386	65
60-65	315	27	12.32	219	47	11-15	115	5	4.61	108	3
20-65	1,229	101	24.91	405%	62	1-15	1,229	101	24.91	405%	62
No History of Hypertension (727 Cases)											
20-39	765	36	3.04	1,184%	43	1-2	1,424	67	18.45	363%	34
40-49	2,296	106	21.33	497	37	3-5	1,877	96	29.22	329	36
50-59	1,766	95	37.70	252	32	6-10	2,162	122	45.36	269	35
60-65	1,296	99	51.62	192	37	11-15	660	51	20.66	247	46
20-65	6,123	336	113.69	296%	36	1-15	6,123	336	113.69	296%	36

Hypertension as a predisposing condition is evaluated in Table 4. In 244 of the 1,141 cases studied there was no statement as to whether or not there was a previous history of hypertension. Of the stated cases, which comprised about 79 per cent of the 1,141 total cases, the number with no known history of hypertension was about four times as great as the number with a known history. Of those with a history of hypertension, 59 per cent were at ages 50 and over, and of those without a history of hypertension, 52 per cent were at ages 50 and over.

Approximately 59 per cent of those with a history of hypertension at the time of admission had died by the end of the study's observation period, as compared with only 46 per cent of those having no such history. The overall mortality ratio for those with a history of hypertension (405 per cent) was 78 percentage points higher than the 327 per cent ratio for all data combined (see Table 1). For those with no history of hypertension, the overall mortality ratio (296 per cent) was 31 percentage points lower than the all-data-combined ratio. For those with a history of hypertension, the overall extra deaths of 62 per 1,000 were 19 higher than the 43 extra deaths per 1,000 for all data combined (see Table 1); for those with no history of hypertension, the overall extra deaths per 1,000 of 36 were 7 lower than the 43 extra deaths per 1,000 for all data combined. The experience by duration since admission showed especially high mortality ratios in the early durations for those with a history of hypertension.

About 13 per cent of the 1,141 cases did not have information under the angina pectoris category (Table 5). Of the stated cases, roughly the same percentage had a history of angina pectoris as did not. For those with a history of angina pectoris, 57 per cent were at ages 50 and over, and for those with no history of angina pectoris, 51 per cent were at ages 50 and over.

Of the veterans with a known history of angina pectoris, about 51 per cent had died by the end of the observation period, as compared with 47 per cent among those with no known history. For those two groups the mortality ratios were 339 and 308 per cent, respectively, a difference of only 31 percentage points. The extra deaths per 1,000 were 45 and 38, respectively, a difference of only 7 deaths per 1,000. The differences were most pronounced for durations 1-2 and 11-15 and for ages 20-39 and 60-65.

Table 6 shows that the overall mortality ratios for current smokers, past smokers, and nonsmokers were 334, 274, and 245 per cent, respectively, and the corresponding extra deaths were 43, 35, and 36 per 1,000, respectively. It is interesting that 75 per cent of the 1,141 admissions

were current smokers. Past smokers and nonsmokers were each about 6 per cent of total experience, with no record of smoking habits available for the remaining 13 per cent. Admissions at ages 55 and over constituted 36, 43, and 51 per cent of the corresponding groups of current smokers, past smokers, and nonsmokers, respectively.

The cholesterol level at time of admission was reported for only 50 per cent of the 1,141 cases that entered the study (Table 7). Of the cases with elevated blood cholesterol level, a disproportionately large number occurred at ages 40-49. Table 7 does not indicate any clear relationship between blood cholesterol level at the time of admission and the chance of surviving coronary artery disease.

With respect to family history of vascular disease, cases where this information was not stated or was unknown comprised 39 per cent of the total experience. The remaining 61 per cent of the cases are shown in Table 8. About four-fifths of the experience was for those with a history of less than two in the immediate family with vascular disease and about one fifth of the experience was for those with a history of two or more in the immediate family with vascular disease.

