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The Impact of Diabetes Mellitus and Prior Myocardial Infarction on Mortality From All Causes and From Coronary Heart Disease in Men

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OBJECTIVES	The goal of this study was to examine the impact of diabetes and prior myocardial infarction (MI) on mortality in men.
BACKGROUND	Previous studies have suggested that a history of diabetes and a prior MI confer similar risk for subsequent fatal coronary heart disease (CHD). Few studies have examined duration of diabetes in relation to mortality.
METHODS	We examined type 2 diabetes and prior MI in relation to mortality among 51,316 men aged 40 to 75 years in the Health Professionals Follow-up Study.
RESULTS	During 10 years of follow-up, we documented 4,150 deaths from all causes, including 1,124 deaths from CHD. Compared with men without diabetes or prior MI at baseline, the multivariate relative risks (RRs) for fatal CHD were 3.84 (95% confidence interval [CI], 3.12 to 4.71) for those with diabetes only, 7.88 (95% CI, 6.86 to 9.05) for those with MI only, and 13.41 (95% CI, 10.49 to 17.16) for those with both diabetes and MI. The corresponding RRs for total mortality were 1.91 (95% CI, 1.70 to 2.15), 2.23 (95% CI, 2.03 to 2.45), and 3.13 (95% CI, 2.56 to 3.84), respectively. Duration of diabetes was an independent risk factor for total as well as CHD mortality; the multivariate RRs of CHD mortality for increasing duration of diabetes (≤ 5 years, 6 to 10 years, 11 to 15 years, 16 to 25 years, 26+ years) were 1.63, 1.93, 2.35, 2.31, and 3.87, respectively (p for trend < 0.001), compared with nondiabetic participants.
CONCLUSIONS	These findings support that both diabetes and MI are associated with elevated total and CHD mortality, and having both conditions is particularly hazardous. Longer duration of diabetes is a strong predictor of death among diabetic men. (J Am Coll Cardiol 2002;40:954-60) © 2002 by the American College of Cardiology Foundation

The prevalence of type 2 (noninsulin-dependent) diabetes mellitus has been rising in the U.S. and worldwide due to increasing obesity and decreasing physical activity (1). It is expected that 21.9 million of adults will have diabetes in the U.S. in year 2025 (2). Coronary heart disease (CHD) is a leading cause of death among people with type 2 diabetes. Previous epidemiologic studies have reported about two- to threefold increased risk of CHD mortality associated with diabetes for men (3) and even greater relative risks among women (4,5).

Recent data suggest that diabetes and prior CHD confer similar risk for fatal CHD (6,7). In the Physicians' Health Study, a prior CHD appeared to be associated with a greater risk of CHD mortality than diabetes in men (8), but that study did not examine duration of diabetes. Therefore, we compared the impact of diabetes and prior myocardial infarction (MI) on total and CHD mortality in men in the Health Professionals Follow-up Study (HPFS). We also evaluated the association between duration of diabetes and mortality.

METHODS

Study population. The HPFS was established in 1986 with the enrollment of 51,529 male health professionals 40 to 75 years of age (9). The HPFS cohort consists primarily of dentists and veterinarians but also includes pharmacists, optometrists, osteopathic physicians, and podiatrists. About 86% of participants were working full-time or part-time at baseline, and about 96% of participants were white. Members of the cohort have reported information on various lifestyle factors including smoking, weight, physical activity, vitamin E supplement use, diagnoses of major conditions, and history of high blood cholesterol and hypertension biennially since their enrollment. Alcohol intake was reported in 1986, 1990, and 1994 using a semiquantitative food-frequency questionnaire. Family history of MI before 60 years of age and height were reported at baseline. Follow-up rates have averaged 94% for each two-year cycle.

For the current analysis, we excluded men who reported a diagnosis of type 1 diabetes ($n = 101$) and those who reported having diabetes diagnosed before turning 30 ($n = 57$). A total of 51,316 men were included in the analysis.

The study was approved by the Human Research Committees at the Harvard School of Public Health.

