ORIGINAL ARTICLE

Temporal Trends in Prevalence of Diabetes Mellitus in a Population-Based Cohort of Incident Myocardial Infarction and Impact of Diabetes on Survival

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OBJECTIVE: **To determine the temporal trends in prevalence of confirmed diabetes mellitus (DM), time from the date DM criteria were met to myocardial infarction (MI), and impact of DM on survival.**

SUBJECTS AND METHODS: **A retrospective cohort design was used to identify residents of Olmsted County, Minnesota, with incident MI from 1979 to 1998. The MI cases were characterized according to prevalent DM. Cases with and without DM were followed up for vital status until January 1, 2003.**

RESULTS: **Of 2171 MI cases, 364 (17%) met criteria for prevalent DM. In the age- and sex-adjusted logistic regression models, the odds of prevalent DM increased 3% with each increasing year between 1979 and 1998 (95% confidence interval [CI], 1%-5%; *P*=.007). Survival for MI cases with DM was unchanged between 1979-1983 and 1994-1998 (*P*=.74). For all MI cases, age-, sex-, and DM-adjusted risk of death decreased 3% from 1979 to 1998 (95% CI, 1%-5%) per year for 28-day survival (*P*=.02) and 2% (95% CI, 1%-3%) per year for 5-year survival (*P*=.02). There was a significant adverse effect of DM on 5-year survival after MI (age-, sex-, and calendar year–adjusted hazard ratio, 1.70; 95% CI, 1.38-2.09; *P*<.001). The adverse effect of DM persisted after adjusting for other cardiovascular disease risk factors, MI severity, and reperfusion therapy (hazard ratio, 1.66; 95% CI, 1.34-2.05; *P*<.001) and was unchanged over time (interaction between DM and calendar year, *P*=.63).**

CONCLUSION: **These data indicate that the prevalence of DM among patients with MI is increasing and that its adverse impact on survival after MI remains unchanged.**

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CI = confidence interval; CK = creatine kinase; CVD = cardiovascular disease; DM = diabetes mellitus; MI = myocardial infarction; NDDG = National Diabetes Data Group; REP = Rochester Epidemiology Project

Diabetes mellitus (DM) affects an estimated 21 million US adults,[1] contributing to increased morbidity, premature death, and high resource utilization; the excess morbidity, mortality, and economic costs are largely attributable to cardiovascular disease (CVD) complications.[1-3] In the general population, CVD mortality has declined substantially during the past 3 decades,[4,5] in part due to both declining incidence of myocardial infarction (MI)[6] and improved survival after MI.[7] Persons with DM are at increased risk of MI and experience worse outcomes after MI.[8-11] The proportion of persons within the population who develop diabetes is increasing,[12-14] and the risk of death for persons with DM relative to those without DM has increased in recent decades.[15,16] Thus, it has been suggested that the declines in CVD mortality observed for the general population are slowing and will ultimately reverse,[17,18] yet little evidence is available to support this hypothesis. The current population-based study was conducted to determine the temporal trends in the prevalence of DM in a cohort of persons with incident MI, the time since criteria for DM were met before MI, and the impact of DM on short- (28-day) and long-term (5-year) survival after MI.

SUBJECTS AND METHODS

SETTING

The opportunity for epidemiological studies in Olmsted County, Minnesota (2000 US Census population, 124,277), is unique. Rochester, the county seat, is geographically isolated and home to Mayo Clinic. County residents receive their medical care from few providers, primarily Mayo Clinic and the Olmsted Medical Center. Since 1907, every Mayo patient has been assigned a unique identifier; all information from every contact (including hospital inpatient and outpatient, office, emergency department, and nursing home visits, as well as death certificate and autopsy information) is contained within a unit medical record. Under the auspices of the Rochester Epidemiology Project (REP), this records-linkage system was expanded to include non-Mayo providers of care to county residents. The result is the linkage of all inpatient and outpatient medical records from all sources of medical care available to and used by members of a geographically defined population.[19] The REP resources have afforded population-based studies

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of multiple conditions, including DM and ischemic heart disease.[4,7,10,12,13,16,20]