TABLE 5
ANGINA PECTORIS
EXPERIENCE BY AGE AT ADMISSION AND DURATION SINCE ADMISSION

AGE AT ADMISSION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000	DURATION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000
		Actual	Expected					Actual	Expected		
History of Angina Pectoris (489 Cases)											
20-39.	416	25	1.59	1,572%	56	1-2	949	69	12.91	534%	59
40-49.	1,334	71	12.93	549	44	3-5	1,179	69	19.03	363	42
50-59.	1,312	77	27.58	279	38	6-10	1,353	79	29.40	269	37
60-65.	803	76	31.26	243	56	11-15	384	32	12.02	266	52
20-65	3,865	249	73.36	339%	45	1-15	3,865	249	73.36	339%	45
No History of Angina Pectoris (503 Cases)											
20-39.	508	21	1.95	1,077%	38	1-2	989	46	12.67	363%	34
40-49.	1,682	80	15.47	517	38	3-5	1,292	73	19.68	371	41
50-59.	1,197	72	25.85	279	39	6-10	1,470	89	29.64	300	40
60-65.	856	65	33.92	192	36	11-15	492	30	15.20	197	30
20-65	4,243	238	77.19	308%	38	1-15	4,243	238	77.19	308%	38

For those cases that reported having two or more members in the family with a history of vascular disease, the overall mortality ratio was 377 per cent, which is 50 percentage points higher than the overall mortality ratio of 327 per cent for all data combined (see Table 1). For those cases that reported having less than two in the family with a history of vascular disease, the overall mortality ratio of 309 per cent was 18 percentage points lower than the overall ratio for all data combined. In each of the groups, 50 per cent of the entrants were dead as of December 31, 1972.

Forty-nine per cent of the 1,141 cases studied could not contribute any data to Table 9 because height or weight, or both, were not stated.

TABLE 6
SMOKING HABITS
EXPERIENCE BY AGE AT ADMISSION AND DURATION SINCE ADMISSION

AGE AT ADMISSION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000	DURATION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000
		Actual	Expected					Actual	Expected		
Current Smokers (857 Cases)											
20-39.	816	40	3.17	1,262%	45	1-2 . . .	1,672	101	21.73	465%	47
40-49.	2,732	142	25.46	558	43	3-5 . . .	2,122	130	32.86	396	46
50-59.	1,957	129	42.10	306	44	6-10 . . .	2,417	149	50.27	296	41
60-65.	1,470	120	58.16	206	42	11-15 . . .	764	51	24.03	212	35
20-65	6,975	431	128.89	334%	43	1-15 . . .	6,975	431	128.89	334%	43
Past Smokers (84 Cases)											
20-39.	40	3	0.17	1,765%	71	1-2 . . .	164	8	2.33	343%	35
40-49.	264	9	2.70	333	24	3-5 . . .	220	5	3.83	131	5
50-59.	259	12	5.70	211	24	6-10 . . .	249	19	5.64	337	54
60-65.	146	15	5.67	265	64	11-15 . . .	76	7	2.44	287	60
20-65	709	39	14.24	274%	35	1-15 . . .	709	39	14.24	274%	35
Nonsmokers (59 Cases)											
20-39.	22	1	0.07	1,429%	42	1-2 . . .	116	7	1.99	352%	43
40-49.	96	7	0.78	897	65	3-5 . . .	147	9	2.98	302	41
50-59.	197	8	4.15	193	20	6-10 . . .	177	11	4.91	224	34
60-65.	189	15	7.67	196	39	11-15 . . .	64	4	2.79	143	19
20-65	504	31	12.67	245%	36	1-15 . . .	504	31	12.67	245%	36