Documentation of diabetes and MI. The 1986 baseline questionnaire inquired about a history of physician-diagnosed diabetes mellitus. Biennial questionnaires mailed

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Abbreviations and Acronyms

CHD	= coronary heart disease
CI	= confidence interval
CVD	= cardiovascular disease
HPFS	= Health Professionals Follow-up Study
MI	= myocardial infarction

between 1988 and 1996 were used to identify newly diagnosed cases of diabetes. To confirm self-reports of diagnosed diabetes, a supplementary questionnaire was mailed to men reporting the diagnosis. Men were considered to have confirmed type 2 diabetes if any of the following criteria were met: 1) one or more classical symptoms (excessive thirst, polyuria, unexplained weight loss, hunger, or pruritus) plus a fasting plasma glucose level of ≥ 140 mg/dl (7.8 mmol/l) or a random plasma glucose level of ≥ 200 mg/dl (11.1 mmol/l); 2) at least two elevated plasma glucose concentrations on different occasions (a fasting level of ≥ 140 mg/dl or a random level of ≥ 200 mg/dl and/or a concentration of ≥ 200 mg/dl after ≥ 2 h of oral glucose tolerance testing) in the absence of symptoms; or 3) treatment with hypoglycemic medications (insulin or oral hypoglycemic agents). We used the National Diabetes Data Group criteria (10) because the analytic cohort preceded the publication of the American Diabetes Association guideline in 1997 (11).

The validity of self-reported type 2 diabetes was documented in a subsample of 71 men from the HPFS. A physician blinded to the information reported on the supplementary questionnaire reviewed the medical records according to the diagnostic criteria. Of the 71 patients, 12 had incomplete records, for example, absent laboratory data ($n = 2$) or incomplete laboratory data ($n = 9$). Among the remaining 59 cases, the diagnosis of type 2 diabetes was confirmed in 57 (97%). One patient denied the diagnosis, and another lacked evidence of diabetes in his submitted records. In the primary analyses, we used self-reported diabetes status. In a secondary analysis, we used only the confirmed diabetic cases.

Diagnosis of MI was also reported through questionnaires. We used self-reported information in the analysis. Validation studies among female nurses (12) and male physicians (13) have shown reliable reporting of CHD events compared with medical record reviews.

Ascertainment of death. Deaths were documented by responses to follow-up questionnaires by family members or the postal service and by a search of the National Death Index. Participants who did not respond were assumed to be alive if they were not listed in the National Death Index. If a death from cancer or cardiovascular disease (CVD) was identified, we sought medical records to confirm the cause of death. We obtained death certificates for deaths whose cause was not confirmed by other sources. Cause of death was decided on the basis of all available information, including death certificates, medical records, and autopsy

results. We classified deaths as being due to CHD (International Classification of Diseases, Ninth Revision, codes 410-414), CVD (codes 390-459, 795), or all other causes.

Statistical analysis. We calculated mortality according to the history of diabetes and CHD at baseline as well as the diagnoses updated every questionnaire cycle during follow-up. Participants contributed person-time from the date of return of the 1986 questionnaire until the date of death or January 31, 1996, whichever came first. The relative risk of death was calculated as the rate for a given category of diabetes and CHD status as compared with the rate for the referent category of no diabetes and no CHD. Duration of clinical diabetes was calculated as years since first diagnosis of diabetes. The variable was updated every questionnaire cycle and was divided into five categories (≤ 5 years, 6 to 10 years, 11 to 15 years, 16 to 25 years, 26+ years). For the analysis of duration of diabetes, we used nondiabetic participants as the reference. We employed Cox proportional hazards regression (14) in analyses. To control as finely as possible for confounding by age, calendar time, and any possible two-way interactions between these two time scales, we stratified the analysis jointly by age in months at start of follow-up and calendar year of the current questionnaire cycle. The time scale for the analysis was then measured as months since the start of the current questionnaire cycle, which was equivalent to age in months because of the way we structured the data and formulated the model for analysis. Multivariate models adjusted for smoking status, body mass index, physical activity, parental history of MI before age 60 years, alcohol intake, and vitamin E supplement use, simultaneously. The SAS PHREG procedure (SAS Institute, Cary North Carolina) was used for all analysis, and the Anderson-Gill data structure (15) was used to handle time-varying covariates efficiently, where a new data record was created for every questionnaire cycle at which a participant was at risk, with covariates set to their values at the time that the questionnaire was returned. All covariates except parental history of MI were updated in each questionnaire cycle. For all relative risks, 95% confidence intervals (CIs) were calculated. Tests for trend were conducted using the median value for each category of duration of diabetes as a continuous variable. All p values were two-sided.

