

SOCIAL FACTORS IN THE PROGNOSIS OF MEN FOLLOWING FIRST MYOCARDIAL INFARCTION

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Information is almost completely nonexistent about the relevance of social characteristics to the prognosis of men following a first myocardial infarction. In contrast, data on the association between such characteristics and incidence of myocardial infarction are relatively plentiful, although gaps and inconsistencies are seen in the findings.¹ The prognostic studies of men following infarction that have been conducted concerned themselves for the most part with medical parameters, with social factors receiving little attention. The present paper explores the prognostic importance of some social characteristics among men following a first myocardial infarction, and in particular examines whether these characteristics appear to have similar or different roles in relation to incidence and to prognosis—an issue that is highly relevant for programs aimed at reducing the impact of coronary heart disease on mortality and disability.

The data are from the Health Insurance Plan of Greater New York (HIP) study of the incidence and prognosis of coronary heart disease—a prospective study begun in 1961.² The study was designed to identify all patients in a defined population of 110,000 men and women aged 25 to 64 years who first

sought medical care for complaints possibly associated with coronary heart disease during the four years 1961–1965. After appropriate screening and clearance procedures, these patients were examined by a study team that gathered medical, personal and demographic information in a standardized fashion at a baseline examination. The final diagnosis and classification of patients was made by the central study staff in accordance with criteria that have been published.² All patients fulfilling criteria for one of the several prognostic cohorts were reexamined six months after baseline and then biennially. Telephone interviews were conducted in the intervening years.

PREVIOUS REPORTS OF FINDINGS

On previous occasions incidence and prognostic data have been presented from the HIP study with respect to a number of personal and medical characteristics. Increased risk for incidence of a first myocardial infarction among men was found to be associated with increasing age, cigarette smoking and a general pattern of physical inactivity on and off the job.² An elevated risk of mortality within one month of the first myocardial infarction was related to advancing age, the presence of prior hypertension or angina, the clinical severity of the episode and the existence of congestive heart failure, and to physical inactivity before the infarct, but not to smoking practices preceding the episode.^{3–5} For the survivors of this early period following the myocardial infarction, the risk of a first recurrence and of cardiac death was especially high among men with elevated blood pressure, prior angina or an abnormal electrocardiogram at the baseline examination. Level of physical activity and smoking habits prior to the infarct and the clinical severity of the episode were unrelated to prognosis in this later period.³ Also, it has been shown that, among men surviving their first myocardial infarction by an average of six months, relatively high serum cholesterol levels and age are not importantly related to prognosis over the succeeding 3.5 years.⁶

TABLE 1. FIRST MYOCARDIAL INFARCTION AMONG MEN: INCIDENCE AND EARLY MORTALITY IN RELATION TO SOCIAL CHARACTERISTICS

	Average Annual Incidence per 1,000 (Age-Adjusted)*			Early Mortality (Age-Adjusted)**	
	Total	Dead in 48 Hours	Other MI	Total	Dead in One Month %
Age					
55-64	9.39 } ***	3.46 } ***	5.93 } ***	449	42.3 } ***
Under 55	3.50 }	0.97 }	2.53 }	433	29.6 }
Color					
Nonwhite	2.66 } ***	1.31	1.35 } ***	38	47.5
White	5.39 }	1.66	3.73 }	831	35.3
Education					
No college	4.97	1.44	3.53	537	33.7
Some college	4.81	1.48	3.33	284	32.1
Religion					
Not Jewish	4.27 } ***	1.62	2.65 } ***	417	41.0 } ***
Jewish	6.38 }	1.49	4.89 }	414	28.1 }
Occupation					
Blue-collar	5.07	1.61	3.45	415	36.1
White-collar	5.74	1.64	4.10	421	31.1
Total	5.20	1.67	3.51	882	36.1

* Numerators for computation of incidence rates are all first myocardial infarctions identified in the male population at risk aged 35-64 during the three years November, 1961-October, 1964. Denominators are derived from three mail surveys of a non-repetitive four per cent random sample of the corresponding population at risk, carried out at the midpoint of the three case finding years.

** Early mortality data are derived from all first myocardial infarctions identified in the male population at risk aged 30-64 during the four years November, 1961-October, 1965.

