Sex and Racial/Ethnic Differences in Cardiovascular Disease Risk Factor Treatment and Control Among Individuals With Diabetes in the Multi-Ethnic Study of Atherosclerosis (MESA)

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OBJECTIVE — To examine sex and racial/ethnic differences in cardiovascular risk factor treatment and control among individuals with diabetes in the Multi-Ethnic Study of Atherosclerosis (MESA).

RESEARCH DESIGN AND METHODS — This study was an observational study examining mean levels of cardiovascular risk factors and proportion of subjects achieving treatment goals.

RESULTS — The sample included 926 individuals with diabetes. Compared with men, women were 9% less likely to achieve LDL cholesterol <130 mg/dl (adjusted prevalence ratio 0.91 [0.83–0.99]) and systolic blood pressure (SBP) <130 mmHg (adjusted prevalence ratio 0.91 [0.85–0.98]). These differences diminished over time. A lower percentage of women used aspirin (23 vs. 33%; $P < 0.001$). African American and Hispanic women had higher mean levels of SBP and lower prevalence of aspirin use than non-Hispanic white women.

CONCLUSIONS — Women with diabetes had unfavorable cardiovascular risk factor profiles compared with men. African American and Hispanic women had less favorable profiles than non-Hispanic white women.

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Population-based health survey data suggest that sex and racial/ethnic disparities are present in diabetes process of care measures and cardiovascular risk factor control (1–9). Available data also indicate that sex-specific race/ethnicity differences are present in cardiovascular risk factor control, but these data are limited to Medicare and Veterans' Hospital patient populations (5,10–13). We therefore performed analyses of participants with diabetes in the Multi-Ethnic Study of Atherosclerosis (MESA) to examine sex and sex-specific racial/ethnic differences in cardiovascular risk factor treatment and control.

RESEARCH DESIGN AND METHODS

— MESA is a multicenter cohort study of 6,814 men and women age 45–84 years with no clinical evidence of cardiovascular disease at time of enrollment (14). Four MESA exam periods occurred between 2000 and 2007. The study was approved by the Institutional Review Board at all participating institutions, and all MESA participants provided informed consent. Criteria for recruitment, data collection methods, and laboratory techniques have been previously described (14). Participants were classified as having diabetes if at exam 1 they had a fasting plasma glucose ≥126 mg/dl, used oral hypoglycemic agents and/or insulin, or reported a physician diagnosis of diabetes.

Statistical analysis

Multivariate models were used to calculate predicted means for lipid, blood pressure, and A1C levels. Prevalence ratios (PRs) were calculated for percentages of participants achieving cardiovascular risk factor goals using binomial regression, with adjustment for age, MESA site, socioeconomic status variables, and either sex or race/ethnicity. Potential effects of selective attrition on longitudinal results were examined using *t* tests to determine if participants lost to follow-up had higher mean cardiovascular risk factor levels compared with those retained in the study. Analyses were performed using SAS version 9.1.

RESULTS

— Of 926 MESA participants with diabetes at exam 1 (2000–2002), 48% were women. Four racial/ethnic groups were represented (19% non-Hispanic white [NHW], 38% African American, 31% Hispanic, and 12% Chinese). Compared with men, women were more likely to report gross family income <$20,000 (42 vs. 26%) and less than high school education (33 vs. 27%).

Cross-sectional data

At exam 1, after adjustment for age, MESA site, and race/ethnicity, systolic blood pressure (SBP) was 3.5 mmHg higher among women than men (133.7 vs. 130.2 mmHg, $P < 0.01$). LDL cholesterol and A1C did not differ by sex. After additional adjustment for socioeconomic status, there was no sex difference in mean SBP

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Table 1—*Cardiovascular disease risk factors and aspirin use for participants with diabetes, 2000–2002*