RESULTS

During 387,188 person-years of follow-up of 51,316 men, we documented 4,150 deaths (1,471 CVD deaths, 1,124 CHD deaths). Table 1 shows the characteristics of men according to the categories of diabetes and MI at baseline. In this cohort of men, 2.5% had only diabetes, 4.0% had only a prior MI, and 0.4% had both diabetes and MI at baseline. Men with MI and no diabetes were more likely to be smokers. The history of hypertension and hypercholesterolemia was more frequent among those with both diabetes and MI. Men in this group were also older, less active,

Table 1. Age-Standardized Distribution of Potential Coronary Risk Factors According to History of Diabetes and CHD in the Health Professionals Follow-Up Study in 1986*

	Disease Status			
	No Diabetes No CHD	Diabetes No CHD	CHD No Diabetes	Diabetes and CHD
No. of men	47,763	1,285	2,038	230
% of group				
Current smokers	10	10	13	6
History of hypertension	21	44	38	61
History of hypercholesterolemia	11	24	41	56
Insulin use	—	19	—	15
Oral hypoglycemic medication	—	31	—	30
Parental history of MI before 60 years of age	12	14	30	26
Multivitamin use	42	40	37	32
Vitamin E supplement use	19	18	19	15
Working full/part time	87	87	81	82
White	96	91	96	92
Mean				
Age (yrs)	54	61	63	64
Alcohol (g/day)	12	8	11	7
Body mass index (kg/m ²)	25	26	26	27
Physical activity (METs/wk)	20	16	18	14
Dietary fiber (g/day)	21	23	23	24
Saturated fat (g/day)	24	25	21	23
Polyunsaturated fat (g/day)	13	14	13	14
Trans fat (g/day)	2.8	2.7	2.6	2.7
Dietary cholesterol (mg/day)	303	344	271	291

*Except for the data on mean age, all data shown are standardized to the age distributions of the cohort in 1986. CHD = coronary heart disease, METs = metabolic equivalents, MI = myocardial infarction.

and less likely to use multivitamins or vitamin E supplements.

Table 2 presents the relative risk of death due to all causes as well as due to CVD and CHD according to the history of diabetes and MI at baseline. Participants with diabetes only had a slightly lower risk of death due to all causes than those with MI only. Men with both conditions had a

relative risk of 3.13 (95% CI, 2.56 to 3.84) compared with those without diabetes and MI. For CVD or CHD deaths, again, having either diabetes or MI conferred an elevated risk. In addition, having only a prior MI conferred much higher risk of death than having diabetes only. The associations were similar when we used confirmed diabetes status; the relative risks of CHD death were 3.67 (95% CI, 2.84 to

Table 2. Relative Risks and 95% CIs of Death From All Causes, Cardiovascular Disease, and CHD According to History of Diabetes and a Prior CHD at Baseline in 1986 in the Health Professionals Follow-Up Study 1986-1996*

	Disease Status			
	No Diabetes No CHD	Diabetes No CHD	CHD No Diabetes	Diabetes and CHD
Deaths from all causes				
No. of cases	3,195	312	545	98
Age-adjusted RR (95% CI)	1.0	2.43 (2.16-2.73)	2.44 (2.22-2.67)	4.17 (3.41-5.10)
Multivariate RR (95% CI)	1.0	1.91 (1.70-2.15)	2.23 (2.03-2.45)	3.13 (2.56-3.84)
All cardiovascular deaths				
No. of cases	848	149	392	82
Age-adjusted RR (95% CI)	1.0	4.22 (3.54-5.04)	6.36 (5.63-7.20)	12.87 (10.23-17.19)
Multivariate RR (95% CI)	1.0	3.34 (2.80-3.99)	5.63 (4.97-6.39)	9.41 (7.45-11.88)
Fatal CHD				
No. of cases	570	113	364	77
Age-adjusted RR (95% CI)	1.0	4.82 (3.93-5.91)	8.95 (7.81-10.25)	18.12 (14.23-23.08)
Multivariate RR (95% CI)	1.0	3.84 (3.12-4.71)	7.88 (6.86-9.05)	13.41 (10.49-17.16)