TABLE 7
BLOOD CHOLESTEROL LEVEL
EXPERIENCE BY AGE AT ADMISSION AND DURATION SINCE ADMISSION

AGE AT ADMISSION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000	DURATION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000
		Actual	Expected					Actual	Expected		
Those with Elevated Blood Cholesterol Level (109 Cases)											
20-39	208	10	0.80	1,250%	44	1-2	216	3	1.81	166%	6
40-49	519	19	5.06	375	27	3-5	307	11	3.25	338	25
50-59	230	11	5.06	217	26	6-10	370	22	5.70	386	44
60-65	66	2	2.74	73	11	11-15	130	6	2.90	207	24
20-65	1,023	42	13.66	307%	28	1-15	1,023	42	13.66	307%	28
Those with Normal Blood Cholesterol Level (452 Cases)											
20-39	435	22	1.68	1,310%	47	1-2	885	50	11.29	443%	44
40-49	1,400	71	12.71	559	42	3-5	1,129	67	17.47	384	11
50-59	1,121	68	23.91	284	39	6-10	1,305	73	27.19	268	35
60-65	753	56	29.69	189	35	11-15	390	27	12.04	224	38
20-65	3,709	217	67.99	319%	40	1-15	3,709	217	67.99	319%	40

TABLE 8
FAMILY HISTORY OF VASCULAR DISEASE
EXPERIENCE BY AGE AT ADMISSION AND DURATION SINCE ADMISSION

AGE AT ADMISSION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000	DURATION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000
		Actual	Expected					Actual	Expected		
History of Vascular Disease: 2 or More in Family (152 Cases)											
20-39	124	5	0.40	1,250%	37	1-2	297	20	3.64	549%	55
40-49	442	26	3.99	652	50	3-5	358	26	5.33	488	58
50-59	434	30	9.39	319	47	6-10	409	24	8.18	293	39
60-65	173	16	6.65	241	54	11-15	109	7	3.28	213	34
20-65	1,173	77	20.43	377%	48	1-15	1,173	77	20.43	377%	48
History of Vascular Disease: Less than 2 in Family (549 Cases)											
20-39	485	26	1.91	1,361%	50	1-2	1,074	55	14.61	376%	38
40-49	1,722	82	16.13	508	38	3-5	1,396	83	22.28	373	43
50-59	1,342	77	29.14	264	36	6-10	1,594	100	34.24	292	41
60-65	1,059	91	42.26	215	46	11-15	544	38	18.31	208	36
20-65	4,608	276	89.44	309%	40	1-15	4,608	276	89.44	309%	40

TABLE 9
BUILD
EXPERIENCE BY AGE AT ADMISSION AND DURATION SINCE ADMISSION

AGE AT ADMISSION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000	DURATION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000
		Actual	Expected					Actual	Expected		
Markedly Overweight (17 Cases)											
20-39.						1-2	31	3	0.46	652%	82
40-49.	56	2	0.46	435%	28	3-5	37	4	0.55	727	93
50-59.	34	3	0.58	517	71	6-10	40	2	0.69	290	33
60-65.	25	5	0.90	556	164	11-15	7	1	0.24	417	109
20-65	115	10	1.94	515%	70	1-15	115	10	1.94	515%	70
Moderately Overweight (23 Cases)											
20-39.	36	1	0.18	556%	23	1-2	45	3	0.52	577%	55
40-49.	104	4	0.92	435	30	3-5	58	2	0.70	286	22
50-59.	29	2	0.64	313	47	6-10	69	4	1.03	388	43
60-65.	24	3	0.89	337	88	11-15	21	1	0.38	263	30
20-65	193	10	2.63	380%	38	1-15	193	10	2.63	380%	38
Slightly Overweight (88 Cases)											
20-39.	114	3	0.36	833%	23	1-2	174	4	2.05	195%	11
40-49.	332	14	3.27	428	32	3-5	243	11	3.40	324	31
50-59.	214	11	4.35	253	31	6-10	275	19	5.02	378	51
60-65.	124	11	4.87	226	49	11-15	92	5	2.38	210	28
20-65	784	39	12.85	304%	33	1-15	784	39	12.85	304%	33
Not Overweight (458 Cases)											
20-39.	325	26	1.26	2,063%	76	1-2	898	51	12.02	424%	43
40-49.	1,423	63	12.94	487	35	3-5	1,141	67	18.22	368	43
50-59.	1,158	69	24.82	278	38	6-10	1,292	79	27.93	283	40
60-65.	819	62	32.34	192	36	11-15	394	23	13.19	174	25
20-65	3,725	220	71.36	308%	40	1-15	3,725	220	71.36	308%	40

Of the remaining 51 per cent, about one-fifth were classified as overweight (slightly, moderately, or markedly—see item 7 of the Appendix).