Description of the REP MI Cohort

The REP MI cohort includes Olmsted County residents who met standardized criteria for incident MI. Detailed descriptions of case finding and case confirmation procedures have been previously published.[20] Potential cases were identified from the list of all residents discharged from local hospitals with any diagnoses compatible with MI using *International Classification of Diseases, Ninth Revision* codes 410 (acute MI), 411 (other acute and subacute forms of ischemic heart disease), 412 (old MI), 413 (angina pectoris), and 414 (other forms of ischemic heart disease). Trained abstractors reviewed the complete medical records of these cases for residency, history of prior MI, presence of cardiac pain, and cardiac biomarkers. A total of 1.9% of individuals refused authorization for use of medical records for research. These individuals were excluded from review. Three electrocardiograms from the first day of the event or hospital admission, the third day, and the last day of hospitalization were recorded and assigned a Minnesota code. Events were classified as definite, probable, suspect, or no MI by applying a published computerized algorithm that considered cardiac pain, biomarker values, and electrocardiogram coding.[21] Persons who were dead on arrival, those who died in the emergency department, and those with in-hospital events with a rapid fatal course for whom no or little data were available (ie, on whom it was impossible to draw blood or elicit information on pain) were categorized as having infarction if they had an autopsy diagnosis of MI. The current study was limited to validated hospitalized MI incident cases from 1979 to 1998.

Identification of Prevalent DM

This study was approved by the Mayo Foundation and Olmsted Medical Center institutional review boards. The complete provider-linked medical records of all validated MI incident cases were reviewed from date first seen by any REP provider until MI to identify those with DM. As described elsewhere,[12] case criteria approximated National Diabetes Data Group (NDDG) recommendations (ie, 2 consecutive fasting glucose levels ≥140 mg/dL or 1- to 2-hour levels from an oral glucose tolerance test ≥200 mg/dL).[22] Persons taking antidiabetic medication for 2 or more weeks or until death also qualified as case patients. The date individuals first met criteria for DM was available from the medical record review for those persons who first meet DM criteria as an Olmsted County resident. For persons who, at their initial visit with any REP provider, were taking antidiabetic medication or had qualifying glucose values plus mention of prior diagnosis (ie, moved in with DM), we assigned the date they gave at that visit as having been first diagnosed as the date they met the criteria. The record review was limited to potential DM cases (ie, individuals assigned any mention of DM or disorder that could be mistaken for DM to rule out DM, hyperglycemia, elevated blood glucose level, impaired glucose tolerance, and diabetic nephropathy) in the REP diagnostic index from 1945 to the present.

Characteristics at MI

Data on other CVD risk factors at the time of MI (age, sex, prior diagnoses of hypertension and hyperlipidemia, body mass index, and current smoking status) were obtained with medical record review. Indicators of MI severity (Killip class, ST-segment elevation, Q-wave MI, and peak creatine kinase [CK] level) were obtained as previously published.[23] Obesity was defined as a body mass index (calculated as weight in kilograms divided by the square of height in meters) of 30 or greater. Killip class was categorized as 1 (no signs of heart failure), 2 (presence of rales, S3 gallop, and venous hypertension), 3 (presence of pulmonary edema), or 4 (presence of cardiogenic shock, defined as a systolic blood pressure <90 mm Hg in the absence of hypovolemia). Copies of up to three 12-lead electrocardiograms from the day of event or hospital admission, day 3, and day of discharge were sent to the Electrocardiogram Reading Center at the University of Minnesota so a Minnesota code could be assigned. ST-segment elevation was defined as elevation of the ST segment of 1 mm or greater in limb leads and 2 mm or greater in anterior chest leads. Q-wave MI was defined according to Minnesota coding, including definite Q-wave MI (ED1-ED7), any diagnostic Q-wave pattern (D1), or any equivocal Q-wave pattern (E1). The CK values were transcribed for up to 3 determinations on each of the first 3 days after hospitalization. Information on the presence or absence of a history of trauma or surgery, which might invalidate enzyme values, was recorded. The measurement method was unchanged over time, but the upper limit of normal in CK values changed in 1989; thus, *peak CK ratio* was defined as the ratio of the maximum CK value to the upper limit of normal. Use of reperfusion therapy was defined as thrombolytic therapy or acute coronary angioplasty within 24 hours after admission.