*** Difference between the two rates statistically significant at the 0.99 confidence level. Unmarked rates show no difference that is statistically significant at the 0.90 confidence level.

CURRENT OBSERVATIONS

The present paper is concerned with a set of social characteristics that intervention or therapeutic programs might have to take into account, but could not modify. These include color, educational attainment, religion and occupational grouping into white collar and blue collar categories. Despite the high degree of correlation among these characteristics, the heterogeneity within each is sufficient to justify examining them separately.

Rates are presented in Table 1 for incidence of first myocardial infarction and for risk of mortality within one month of the event; Tables 2 and 3 provide data on risk of mortality and first recurrent myocardial infarction over two successive time periods—the five-month period ending at six months post infarct, and the ensuing 3.5 years ending at four years post

infarct. By the cut-off date for observations included in the current analysis, 72 per cent of the 543 men who survived six months from date of infarct had been followed for the ensuing 3.5 years. Life table techniques for deriving probabilities take into account the varying periods of follow-up contributed by the remaining men. Four men died and five men had recurrent myocardial infarctions and were lost to follow-up.

Confidence levels in tests of statistical significance of the differences between rates have been indicated in the tables. For most of the frequencies involved only very large differentials are statistically significant at the 0.95 confidence level, and the approach in discussing the data is to search for leads worthy of further attention, with emphasis on suggestive patterns rather than on the results of tests of statistical significance.

Because of the relevance of age differentials in considering the social variables, it is useful to reexamine the study findings with respect to age. Important and well-established relations are

TABLE 2. PROGNOSIS IN RELATION TO AGE, COLOR, EDUCATION AND RELIGION

	<i>Early Prognosis</i> (1-5 Months Post Infarct) <i>Age-Adjusted Per Cent</i>				<i>Later Prognosis</i> (6-47 Months Post Infarct) <i>Age-Adjusted Probability (%)</i>			
	<i>Alive</i> <i>1 Month</i> <i>Post</i> <i>Infarct</i>	<i>Death</i> <i>All</i> <i>Causes</i>	<i>Cardiac</i> <i>Only</i>	<i>First</i> <i>Recur-</i> <i>rence</i>	<i>Alive</i> <i>6</i> <i>Months</i> <i>Post</i> <i>Infarct</i>	<i>Death</i> <i>All</i> <i>Causes</i>	<i>Cardiac</i> <i>Only</i>	<i>First</i> <i>Recur-</i> <i>rence</i>
Age								
55-64	259	5.0	4.6	5.0	246	16.1	13.4	21.1
Under 55	305	2.6	2.6	3.0	297	12.3	11.1	17.3
Color								
Nonwhite	21	(4.8)	(4.8)	(4.8)	20	(23.0)	(23.0)	(28.3)
White	537	3.5	3.3	3.7	518	13.7	11.8	18.7
Education								
No college	356	3.6	3.6	4.2	343	15.1	13.0	19.3
Some college	194	2.6	2.1	2.1	189	12.2	10.7	18.3
Religion								
Not Jewish	250	3.5	3.5	4.9	241	15.9	13.3	19.8
Jewish	297	3.2	2.9	2.6	287	12.3	10.6	18.1
Total	564	3.7	3.5	3.9	543	14.0	12.2	19.0

Note: Rates shown in () have not been age-adjusted because of the low frequencies. In no case does the difference between any pair of rates shown meet a test of statistical significance at the 0.90 confidence level. Men unclassified with respect to a given characteristic are not shown separately in the table.

found in the HIP incidence rates. Among men aged 55 to 64 years the rate of incidence of a first myocardial infarction is more than 2.5 times that among men under age 55 (Table I). The first infarction is also more likely to be fatal among the older men; within the first 48 hours mortality in the older group is about 3.5 times that among the younger men; within the first month the mortality among those aged 55–64 is about 1.5 times that of the men under 55. Although the older men surviving one month still show a higher risk both for death and recurrence over the next five months, it is of interest that the disadvantage in relation to age is relatively diminished among the six-month survivors followed for the ensuing 3.5 years (Table 2). In light of these observations, rates for social characteristics have been age-adjusted (except where noted).