The overall mortality ratios in Table 9 vary directly with the degree of overweight, being highest for the markedly overweight group and lowest for the slightly overweight group. (It should be noted that the mortality ratios for each of the three overweight groups are based on relatively small amounts of data.) The overall mortality ratio for the *slightly overweight group* was actually lower than the corresponding mortality ratio for the not-overweight group. The same relationships generally held true for the corresponding extra deaths per 1,000.

The spread in the overall mortality ratio for the three overweight groups was rather high (211 percentage points). The moderately overweight and markedly overweight groups each showed an overall mortality ratio well in excess of the overall ratio for all data combined (327 per cent). Mortality ratios decreased with advancing age at admission for the slightly overweight and the not-overweight groups. For the not-overweight group, the mortality ratio decreased with increasing duration since admission; there was no definite pattern by duration for any of the three overweight groups. Only the markedly overweight group showed a high number of extra deaths per 1,000 (70) compared with the 43 extra deaths per 1,000 for all data combined. Fifty-nine per cent of the entrants in the markedly overweight group were dead at the end of the study, compared with less than 50 per cent in each of the other three groups.

The alcohol habits at time of admission were stated in 973 (85 per cent) of the 1,141 cases studied. Of these 973 cases (Table 10), moderate and light drinkers comprised about 57 per cent, nondrinkers 26 per cent, and heavy drinkers 17 per cent.

Mortality ratios for all ages and durations combined varied directly with the degree of drinking, being highest for the heavy drinkers (394 per cent) and lowest for the nondrinkers (302 per cent), a difference of 92 percentage points. The extra death rate was also highest for the heavy drinkers (52 per 1,000). In each of the three categories, the mortality ratios decreased with advancing age at admission and generally tended to decrease with increasing duration since admission.

SUMMARY

Table 11 summarizes the results of this study. Despite the fact that all patients who died during the original hospital stay were omitted from the study, the presence of coronary artery disease was found to be associated with a high degree of extra mortality (327 per cent of the expected

number of deaths, or 43 extra deaths per 1,000, with expected deaths based on the 1959-61 United States Life Table for the white male population).

The mortality ratios were found to decrease with increasing age at admission. Of the other variables studied, all except occupation and blood cholesterol level appear to have an effect on the prognosis for veterans with coronary artery disease who were discharged from the hospital following first admission. The relative importance of the variables is sug-

TABLE 10
ALCOHOL HABITS
EXPERIENCE BY AGE AT ADMISSION AND DURATION SINCE ADMISSION

AGE AT ADMISSION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000	DURATION	LIFE YEARS EXPOSED	NUMBER OF DEATHS		MORTALITY RATIO	EXTRA DEATHS PER 1,000
		Actual	Expected					Actual	Expected		
Heavy Drinkers (169 Cases)											
20-39	140	7	0.40	1,750%	47	1-2	329	20	4.38	457%	47
40-49	471	24	4.61	521	41	3-5	405	36	6.41	562%	73
50-59	423	35	8.45	414	63	6-10	426	26	8.62	302%	41
60-65	251	24	9.40	255	58	11-15	125	8	3.45	232%	36
20-65	1,285	90	22.86	394%	52	1-15	1,285	90	22.86	394%	52
Moderate and Light Drinkers (556 Cases)											
20-39	516	24	2.06	1,165%	43	1-2	1,086	64	14.58	439%	46
40-49	1,718	93	15.74	591	45	3-5	1,383	82	21.77	377%	44
50-59	1,395	72	30.64	235	30	6-10	1,623	95	34.09	279%	38
60-65	1,011	88	40.45	218	47	11-15	548	36	18.45	195%	32
20-65	4,640	277	88.89	312%	41	1-15	4,640	277	88.89	312%	41
Nondrinkers (248 Cases)											
20-39	176	11	0.69	1,594%	59	1-2	485	24	6.96	345%	35
40-49	782	36	7.49	481	36	3-5	633	33	11.10	297%	35
50-59	503	37	10.88	340	52	6-10	718	54	17.04	317%	51
60-65	600	45	23.69	190	36	11-15	225	18	7.65	235%	46
20-65	2,061	129	42.75	302%	42	1-15	2,061	129	42.75	302%	42

gested by their variation in each case from the 327 per cent overall average mortality ratio and from the 43 overall extra deaths per 1,000.