Survival After MI

Each MI incidence case was followed up for vital status until January 1, 2003, or the date of death for those who died as determined from medical records (which include obituary notices and death certificates) and State of Minnesota death tapes.

TABLE 1. **Characteristics at Time of MI as a Function of Prevalent DM and Calendar Period***

Characteristics	Full period (1979-1998)			With DM				
	With DM	Without DM	*P* value†	1979-1983	1984-1988	1989-1993	1994-1998	*P* value‡
No. (%) of cases	364 (17)	1807 (83)		67 (15)	67 (14)	108 (18)	122 (19)	.007
Mean (SD) age at MI (y)	70 (12)	67 (14)	<.001	68 (12)	69 (13)	71 (12)	70 (11)	.09
Female (%)	200/364 (55)	743/1807 (41)	<.001	52	52	50	62	.12
Diagnosed hypertension (%)	255/357 (71)	901/1757 (51)	<.001	62	68	78	73	.03
Diagnosed hyperlipidemia (%)	115/350 (33)	497/1720 (29)	.14	17	20	34	48	<.001
Obese (%)§	133/360 (37)	376/1797 (21)	<.001	28	31	36	45	.02
Current smoker (%)	53/363 (15)	578/1793 (32)	<.001	16	15	17	11	.19
Killip class (%)			.006					.76
1	208/357 (58)	1180/1781 (66)		59	54	58	60	
2	27/357 (8)	118/1781 (7)		2	12	8	8	
3	105/357 (29)	389/1781 (22)		34	29	28	28	
4	17/357 (5)	94/1781 (5)		5	5	6	4	
ST-segment elevation (%)	115/323 (36)	633/1570 (40)	.11	NA	44	29	37	.53
Q wave (%)	152/297 (51)	736/1483 (50)	.63	NA	52	41	60	.06
Median (IQR) peak CK ratio	3.2 (1.9-6.4)	3.6 (1.9-7.5)	.15	4.3 (2.5-8.8)	4.6 (2.4-9.5)	2.7 (1.8-4.8)	2.7 (1.2-5.0)	.004
Use of reperfusion therapy (%)	84/364 (23)	519/1807 (29)	.03	3	22	26	32	<.001

*For each variable, the percentage with missing values was ≤1% during the entire study period, with the exceptions of ST-segment and Q-wave (not all electrocardiograms were available for coding for the period 1979-1993) and peak creatine kinase (CK) ratio (3% of cases seen exclusively at non-Mayo Rochester Epidemiology Project providers were missing normal values, and an additional 4% of cases had values considered invalid because of trauma or surgery). For these variables, the percentage of cases with unavailable values in 1979-1983, 1984-1988, 1989-1993, and 1994-1998, respectively, was as follows: ST segment, 55%, 1%, 0%, and 2% for cases with diabetes mellitus (DM) and 54%, 2%, 1%, and 3% for cases without DM; Q wave, 58%, 10%, 9%, and 9% for cases with DM and 59%, 8%, 5%, and 7% for cases without DM; peak CK ratio, 9%, 3%, 2%, and 12% for cases with DM and 6%, 6%, 5%, and 12% for cases without DM. IQR = interquartile range; MI = myocardial infarction; NA = not applicable.

†*P* values for overall comparison between cases with and without DM.

‡Data are presented by 5-year periods; *P* values for test for trend were based on univariate regression, with calendar year of MI entered as a continuous variable.

§Obesity is defined as body mass index of ≥30.

Statistical Analyses

Analyses were conducted using SAS statistical software, version 8.02 (SAS Institute Inc, Cary, NC), with $P<.05$ used to determine statistical significance. Characteristics at the time of MI were summarized over the full period and for each quinquennium (1979-1983, 1984-1988, 1989-1993, and 1994-1998) using descriptive statistics. Differences between MI cases with and without DM during the full period were assessed with logistic and linear regression analyses for dichotomous and continuous variables, respectively, and adjusting for age at MI and sex. Time trends for 1979-1998 were analyzed for MI cases with and without DM separately by testing for a significant effect of calendar year of MI with logistic and linear regression analyses for dichotomous and continuous variables, respectively. Differences in temporal trends between MI cases with and without DM were assessed by testing for significant interactions between DM status and calendar year of MI.