Whites and Nonwhites

Incidence of a first myocardial infarction occurs in nonwhite men at half the rate found for white men (2.7 and 5.4 per 1,000 per year, respectively). But the risk of dying within a month of the attack is 48 per cent among the nonwhites and 35 per cent among whites (Table 1 and Figure 1). A continued disadvantage in prognosis of the nonwhite men is suggested by comparison of the probabilities of cardiac death among the six-month survivors: over the next 3.5 years the rate for the nonwhites (23 per cent) is almost twice that noted for the whites (12 per cent). These relations must be viewed with caution because of the very small number of nonwhites involved.

Educational Attainment

Rates of incidence of first myocardial infarction and of mortality within one month are similar for men with some college education and for those who have never attended college (Table 1). Among survivors of the attack the men with no college education experience a slightly higher cardiac mortality both in the early prognosis period (one to five months post infarct) and over the next 3.5 years (Table 2 and Figure 1).

Religion

Incidence of a first myocardial infarction among Jewish men is higher than that among men who are not Jewish (6.4 and 4.3 per 1,000), and the higher rate among the Jews is concentrated among those episodes that are not fatal within 48 hours (Table 1). Mortality within one month of the attack is higher for the non-Jews (41 per cent) than for the Jews (28 per cent). A less favorable prognosis for the non-Jews over the two longer time periods examined is also suggested by the probabilities of cardiac mortality (Table 2 and Figure 1), but the margins are quite small.