In brief, the data indicate that the presence of coronary artery disease is associated with a significant degree of extra mortality. The amount of that extra mortality appears to increase in the presence of other factors such as overweight, congestive failure, history of hypertension, history of

TABLE 11
SUMMARY

	Percentage Distribution of Admissions	Number of Actual Deaths	Mortality Ratio	Deviation of Mortality Ratio from Average	Extra Deaths per 1,000	Deviation of Extra Deaths from Average
All data combined (average)	100.0%	575	327%		43	
Age at admission:						
20-39	9.8%	51	1,285%	958	47	4
40-49	35.8	176	542	215	42	-1
50-59	30.7	171	288	-39	40	-3
60-65	23.7	177	221	-106	48	5
Occupation:						
Strenuous	64.7	368	329	2	43	0
Sedentary	35.2	207	325	-2	43	0
Congestive failure:						
Yes	12.4	100	417	90	82	39
No	62.9	343	311	-16	38	-5
Hypertension:						
Yes	14.9	101	405	78	62	19
No	63.7	336	296	-31	36	-7
Angina pectoris:						
Yes	42.9	249	339	12	45	2
No	44.1	238	308	-19	38	-5
Smoking:						
Current	75.1	431	334	7	43	0
Past	7.4	39	274	-53	35	-8
Never	5.2	31	245	-82	36	-7
Elevated cholesterol:						
Yes	9.6	42	307	-20	28	-15
No	39.6	217	319	-8	40	-3
Family history:						
2 or more	13.3	77	377	50	48	5
Less than 2	48.1	276	309	-18	40	-3
Overweight:						
Marked	1.5	10	515	188	70	27
Moderate	2.0	10	380	53	38	-5
Slight	7.7	39	304	-23	33	-10
Not	40.1	220	308	-19	40	-3
Alcohol:						
Heavy drinkers	14.8	90	394	67	52	9
Moderate and light drinkers	48.7	277	312	-15	41	-2
Nondrinkers	21.7	129	302	-25	42	-1

angina pectoris, and family history of vascular disease. Smoking and drinking also appear to be associated with extra mortality. On the other hand, the blood cholesterol level and occupation data did not yield any substantial mortality differences.

The reader of this report should be aware of some of the limitations of this mortality study among VA patients with coronary artery disease:

1. The VA hospital patients studied probably constituted a special class of patients. Therefore, generalizations to the general or insurable population may have limited applicability.

2. Elements of bias may have been introduced at various stages of the study as a result of a number of factors, such as the skill and concern of those who filled out the original medical histories, the accuracy of the patients' replies to the initial questions (especially those concerning smoking and drinking habits and family history), omissions in the records, how the original 2,906 cases were reduced to 1,141, and the considerable degree of judgment that had to be exercised in classifying the 1,141 cases into the various categories studied. Also, it should be remembered that those who died during the original hospitalization for coronary artery disease were excluded from the study.

3. No information was available as to (a) the type of coronary artery disease (myocardial infarction, angina pectoris, other) exhibited by the individual patient, (b) the degree of severity of the initial coronary artery disease, (c) the type of treatment given, or (d) the patient's condition at time of discharge from the hospital.

4. It is possible that some of those who were actually dead as of December 31, 1972, may not have been reported "dead" to the Veterans Administration at the time its files were examined. If that is the case, the number of actual deaths, the mortality ratios and the extra deaths per 1,000 shown in some or all of the tables of this report are somewhat understated.