Survival after MI was estimated using the Kaplan-Meier product limit method. For persons with and without DM separately, post-MI survival in the first quinquennium was compared with that in the last quinquennium using the 2-sample log-rank test. The effects of DM and calendar year of MI on survival were assessed using logistic regression for 28-day survival and Cox proportional hazards for 5-year survival among 28-day survivors. Survival was assessed in 4 separate models that, in addition to DM and calendar year, sequentially added age at MI and sex, other CVD risk factors (eg, prior diagnoses of hypertension and hyperlipidemia, body mass index, and current smoking status), Killip class, and use of reperfusion therapy. The hypothesis that trends in survival differed between persons with and without DM was assessed by testing for a significant interaction between DM status and calendar year of MI.

RESULTS

Characteristics at MI

Characteristics at MI are provided in Table 1. There were 2171 incident MI cases from 1979 to 1998 (43% female;

TABLE 1. **Continued***

Without DM				
1979-1983	1984-1988	1989-1993	1994-1998	*P* value‡
387 (85)	415 (86)	501 (82)	504 (81)	…
65 (14)	67 (14)	67 (14)	68 (14)	.05
40	38	44	41	.36
49	49	49	57	.004
20	18	32	41	<.001
17	16	20	29	<.001
39	30	31	30	.01
				.07
62	66	66	70	
10	8	6	4	
22	20	24	21	
6	6	5	5	
NA	45	38	41	.19
NA	51	43	57	.05
4.8 (2.5-9.0)	4.1 (2.3-8.2)	3.6 (1.9-7.2)	2.6 (1.3-5.1)	<.001
4	23	38	44	<.001

mean ± SD age at MI, 67±14 years). Of the 2171 MI cases, 364 (17%) met criteria for DM before MI. The age at which individuals first met criteria for DM ranged from 7 to 92 years; 94% were 30 years or older. The mean ± SD length of time between the date DM criteria were met and MI was 13±10 years. Compared with MI cases without DM, those with DM were older; more likely to be female, obese, and diagnosed as having hypertension; and less likely to be smokers and to receive reperfusion therapy within 24 hours of MI. Killip class was slightly higher for MI cases with DM compared with those without DM; the 2 groups appeared similar for other severity measures.

Temporal Trends in Characteristics at MI

Table 1 also provides temporal trends in characteristics at MI. The proportion of MI cases with confirmed DM increased 27% from 1979-1983 (15%) to 1994-1998 (19%). In the age- and sex-adjusted logistic regression models, the odds of prevalent DM increased 3% with each increasing year between 1979 and 1998 (95% confidence interval [CI], 1%-5%; *P*=.007). Time from the date DM criteria were met to MI was unchanged between 1979 and 1998 (for age- and sex-adjusted effect of calendar year, *P*=.60). The MI cases with and without DM both exhibited slight increases in age at MI; the trends were not statistically significant. Both groups exhibited declines in the proportions currently smoking; the trend was significant only for MI cases without DM. Both groups exhibited significant increases in the proportions with diagnosed hypertension and hyperlipidemia, in the proportions who were obese, and in the proportions treated with reperfusion therapy; both groups exhibited significant declines in peak CK ratios. Temporal trends in characteristics at MI (age, sex, hypertension, hyperlipidemia, obesity, smoking, Killip class, ST-segment elevation, Q wave, peak CK ratio, and use of reperfusion therapy) did not differ significantly between MI cases with and without DM (*P*>.25 for interactions between DM and calendar year of MI).

Mortality After MI

Effect of DM on Mortality. A total of 1179 (54%) of all 2171 MI cases died during follow-up, 262 (72%) of the 364 with DM and 917 (51%) of the 1807 without DM. Kaplan-Meier estimated survival for MI cases with DM was less than that for cases without DM at both 28 days (86% [95% CI, 82%-90%] vs 89% [95% CI, 88%-91%]; *P*=.07) and 5 years (52% [95% CI, 47%-57%] vs 68% [95% CI, 66%-70%]; *P*<.001). Table 2 provides results of 28-day mortality (logistic regression) and 5-year mortality (Cox proportional hazards) for the age-, sex-, and calendar year–adjusted and fully adjusted models. The risk of death within 28 days after MI was approximately 30% higher for persons with DM compared with those without DM in each of the sequentially adjusted models, but the difference was not statistical significant in any of the models. Among 28-day survivors, 5-year mortality for MI cases with DM was approximately 70% higher than that for MI cases without DM and was significantly increased in each of the sequentially adjusted models. The adverse effect of DM on 5-year survival after MI did not differ as a function of sex or age at MI (for interaction terms, *P*=.60 and *P*=.11, respectively).