	n	LDL cholesterol (mg/dl)	SBP (mmHg)	Diastolic blood pressure (mmHg)	Pulse pressure (mmHg)	A1C (%)	Aspirin (%)
Sex							
Women	448	112.6 ± 2.31	133.3 ± 1.37	68.6 ± 0.64*	64.7 ± 1.06*	7.38 ± 0.12	97 (23)*
Men	478	109.6 ± 2.14	131.1 ± 1.26	75.2 ± 0.58	55.9 ± 0.97	7.44 ± 0.11	155 (33)
Race/ethnicity and sex subgroups							
NHW	176	110.5 ± 3.13	129.9 ± 91.83	69.9 ± 0.85	60.0 ± 1.42	7.18 ± 0.16	64 (38)
Women	72	110.3 ± 4.49	127.9 ± 2.67	65.9 ± 1.24	62.0 ± 2.06	7.28 ± 0.23	20 (29)
Men	104	110.3 ± 3.92	130.8 ± 2.27	73.6 ± 1.05	57.1 ± 1.75	7.14 ± 0.19	44 (44)
African American	356	112.2 ± 2.51	135.6 ± 1.49††	74.7 ± 0.69†††	60.9 ± 1.16	7.65 ± 0.13††	96 (28)†
Women	184	116.3 ± 3.18	136.8 ± 1.89‡‡	72.1 ± 0.88	64.7 ± 1.46	7.56 ± 1.16	42 (24)
Men	172	108.2 ± 3.18	134.4 ± 1.89	77.2 ± 0.87	57.2 ± 1.46	7.75 ± 0.16	54 (32)
Hispanic	285	114.1 ± 2.96	135.0 ± 1.75†	70.9 ± 0.81	64.1 ± 1.36†	7.55 ± 0.15	56 (20)†††
Women	140	113.7 ± 3.67	136.8 ± 2.18‡‡	67.0 ± 1.01	69.8 ± 1.69‡‡	7.46 ± 0.18	22 (16)‡
Men	145	114.5 ± 3.59	133.0 ± 2.12	74.7 ± 0.99	58.4 ± 1.64	7.69 ± 0.18	34 (24)
Chinese	109	107.6 ± 4.07	128.4 ± 2.41	72.3 ± 1.12	56.1 ± 1.87	7.24 ± 0.21	36 (34)
Women	52	108.9 ± 5.49	130.9 ± 3.24	68.9 ± 1.50	61.9 ± 92.50	7.54 ± 0.29	13 (26)
Men	57	106.3 ± 5.06	125.8 ± 2.99	75.6 ± 1.39	50.2 ± 2.31	7.04 ± 0.25	23 (41)

Data are means ± SE or *n* (%). A1C was from exam 2. Comparisons were adjusted as follows: women vs. men adjusted for age, site, race/ethnicity, income, education level, and health insurance (government-sponsored vs. private vs. no insurance). African American vs. NHW adjusted for the same variables without race/ethnicity and including sex, similarly for Hispanic vs. NHW and Chinese vs. NHW. African American women vs. NHW women adjusted for same variables without sex and race/ethnicity, similarly for Hispanic women vs. NHW women and Chinese women vs. NHW women. *$P < 0.0001$ for comparisons of women vs. men. †$P < 0.05$, ††$P < 0.01$, †††$P < 0.0001$ for comparisons of African American, Hispanic, and Chinese vs. NHW. ‡$P < 0.05$, ‡‡$P < 0.01$ for comparisons of African American, Hispanic, and Chinese women vs. NHW women.

(Table 1). African American and Hispanic women had significantly higher mean SBP values than NHW women. A significantly lower percentage of women were taking aspirin (Table 1). Hispanic women reported taking less aspirin than NHW women.

A lower percentage of women achieved LDL cholesterol <130 mg/dl (69.4 vs. 77.1%, $P = 0.01$) and SBP <130 mmHg (42.2 vs. 57.8%, $P = 0.002$) compared with men. Women were 9% less likely to achieve LDL cholesterol <130 mg/dl than men (adjusted PR 0.91 [0.85–0.98]) and 9% less likely to achieve SBP <130 mmHg (adjusted PR 0.91 [0.83–0.99]). African American and Hispanic women were 31% (adjusted PR 0.69 [0.51–0.91]) and 30% (adjusted PR 0.70 [0.52–0.95]) less likely, respectively, to achieve blood pressure <130/80 mmHg compared with NHW women.

Longitudinal data

Of 926 subjects with diabetes at exam 1, 802 completed exam 2, 751 exam 3, and 719 exam 4. At exam 4, LDL cholesterol (96.4 vs. 94.6 mg/dl, $P = 0.54$) and SBP (130.3 vs. 127.6 mmHg, $P = 0.11$) did not differ between women and men. At exam 4, there was no difference in the percentage of women achieving LDL cholesterol <130 mg/dl (adjusted PR 0.97 [0.91–1.04]) or SBP <130 mmHg (adjusted PR 0.95 [0.88–1.02]) compared with men. African American women were 33% less likely to achieve blood pressure <130/80 mmHg (adjusted PR 0.67 [0.49–0.91]) compared with NHW women. Although women reported higher antihypertensive and lipid-lowering medication use compared with men at exam 1, there was no difference at exam 4 in antihypertensive (80 vs. 75%, $P = 0.20$) or lipid-lowering medication (51 vs. 49%, $P = 0.70$) use. Aspirin use increased for both sexes from 2000 to 2007; however, women remained less likely to report aspirin use at exam 4 compared with men (44 vs. 57%, $P < 0.05$). Aspirin use remained lower for African American and Hispanic women compared with NHW women (51 and 39% vs. 58%, respectively).

CONCLUSIONS — Among MESA participants with diabetes, at the baseline exam, a lower proportion of women achieved consensus treatment targets for SBP and LDL cholesterol, after adjustment for covariates. These differences were observed despite a greater reported use of blood pressure and lipid-lowering medications among women. African American and Hispanic women had lower proportions achieving consensus treatment goals for blood pressure and less reported use of aspirin compared with NHW women. The sex difference in LDL cholesterol and SBP control diminished over time.