5. Information regarding the cause of death and the final cardiovascular status of those who died and of the survivors was not obtained, mainly because of time and cost considerations.

Therefore, this report, which summarizes the findings of the mortality study among VA patients with coronary artery disease, should be regarded chiefly as a presentation of mortality results.

The Liaison Committee wishes to thank the Veterans Administration for its cooperation in this study, especially Dr. Lyndon E. Lee, Jr., Mr. Louis Mesard, and Mr. Daniel I. Rosen.

APPENDIX

The classification of the 1,141 cases into various categories for purposes of this investigation was done as follows:

1. *Age at admission.*—The age at admission is the individual recorded calendar age in the year of admission. Each case was placed in its appropriate age-at-admission group.

2. *Occupation.*—The codes for occupation for each individual case were based on the 1972 Occupation and Hazardous Sports Codes (TSA, 1971 Reports, p. 81). Initial distributions of the data were prepared for the following classes: professional and technical (codes 000-090); managers, administrators, owners, assistant managers, department heads—except farm (codes 100-180); sales and clerical workers (codes 200-280); craftsmen, foremen and apprentices (codes 300-390, 400-480); operatives—manufacturing (codes 500-590); operatives—other than manufacturing and farms (codes 600-690); laborers and helpers—other than farms (codes 700-780); service workers (codes 800-890); miscellaneous (codes 900-990). Because of the limited number of cases in many of the occupational classes, it was decided to use only two broad occupational classes, namely, those whose occupations were generally strenuous (codes 040, 090, 270-280, 300-370, 400-480, 500-590, 600-680, 700-780, 800-890, 900-910, 930) and those whose occupations were generally sedentary (all other codes).

3. *Congestive failure at time of admission, hypertension, and angina pectoris.*—Each clinical record was classified as a "yes," "no," or "no response" for each of the following categories: congestive failure, history of hypertension, and history of angina pectoris.

4. *Smoking habits.*—The patient was classified as a current smoker (if he smoked at the time of admission), a past smoker (if he smoked previously but discontinued) or a nonsmoker (if he never smoked). While units per day (i.e., number of cigarettes, cigars, or pipes smoked in a day) were usually stated for current and past smokers, it was decided not to tabulate those figures.

5. *Blood cholesterol level.*—Given the patient's age at admission and his recorded blood cholesterol level, he was classified as having elevated blood cholesterol if his cholesterol level was greater than or equal to the amount shown in the following table:

Age at Admission	Blood Cholesterol Level (mg/100 ml)
20-40.....	301 and over
41-50.....	321 and over
51-60.....	341 and over
61-65.....	361 and over

Otherwise the patient was classified as having normal blood cholesterol. The figures in the preceding table were based on the ratings given by a large life insurance company for hypercholesterolemia.

6. *Family history of vascular disease:*—Three spaces were provided in the patient's record, one each for the patient's father, mother, and siblings. A code of either 1, 0, or 2, depending on whether the answer was "yes," "no," or "not stated," was assigned. From these, a three-digit code was developed, representing the father, mother, and siblings, respectively, and the following categories were formed accordingly: two or more in family with history (codes 011, 101, 110, 111, 112, 121, 211) and less than two in family with history (codes 000, 001, 002, 010, 020, 100, 200). All other cases were counted as not-stated cases.

7. *Build:*—Whether a patient was overweight (and to what degree) was determined by comparing the recorded weight with a table of average weights based on given height (in inches) and age. The Table of Average Weights of Men (in pounds) from the *Build and Blood Pressure Study, 1959* was used for this purpose. Thus a patient was not overweight, slightly overweight, moderately overweight, or markedly overweight if his recorded weight exceeded his average weight by 11 per cent or less, 12–24 per cent, 25–34 per cent, or 35 per cent and over, respectively. Cases which did not have a recorded weight and/or height were classified as "not stated."

8. *Alcohol habits:* The patient stated whether he was a heavy drinker, a light or moderate drinker, or a nondrinker at time of admission, and he was coded accordingly.