Temporal Trends in Mortality. As indicated in Table 2, the risk of death within 28 days of MI declined approximately 3% with each increasing calendar year of MI between 1979 and 1998. Among the 1916 MI cases who survived 28 days (1603 without DM and 313 with DM), the hazard ratio of death within 5 years of MI declined approximately 2% per year (95% CI, 1%-3%). The inverse effects of calendar time were statistically significant in the models that were limited to age at MI, sex, and DM status; the effects of calendar time were no longer significant in models that sequentially added other CVD risk factors, Killip class, and use of reperfusion therapy. There was no significant interaction between DM and calendar year of MI (*P*=.63).

As shown in Figure 1, survival for MI cases without DM improved between 1979-1983 and 1994-1998, although the unadjusted comparison was not statistically significant (*P*=.05); survival for MI cases with DM did not change between these 2 time periods (*P*=.74). There was no significant difference in time trends between the 2 groups in regression models that included age at MI and sex in addition to DM

TABLE 2. **Short- and Long-term Survival After MI***

Characteristic	0-28 Days (N=2171)			28 Days to 5 years (N=1916)		
	β (SE)	OR (95% CI)	*P* value	β (SE)	HR (95% CI)	*P* value
Age-, sex-, and calendar year–adjusted model						
Prevalent DM	.2378 (.1754)	1.27 (0.90-1.79)	.18	.5309 (.1047)	1.70 (1.38-2.09)	<.001
Age at MI (y)	.0646 (.0066)	1.07 (1.05-1.08)	<.001	.0682 (.0044)	1.07 (1.06-1.08)	<.001
Male	–.1930 (.1508)	0.82 (0.61-1.11)	.20	.1695 (.0983)	1.18 (0.98-1.44)	.08
Year of MI	–.0282 (.0125)	0.97 (0.95-0.99)	.02	–.0184 (.0079)	0.98 (0.97-0.99)	.02
Fully adjusted model						
Prevalent DM	.2624 (.1853)	1.30 (0.90-1.87)	.16	.5048 (.1087)	1.66 (1.34-2.05)	<.001
Age at MI (y)	.0476 (.0080)	1.05 (1.03-1.06)	<.001	.0494 (.0051)	1.05 (1.04-1.06)	<.001
Male	–.1666 (.1583)	0.85 (0.62-1.15)	.29	.3060 (.1011)	1.36 (1.11-1.66)	.002
Diagnosed hypertension	.1959 (.1624)	1.22 (0.88-1.67)	.23	.5465 (.1043)	1.73 (1.41-2.12)	<.001
Diagnosed hyperlipidemia	–.0047 (.1745)	0.99 (0.71-1.40)	.98	–.3160 (.1155)	0.73 (0.58-0.91)	.006
Current smoker	–.0349 (.2109)	0.97 (0.64-1.46)	.87	.0148 (.1329)	1.02 (0.78-1.32)	.91
Body mass index	–.0275 (.0156)	0.97 (0.94-1.00)	.08	–.0453 (.0108)	0.96 (0.94-0.98)	<.001
Killip class	.5557 (.0680)	1.74 (1.53-1.99)	<.001	.3599 (.0434)	1.43 (1.32-1.56)	<.001
Use of reperfusion therapy	–.3830 (.2224)	0.68 (0.44-1.05)	.08	–.6715 (.1445)	0.51 (0.38-0.68)	<.001
Year of MI	–.0140 (.0140)	0.98 (0.96-1.01)	.32	.0040 (.0086)	1.00 (0.98-1.02)	.64

*CI = confidence interval; DM = diabetes mellitus; HR = hazard ratio; MI = myocardial infarction; OR = odds ratio.

status and calendar year of MI (for the interactions between DM and calendar year of MI, *P*=.47 for 28-day mortality and *P*=.47 for 5-year mortality). The absence of a significant interaction can also be interpreted as suggesting that the adverse effect of DM on long-term survival was unchanged over time.