*Adjusted for age (continuous), smoking (never, past, current <14, 15-24, 25+ cigarettes/day), body mass index (<23, 23-24.9, 25-29.9, 30-34.9, 35+ kg/m²), physical activity (<3.9, 3.9-10.8, 10.9-21.4, 21.5-40.0, 40.1+ metabolic equivalents/wk), alcohol intake (nondrinker, <5, 5-29, 30+ g/day), family history of myocardial infarction (yes, no), and vitamin E supplement use (yes, no).

CHD = coronary heart disease; CI = confidence interval; RR = relative risk.

Table 3. Relative Risks and 95% CIs of Death From All Causes, Cardiovascular Disease, and CHD According to the Status of Diabetes and CHD at Baseline and During Follow-Up in the Health Professionals Follow-Up Study 1986-1996*

	Disease Status			
	No Diabetes No CHD	Diabetes No CHD	CHD No Diabetes	Diabetes and CHD
Deaths from all causes				
No. of cases	2,867	375	697	211
Age-adjusted RR (95% CI)	1.0	2.10 (1.88-2.34)	2.15 (1.98-2.34)	3.85 (3.35-4.44)
Multivariate RR (95% CI)	1.0	1.76 (1.58-1.96)	2.07 (1.90-2.25)	3.12 (2.71-3.60)
All cardiovascular deaths				
No. of cases	699	145	467	160
Age-adjusted RR (95% CI)	1.0	3.35 (2.79-4.01)	5.94 (5.27-6.71)	12.29 (10.31-14.65)
Multivariate RR (95% CI)	1.0	2.75 (2.29-3.30)	5.51 (4.88-6.23)	9.64 (8.06-11.53)
Fatal CHD				
No. of cases	440	108	432	144
Age-adjusted RR (95% CI)	1.0	4.08 (3.30-5.04)	9.08 (7.91-10.43)	18.43 (15.19-22.36)
Multivariate RR (95% CI)	1.0	3.37 (2.72-4.17)	8.39 (7.29-9.65)	14.51 (11.91-17.67)

*The diagnoses of diabetes and CHD were updated every two years. Adjusting for the same covariates as Table 2. CHD = coronary heart disease; CI = confidence interval; RR = relative risk.

4.75) for those with diabetes only (n = 67) and 11.03 (95% CI, 7.58 to 16.05) for those with both diabetes and MI (n = 30).

We then updated the status of diabetes and MI every two years during follow-up. A total of 230 men had both diabetes and MI at baseline, but the number was increased to 746 using updated information. Similarly, the number of diabetic men without MI was increased from 1,285 to 2,428. The number of nondiabetic men with prior MI changed from 2,038 to 3,652 using updated information. This update also resulted in assigning about twice as many deaths to the category with both diabetes and MI (Table 3), in part because many of the diabetic patients at baseline developed nonfatal MI during follow-up. The overall findings were similar to those using baseline information (Table 2). The mortality risk was slightly attenuated for those with diabetes only when we used updated data, probably reflecting the inclusion of many newly diagnosed diabetic patients with shorter duration.

Among diabetic men duration of diabetes was monotonically associated with total mortality (Table 4). Compared with nondiabetic men, those with diabetes diagnosis ≤5 years had a relative risk of 1.48 (95% CI, 1.27 to 1.72), and

those with diagnosis more than 26 years had a relative risk of 1.91 (95% CI, 1.43 to 2.55). A stronger association was found for death from CHD; the relative risk for those with diabetes diagnosis more than 26 years was 3.87 (95% CI, 2.64 to 5.67) compared with nondiabetic men. Adjusting for history of high blood cholesterol and hypertension did not materially alter the overall associations.

We also examined duration of diabetes and CHD deaths stratified by history of MI (Fig. 1). Duration of diabetes was linearly associated with increased CHD mortality independent of MI status. Compared with men without diabetes or MI, those with prior MI and diabetes longer than 26 years had the relative risk of 21.08 (95% CI, 12.42 to 35.78).