FIGURE 1. PROGNOSIS OF MEN UNDER AGE 65 AFTER FIRST MYOCARDIAL INFARCTION, BY COLOR, EDUCATION, RELIGION AND OCCUPATION

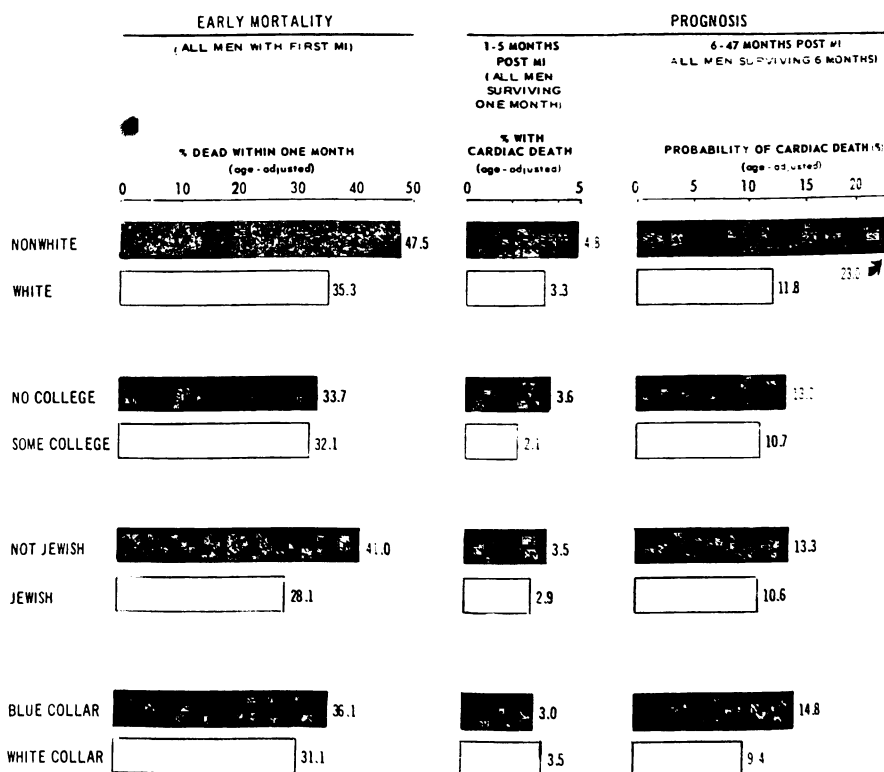
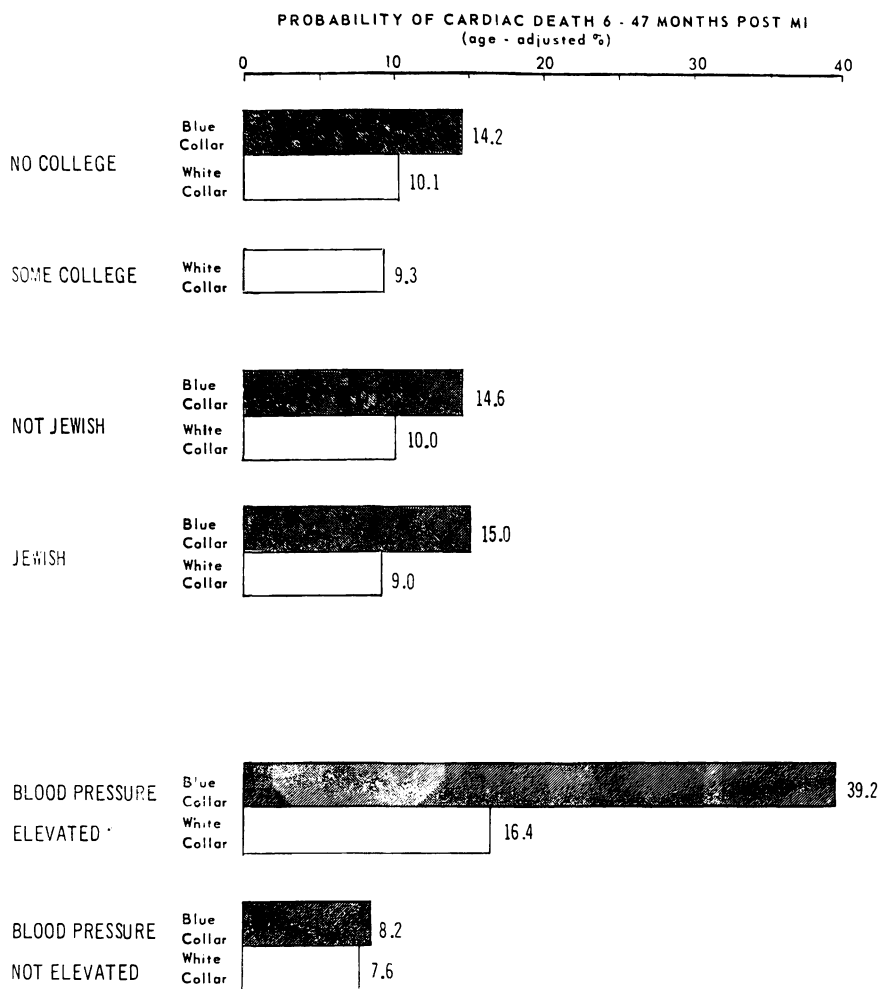


FIGURE 2. PROGNOSIS OF MEN SURVIVING SIX MONTHS FROM FIRST MYOCARDIAL INFARCTION, OCCUPATION BY OTHER VARIABLES



*See footnote ††, Table 3, for definition.

Occupation

Only minor differentials in incidence and early mortality rates are apparent between white-collar and blue-collar workers (Table 1). Prognosis of one-month survivors over the next five months is also similar for the two occupational categories,

with practically no differences in the rates of overall mortality, cardiac mortality and first recurrence in this time period (Table 3). But the differences in probability of mortality over the next 3.5 years suggest an adverse risk among the blue-collar men ($p < 0.10$). The probability of cardiac death over this period is 15 per cent among the blue-collar men and nine per cent for the white-collar group (Figure 1).

It is apparent from Figure 2 that the poorer prognosis among the blue-collar men over the 3.5-year period is not explained by the other variables, education and religion. Conversely, the modest differentials in prognosis with respect to education and religion seem to reflect the greater concentration of blue-collar men in the no-college and non-Jewish groups. It will be noted that cardiac mortality is almost identical among blue-collar men who are Jewish and those who are not; the same is true for the white-collar men. Similarly, the cardiac mortality rates for