DISCUSSION

This study took advantage of unique REP resources to investigate temporal trends in the prevalence of confirmed DM in a population-based cohort of persons with validated incident MI and temporal trends in the impact of DM on short- and long-term survival after MI. The proportion of MI cases with prevalent DM increased 3% per year between 1979 and 1998. Among 28-day survivors, the 5-year risk of death was 70% higher for cases with DM compared with those without DM. The adverse effect of DM on long-term survival after MI was independent of other CVD risk factors, MI severity, and MI treatment and, importantly, was unchanged between 1979 and 1998.

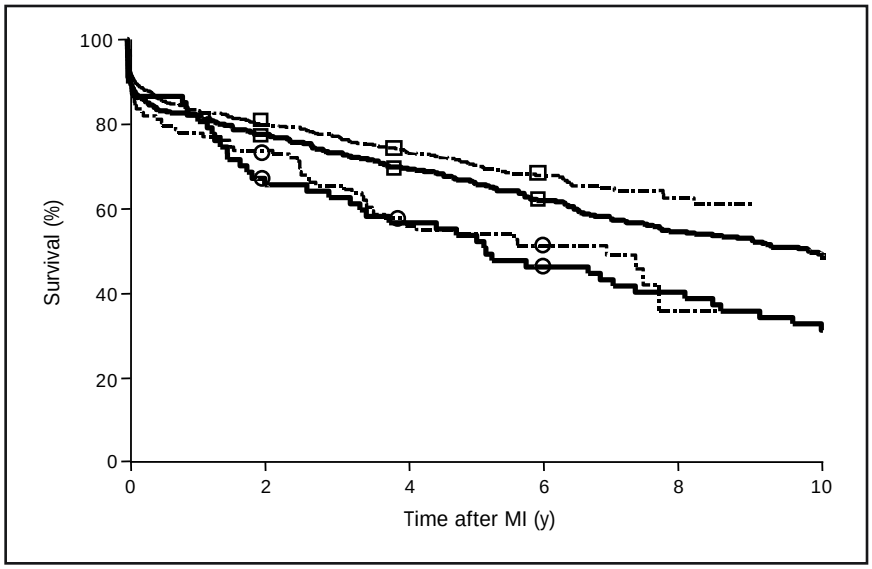

FIGURE 1. Kaplan-Meier curves comparing survival after incident myocardial infarction (MI) in Olmsted County, Minnesota, residents from 1979 to 1998 for MI cases with (circles) and without (squares) prevalent diabetes mellitus (DM) for calendar years 1979-1983 (solid lines) (n=67 with DM and n=387 without DM) vs 1994-1998 (dashed lines) (n=122 with DM and n=504 without DM).

This study also provided unique comparisons between MI cases with and without DM for temporal trends in other CVD risk factors, MI severity, and MI treatment. We found no evidence of significant differences in temporal trends between MI cases with and without DM. Although this similarity may have contributed to the observation that the adverse effect of DM on long-term survival after MI was unchanged in 1979 to 1998, the adverse effect of DM on survival was minimally affected by adjustment for these other factors (Table 2).

Results of comparisons of characteristics between MI cases with and without DM during the full period (Table 1) are similar to those observed by Franklin et al[24] in their comparison of persons with and without DM among those who experienced acute coronary syndrome. Franklin et al[24] found that, compared with cases without a history of DM, the approximately 25% of cases with a history of DM were older; more likely to be female, obese, and hypertensive; and less likely to be smokers and to be treated with effective cardiac therapies. Franklin et al did not examine temporal trends. Our finding that the prevalence of confirmed DM among MI cases increased 3% per year between 1979 and 1998 is generally greater than trends observed for the population during this period. We previously reported that the age- and sex-adjusted prevalence of confirmed DM among all local residents 45 years or older increased 15% between 1980 and 1990[12]; the unadjusted prevalence of confirmed DM among all local decedents 45 years or older increased 23% between 1980 and 1994.[16] Similarly, the temporal increases in obesity and declines in smoking observed for MI cases with and without DM (Table 1) are consistent with local and national trends observed for all persons with DM,[25,26] as well as with trends for the population generally during the past few decades.[27] The temporal trends in MI severity and MI treatment observed for MI cases with and without DM separately were consistent with those previously reported for all Olmsted County MI cases during 1983 to 1994.[23]