We examined whether the associations between existing diabetes and prior MI and mortality were modified by other potential risk factors (Table 5). For these analyses we used updated diabetes and MI status and also updated the stratification variables every two years when such data were available. The risk of death due to diabetes or MI was higher in the younger age group than the older group. In men with both diabetes and MI, the relative risks of death due to all causes were 6.10 (95% CI, 3.56 to 10.44) for men <60 years and 2.41 (95% CI, 1.98 to 2.94) for those ≥70

Table 4. Relative Risks and 95% CIs of Death From All Causes and CHD According to Duration of Diabetes in the Health Professionals Follow-Up Study 1986-1996*

	No Diabetes	Duration of Diabetes					p for Trend
		≤5 Years	6-10 Years	11-15 Years	16-25 Years	26+ Years	
Deaths from all causes							
No. of cases	3,564	180	82	54	84	47	
Age-adjusted RR (95% CI)	1.0	1.72 (1.48-2.00)	1.90 (1.52-2.37)	2.18 (1.67-2.86)	2.32 (1.87-2.88)	2.56 (1.93-3.44)	< 0.001
Multivariate RR (95% CI)	1.0	1.48 (1.27-1.72)	1.58 (1.27-1.97)	1.71 (1.31-2.24)	1.85 (1.48-2.30)	1.91 (1.43-2.55)	< 0.001
Deaths from CHD							
No. of cases	872	62	30	23	35	29	
Age-adjusted RR (95% CI)	1.0	2.45 (1.89-3.18)	2.75 (1.91-3.97)	3.66 (2.41-5.54)	3.72 (2.65-5.23)	6.38 (4.39-9.27)	< 0.001
Multivariate RR (95% CI)	1.0	1.63 (1.25-2.11)	1.93 (1.34-2.79)	2.35 (1.54-3.58)	2.31 (1.64-3.25)	3.87 (2.64-5.67)	< 0.001

*Adjusted for the same variables as in Table 2 as well as history of CHD. CHD = coronary heart disease; CI = confidence interval; RR = relative risk.