TABLE 3. PROGNOSIS IN RELATION TO OCCUPATION AND BLOOD PRESSURE

	Early Prognosis (1-5 Months Post Infarct) Age-Adjusted Per Cent					Later Prognosis (6-42 Months Post Infarct) Age-Adjusted Probability (%)			
	Alive		Dead		First Months Post Infarct	Alive		Dead	
	1 Month	Post	All	Cardiac		Post	All	Cardiac	First
	Infarct	Causes	Only	Recur- rence		Infarct	Causes	Only	Recur- rence
Blue collar	266	3.0	3.0	3.8	258	16.9 } †	14.8 } †	20.7	
White collar	290	3.8	3.5	3.5	279	11.1 }	9.4 }	17.3	
Blood pressure elevated††									
Blue-collar	53	3.1	3.1	4.6	51	43.2 } **	39.2 } *	44.1 } *	
White-collar	71	8.1	8.1	7.0	65	19.2 }	16.4 }	25.0 }	
Blood pressure not elevated									
Blue-collar	192	3.1	3.1	3.6	186	9.3	8.2	14.8	
White-collar	201	2.5	1.9	2.5	196	8.5	7.4	15.7	
Total	564	3.7	3.5	3.9	543	14.0	12.2	19.0	

Note: Confidence levels in tests of statistical significance of the difference between two rates are noted by ** for 0.99, * for 0.95, and † for 0.90. Unmarked rates show no difference statistically significant at the 0.90 level.

†† The classification of blood pressure as of time of myocardial infarction is based on a combination of medical record information and patient history. "Elevated" is defined as 3+ readings dated before the infarct, not during any hospitalization, of diastolic 95+ or systolic 160+; or, one or two such elevated readings are present plus either a physician diagnosis of hypertension or LVH by ECG. Men unclassified as to blood pressure are not shown separately in the table.

white-collar men with and without some college education are very close (nine and ten per cent, respectively) .

The difference between blue-collar and white-collar men in their prognosis in the period 6-47 months post infarct is concentrated among men whose blood pressure was elevated as of the time of first myocardial infarction (lower part of Figure 2 and Table 3) . Over this time period the hypertensive blue-collar men show almost twice the rate of first recurrence and 2.5 times the rate of cardiac death found among the hypertensive white-collar men. Differences between blue- and white-collar men whose blood pressure is not elevated are negligible.

A Note on "Not Stated's"

In calculating rates and percentages shown in the tables and figures, persons not classified with respect to characteristics have not been included. Follow-up procedures in the study provided information on survival status at four years post infarct for all but four of the 882 men with a first infarct. However, among these 882 men, 51 could not be interviewed because most of them died within one month of the attack. Information from record sources at HIP was not available for education, religion and occupation. To estimate the distribution of the "unknowns" for religion and occupation among deaths in the first month after infarct, death certificate entries on place of burial and occupation were reviewed; no outside source was available for education. Survivors with religion or occupation unknown were distributed as the other survivors with known characteristics.

The one month mortality rates obtained after allocation of the not stated's show the same relation between characteristics as the rates calculated with the unclassified men omitted. Relevant figures follow. Rates are not age-adjusted and therefore differ slightly from those in Table 1.

	One month post MI mortality	
	Not stated's not distributed	Not stated's distributed
<i>Religion</i>		
Not Jewish	40.0	42.1
Jewish	28.3	29.9
<i>Occupation</i>		
Blue collar	35.9	37.8
White collar	31.1	33.6

SUMMARY AND DISCUSSION

Current and earlier observations in the HIP study indicate that a number of factors associated with excess risk for incidence of a first myocardial infarction are unrelated to an adverse prognosis following the first few months post infarct. Important exceptions are prior hypertension and prior angina. On the other hand, age, prior physical inactivity and cigarette smoking, and relatively high cholesterol levels do not seem to affect prognosis in men in the later period here examined. Color and religion show different directional relations for incidence and prognosis: nonwhite and non-Jewish men have relatively low incidence rates, but relatively high death rates immediately after the myocardial infarction, and cardiac mortality seems to persist at a somewhat higher rate among these men than among the others. The poorer prognosis among non-Jewish men within one month of the attack raises questions about the role of patients' medical care behavior in surviving an initial heart attack. Although specific data are not available, indications are that Jews seek medical care more extensively than do non-Jews, and a useful line of inquiry would be to determine the chain of events following the attack in each of these population groups. Similar considerations might be applicable to the difference in case fatality rates between whites and nonwhites.