Our findings are consistent with previous reports showing sex and racial/ethnic differences in cardiovascular risk factor control among individuals with diabetes (2,12,13,15). Inconsistent findings have been reported regarding sex and racial/ethnic differences in use of medications for management of cardiovascular factors (3,4,8).

There are several potential mechanisms for the sex and racial/ethnic differences we observed. Regression adjustment for socioeconomic status variables eliminated the significant sex difference in mean SBP. Socioeconomic variables may correlate with access to high-quality medical care and with personal behaviors that influence risk factor levels, including medication adherence, diet, and exercise. Our findings may also indicate a disparity in medication titration by physicians.

There are several limitations to our study. Information on medication use was self-reported and patient adherence was

not recorded. Study participation may also have influenced treatment patterns because exam results were reported to the participants. Despite these limitations, our findings provide new information about sex and sex-specific race/ethnicity differences in cardiovascular risk factor treatment and control among individuals with diabetes in a contemporary multiethnic cohort with diverse sources of insurance.

In conclusion, we found that among subjects with diabetes in MESA, women had unfavorable cardiovascular risk factor profiles compared with men at baseline exam; however, these differences diminished over time. African American and Hispanic women had less favorable profiles than NHW women.

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References

1. Saaddine JB, Engelgau MM, Beckles GL, Gregg EW, Thompson TJ, Narayan KM. Improvements in diabetes processes of care and intermediate outcomes: United States, 1988–2002. Ann Intern Med 2006;144:465–474
2. Saydah SH, Fradkin J, Cowie CC. Poor control of risk factors for vascular disease among adults with previously diagnosed diabetes. JAMA 2004;291:335–342
3. Wexler DJ, Grant RW, Meigs JB, Nathan DM, Cagliero E. Sex disparities in treatment of cardiac risk factors in patients with type 2 diabetes. Diabetes Care 2005; 28:514–520
4. Ferrara A, Williamson DF, Karter AJ, Thompson TJ, Kim C. Sex differences in quality of health care related to ischemic heart disease prevention in patients with diabetes: the Translating Research Into Action for Diabetes (TRIAD) study, 2000–2001. Diabetes Care 2004;27:2974–2986
5. Tseng CL, Sambamoorthi U, Rajan M, Tiwari A, Frayne S, Findley P, Pogach L. Are there gender differences in diabetes care among elderly Medicare enrolled veterans? J Gen Intern Med 2006;21:S47–S53
6. Bertoni AG, Clark JM, Feeney P, Yanovski SZ, Bantle J, Montgomery B, Safford MM, Herman WH, Haffner S. Suboptimal control of glycemia, blood pressure, and LDL cholesterol in overweight adults with diabetes: the Look AHEAD Study. J Diabetes Complications 2008;22:1–9
7. Brown AF, Gregg EW, Stevens MR, Karter AJ, Weinberger M, Safford MM, Gary TL, Caputo DA, Kim C, Beckles GL. Race, ethnicity, socioeconomic position, and quality of care for adults with diabetes enrolled in managed care: the Translating Research Into Action for Diabetes (TRIAD) study. Diabetes Care 2005;28: 2864–2870
8. Bonds DE, Zaccaro DJ, Karter AJ, Selby JV, Saad M, Goff DC. Ethnic and racial differences in diabetes care: the Insulin Resistance Atherosclerosis Study. Diabetes Care 2003;26:1040–1046
9. Harris MI. Racial and ethnic differences in health care access and health outcomes for adults with type 2 diabetes. Diabetes Care 2001;24:454–459
10. Correa-de-Araujo R, McDermontt K, Moy E. Gender differences across racial and ethnic groups in the quality of care for diabetes. Womens Health Issues 2006;16: 56–65
11. Trivedi AN, Zaslavsky AM, Schneider EC, Ayanian JZ. Trends in the quality of care and racial disparities in Medicare managed care. N Engl J Med 2005;353:692–700
12. Chou AF, Brown AF, Jensen RE, Shih S, Pawlson G, Hudson-Scholle S. Gender and racial disparities in the management of diabetes mellitus among Medicare patients. Womens Health Issues 2007;17: 150–161
13. Adams AS, Zhang F, Mah C, Grant RW, Kleinman K, Meigs JB, Ross-Degnan D. Race differences in long-term diabetes management in an HMO. Diabetes Care 2005;28:2844–2849
14. Bild DE, Bluemke DA, Burke GL, Detrano R, Diez Roux AV, Folsom AR, Greenland P, Jacob DR, JR, Kronmal R, Liu K, Nelson JC, O'Leary D, Saad MF, Shea S, Szklo M, Tracy RP. Multi-ethnic study of atherosclerosis: objectives and design. Am J Epidemiol 2002;156:871–881
15. Harris MI, Eastman RC, Cowie CC, Flegal KM, Eberhardt MS. Racial and ethnic differences in glycemic control of adults with type 2 diabetes. Diabetes Care 1999;22: 403–408