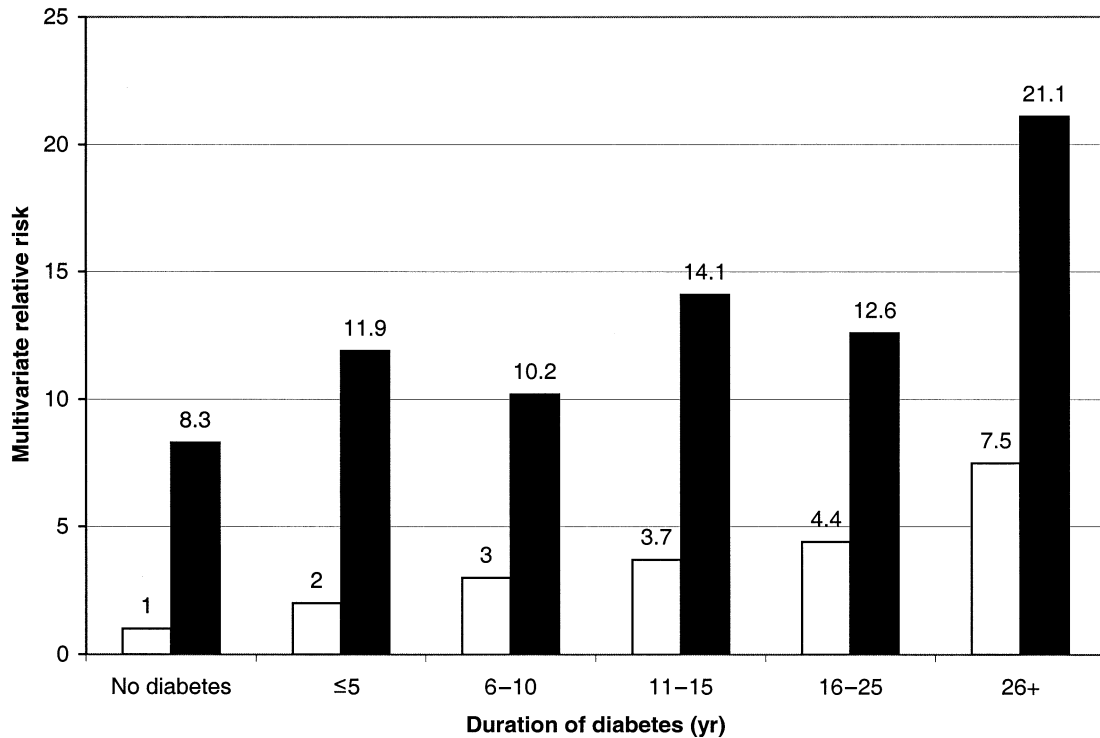


Figure 1. Duration of diabetes and death from coronary heart disease (CHD) by CHD history in the Health Professionals Follow-up Study 1986 to 1996. **White bars** = those without a history of CHD; **black bars** = those with a history of CHD.

years. The increased CHD mortality associated with having both diabetes and MI was more striking; the relative risks were 33.66 (95% CI, 17.26 to 65.65) for men <60 years and 9.50 (95% CI, 7.19 to 12.56) for those ≥70 years.

Prior diabetes or CHD conferred higher relative risks of death due to CHD among those without hypertension than those with hypertension (Table 5). The positive associations were also stronger in men without history of high blood cholesterol.

DISCUSSION

Summary of findings. This prospective study provides further evidence that diabetes, especially of long duration, is a powerful predictor of elevated risk of total and CHD mortality in men, although the magnitude for CHD mortality is smaller than that associated with prior MI. Individuals with both diabetes and prior MI were at particularly high risk.

Our findings support current guidelines that recommend aggressive management of cardiovascular risk factors including hypertension, dyslipidemia, and lifestyle factors (smoking, obesity, and diet) in diabetic patients. Recent guidelines from the American Diabetes Association (16) and National Cholesterol Education Program (17) also recommend the same cholesterol-lowering goal for people with diabetes and no clinical CHD as for those with pre-existing CHD.

Review of other epidemiologic studies. Several recent studies have compared the impact of diabetes and prior CHD on total and CHD mortality. A Finnish study, which

combined both men and women, reported that CHD mortality among subjects with diabetes but no CHD was not significantly different from those with CHD but no diabetes (6). In the Nurses' Health Study of women, the impacts of diabetes and prior CHD were similar for total and CHD mortality (7). Our results in men were in accord with the Physicians Health Study which found that the magnitude of excess risk conferred by diabetes was similar to that conferred by prior CHD for all-cause mortality but weaker for CHD mortality in men (8).

Few studies have evaluated duration of diabetes in relation to CHD mortality. The Whitehall Study with 15 years of follow-up of men did not find any increase of mortality with increasing duration of diabetes (18). However, there were only 47 deaths among diabetic patients with known duration of diabetes. The London Cohort of the WHO Multinational Study of Vascular Disease in Diabetics also did not find any association between duration of type 2 diabetes and CVD mortality among 246 diabetic patients (19). Lack of statistical power might be an explanation for these null findings. The Nurses' Health Study found a linear association between duration of diabetes and total as well as CHD mortality in women (7). Our results in men also indicated increased total and CHD mortality with increasing duration of diabetes.

Strengths and limitations. Our study provided a unique opportunity to evaluate diabetes and CHD in relation to mortality using baseline as well as updated disease status with a large sample size and relatively long duration of

Table 5. Multivariate Relative Risks* and 95% Confidence Intervals of Death From All Causes and CHD According to the Status of Diabetes and CHD at Baseline and During Follow-Up in the Health Professionals Follow-Up Study 1986-1996: Subgroup Analysis