Few previous studies have examined temporal trends in the prevalence of DM among persons with CVD. A Minnesota Heart Survey study revealed that the proportion of persons hospitalized with definite MI whose discharge summary included a diagnosis of DM increased significantly between 1970 and 1985 for both men (8.2% vs 16.8%) and women (16.0% vs 25.8%).[28] The Minnesota Heart Survey study data also revealed that, among persons hospitalized with MI, the proportion of deaths within 5 years of discharge for which DM was the underlying cause of death increased from 0% in 1970 to 8% in 1985.[29] Interpretation of these findings is limited by temporal increases in the number of comorbidities listed on discharge summaries and in the likelihood that decedents with DM have DM coded on the death certificate.

Previous investigations of temporal trends in the relative risk of CVD death associated with DM have found conflicting results, in part due to different periods under investigation.[15,16,30,31] A REP study that compared persons with and without confirmed DM[16] and a National Health and Nutritional Examination Survey study comparing persons with and without self-reported DM[15] found that mortality rates for those with DM improved less than mortality rates for those without DM in 1970 to 1994; both studies were limited because identification of CVD was based on death certificate data. By contrast, a Framingham Study, in which DM and CVD events were determined prospectively at sequential assessments, found a 50% decline in the combined rate of incident MI, incident stroke, and coronary heart disease deaths among adults with DM from 1950-1966 to 1977-1995 compared with 35% for adults without DM; however, the difference was not statistically significant.[30] Importantly, none of these studies distinguished CVD incidence from trends in survival after CVD. Our study explicitly examined temporal trends in survival after MI for persons with and without DM.

Study Limitations

The generalizability of study findings to individuals of races other than white cannot be assessed because the Olmsted County population during the study period was more than 95% white. With the exception of a higher proportion of the working population employed in the health care industry, characteristics of Olmsted County residents are similar to those of US whites,[19] and no single county can be expected to be completely representative of the general population. Therefore, our findings should be further examined in different populations and geographic settings. The current study was limited to hospitalized MI cases. Thus, findings may not be applicable to all MI cases, (eg, those with sudden cardiac death and unrecognized [silent] MI). Ascertainment of DM was based on retrospective review of medical records, including all laboratory glucose values. Individuals who never met NDDG criteria but who met less stringent American Diabetes Association criteria were not included.[32] Individuals who would have met NDDG criteria if tested but never came to clinical attention while residing locally were also not included. However, because DM is a chronic disabling disease, almost all individuals who meet NDDG criteria ultimately receive clinical attention. In a study of all Rochester residents who died at 45 years or older in 1970 to 1995, the median length of medical record available for review (ie, time from first contact with an REP provider until death) was 43 years (interquartile range, 24-58 years), and more than 25% had a diagnosis in the REP diagnostic index that qualified them as a candidate case for the REP DM cohort;

this percentage was unchanged over time.[16] Moreover, we previously observed that in any 5-year period essentially all local residents had a blood glucose value measured, and the proportion was essentially unchanged over time.[13] Therefore, increased detection and/or surveillance is unlikely to completely explain temporal increases in the proportion of MI cases who met NDDG criteria for DM. If increased detection and/or surveillance were the explanation, we would also expect to see increases in the time from the date DM criteria were met to MI and improved survival after MI for DM cases relative for non-DM cases, neither of which was observed.

CONCLUSION

Given the importance of DM for CVD incidence and mortality after CVD, our findings reinforce the need for primary prevention of DM, prevention of CVD in persons with DM, and effective DM management strategies in those who experience MI. One of the most significant events in medicine during the past several years has been a substantial decline in CVD mortality.[5] We found that the burden of DM among patients with MI is increasing and that survival after MI remains substantially worse for those with DM compared with those without DM. The implications of these trends for predictions that past improvements in CVD mortality will not continue[18] remain to be discovered.

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