Education and occupation do not discriminate well for either incidence or early mortality, but a differential worthy of note is

found between blue-collar and white-collar workers in their cardiac mortality rates in the period 6–47 months post infarct. In this period the cardiac death rate among the blue-collar men is 1.6 times the rate among white-collar men. Educational and religious background differentials do not explain the higher rate among the blue-collar men.

Mortality from all causes among men with myocardial infarction is only slightly greater than the cardiac death rate, and the gap between the total mortality rates for the white- and blue-collar men in the period 6–47 months post infarct is of the same relative magnitude. This differential is not simply a reflection of generally higher mortality rates among blue-collar men. Mortality over a 3.5-year period for a random sample of men in the HIP population who had no known coronary disease at the start of follow-up was found to be the same for white-collar and blue-collar men.

Perhaps the most interesting aspect of the elevated risk among blue-collar workers for cardiac mortality 6–47 months post infarct is the concentration of the risk among the hypertensive men. The differential is substantial between blue- and white-collar hypertensives ($p < .01$), and it is negligible among the normotensive men. Moreover, the distribution of the hypertensive men by actual level of systolic blood pressure is similar for the two occupational groups, both at the baseline examination and at the first follow-up examination six months later. Neither is any difference in the distribution of other medical parameters able to account for the adverse prognosis in the blue-collar group: similar proportions of the blue- and white-collar men had angina prior to the myocardial infarction and showed electrocardiographic abnormalities of specified types at the time of the baseline examination.

Attention has been directed by others to the possibility that various life circumstances may be importantly associated with the process of recovery from myocardial infarction.⁷ Though the present study does not offer “hard” evidence on the subject, several observations seem to be relevant. At the first follow-up

examination patients were asked if they had taken any regular medication in the six-month interval from baseline examination, and, if so, what kind of medication. Hypertensive blue-collar men were less likely to indicate that they had taken anti-hypertensive drugs than were hypertensive white-collar men (12 per cent versus 40 per cent). Only 25 per cent of the blue-collar hypertensives reported taking regular medication of any type, in comparison with 41 per cent of the comparable white-collar men. Variation in response reliability may account for these differentials, but they do raise the question whether understanding of and compliance with physicians' instructions may not in fact differ between the two occupational groups. This possibility is of special interest in light of the elevated risk among the hypertensive blue-collar men, which has been noted.

Clearer evidence may be seen relating to the impact of the first myocardial infarction on the life activities of the men who survive it. Prior to the episode virtually all of the men were employed. Blue-collar men were more likely to be classified as "most active" than were white-collar men (42 versus 31 per cent). A higher proportion of the blue-collar men were cigarette smokers (69 versus 51 per cent) and relatively more of them were 20 per cent or more above average weight for their age-height group (18 per cent versus ten per cent for the white-collar men).

Following the infarct, blue-collar men return to work more slowly than do white-collar men, and they are more likely both to return to a changed type of job and to exit from the labor force entirely.⁸ Among the men examined one year after the myocardial infarction the proportions of blue-collar workers who had shifted out of the "most active" physical activity category, the cigarette smoking group and the highest relative weight class were all larger than the corresponding proportions of white collar men (Table 4.)

That is not to suggest that lesser changes among the blue-collar men might have resulted in a more favorable prognosis. What appears to be important is that the myocardial infarction

TABLE 4. CHANGES IN LIFE STYLE FOLLOWING MYOCARDIAL INFARCTION

	Blue-Collar			White-Collar		
	Prior to Infarct %	1 Year Post Infarct %	Decrease	Prior to Infarct %	1 Year Post Infarct %	Decrease
Cigarette smokers	68.7	34.2	34.5	50.7	24.1	26.6
"Most active" physical activity class	41.6	10.7	30.9	30.6	8.5	22.1
Relative weight 120 +	18.3	8.1	10.2	10.1	6.4	3.7

is followed by greater changes in style of living in a socioeconomic group for which a relatively poor prognosis has been demonstrated, a circumstance of some significance for inquiries into secondary prevention.

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