	Disease Status			
	No Diabetes No CHD	Diabetes No CHD	CHD No Diabetes	Diabetes and CHD
Death From All Causes				
Age				
<60 (n = 688)	1.0	2.79 (2.05-3.80)	3.16 (2.39-4.18)	6.10 (3.56-10.44)
60-69 (n = 1,440)	1.0	1.79 (1.49-2.16)	2.54 (2.21-2.93)	4.18 (3.34-5.23)
≥70 (n = 2,022)	1.0	1.55 (1.33-1.79)	1.69 (1.51-1.90)	2.41 (1.98-2.94)
Hypertension				
No (n = 2,184)	1.0	1.87 (1.57-2.23)	2.24 (1.98-2.53)	3.68 (2.82-4.81)
Yes (n = 1,966)	1.0	1.51 (1.31-1.75)	1.80 (1.59-2.03)	2.62 (2.20-3.11)
High blood cholesterol				
No (n = 2,790)	1.0	1.74 (1.52-1.99)	2.11 (1.88-2.38)	3.43 (2.76-4.25)
Yes (n = 1,360)	1.0	1.83 (1.51-2.21)	2.12 (1.86-2.41)	3.15 (2.59-3.85)
Family history of MI				
No (n = 3,602)	1.0	1.71 (1.52-1.92)	2.01 (1.83-2.21)	2.97 (2.53-3.49)
Yes (n = 548)	1.0	2.10 (1.51-2.91)	2.35 (1.91-2.88)	3.96 (2.84-5.51)
Death From CHD				
Age				
<60 (n = 141)	1.0	6.16 (3.37-11.28)	18.37 (12.36-27.36)	33.66 (17.26-65.65)
60-69 (n = 406)	1.0	3.50 (2.45-4.99)	9.52 (7.56-11.99)	20.46 (15.11-27.71)
≥70 (n = 577)	1.0	2.68 (1.99-3.61)	6.26 (5.19-7.56)	9.50 (7.19-12.56)
Hypertension				
No (n = 452)	1.0	4.13 (2.86-5.96)	11.84 (9.55-14.67)	23.12 (16.08-33.26)
Yes (n = 672)	1.0	2.36 (1.81-3.07)	5.76 (4.79-6.91)	9.05 (7.13-11.48)
High blood cholesterol				
No (n = 607)	1.0	3.59 (2.73-4.71)	9.03 (7.45-10.94)	16.96 (12.62-22.79)
Yes (n = 517)	1.0	2.79 (1.97-3.96)	6.71 (5.43-8.29)	10.70 (8.10-14.15)
Family history of MI				
No (n = 916)	1.0	3.24 (2.56-4.09)	8.51 (7.30-9.92)	14.06 (11.25-17.57)
Yes (n = 208)	1.0	4.14 (2.38-7.23)	8.20 (5.82-11.57)	16.95 (10.82-26.54)

*Adjusted for the same variables as in Table 2.
CHD = coronary heart disease; MI = myocardial infarction.

follow-up. The follow-up rate in this cohort was high. We had detailed information on various cardiovascular risk factors and adjusted for them in multivariate analyses.

Several limitations need to be considered. First, diagnosis of diabetes and CHD were self-reported. Although studies have indicated that self-reporting of these medical conditions are reliable, some misclassification is inevitable. Second, our nondiabetic participants were not uniformly screened for glucose intolerance and may include a few subclinical cases of diabetes. However, we believe that the proportion of undiagnosed diabetes in our cohort of health professionals is small relative to the general population due to their education and access to health care. Third, the reported duration of diabetes might be underestimated because the actual onset of diabetes frequently precedes clinical diagnosis by several years. However, these possibilities would have attenuated the association between diabetes and mortality and led to underestimates of the risk in the diabetic population. Fourth, the reference group of participants without diabetes or CHD will include those with impaired glucose tolerance, a precursor

of diabetes, which also increases total as well as CVD mortality (20). If these people with impaired glucose tolerance were excluded from the reference, the excess risk related to either diabetes or CHD would have been even greater. Finally, because the vast majority of our participants were white, our findings may not be generalized to other racial groups.

In our analysis we used the National Diabetes Data Group criteria (10) because all of the diabetic patients were diagnosed before 1996, before the release of new criteria from the American Diabetes Association (11). Thus, the participants without diabetes will include some diabetic cases based on current criteria. However, again, assigning the cases to diabetic groups would likely make the results stronger.

Conclusions. In this population of men, both a prior MI and diabetes elevated risk of total and CHD mortality substantially. A combination of diabetes and MI is associated with dramatically increased risk of total and CHD mortality. Increasing duration of diabetes is associated with increased risk of total and CHD mortality.

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