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# Gender Disparities in Lipid-Lowering Therapy Among Veterans With Diabetes

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A B S T R A C T

*Purpose:* We sought to compare lipid-lowering therapy among female and male veterans with diabetes and hyperlipidemia.
*Methods:* We conducted a cross-sectional study of veterans serviced by the Veterans Health Administration in 2006 who had both diabetes and hyperlipidemia and compared all female patients to age- and facility-matched males. We compared proportions of patients with any prescription for lipid-lowering therapy in the year and, among those with elevated low-density lipoprotein cholesterol (LDL >100 mg/dL) and no prior treatment, we compared initiation of lipid-lowering therapy. We used multiple logistic regression to estimate odds ratios (AOR) and 95% confidence intervals (CI), adjusting for race, VA eligibility, health care utilization, cardiovascular diseases, mental health conditions, and a comprehensive list of other comorbidities. We also performed the analysis stratified by age.
*Findings:* Women had higher LDL levels than men (110 ± 38 vs. 101 ± 36 mg/dL) and were less likely to be receiving lipid-lowering therapy (80% vs. 84%; AOR, 0.79; 95% CI, 0.76–0.82) or to be initiated on such therapy (37% vs. 42%; AOR, 0.82; 95% CI, 0.74–0.90). Differences were greatest in the youngest women (<45 years old) for both any lipid-lowering therapy (61% vs. 75%; AOR, 0.50; 95% CI, 0.45–0.56) and initiation of therapy (26% vs. 38%; AOR, 0.55; 95% CI, 0.42–0.73). Adjustment for potential confounders did not change the risk estimates.
*Conclusion:* Women veterans with diabetes and hyperlipidemia receive less aggressive lipid-lowering therapy than men, especially among younger age groups. This disparity is of concern, because early intervention to control hyperlipidemia can reduce the later burden of cardiovascular disease among diabetic women.


## Introduction

Women with diabetes are more likely than men to have a low-density lipoprotein cholesterol (LDL) above treatment goals (Ferrara et al., 2008; Gouni-Berthold, Berthold, Mantzoros, Bohm, & Krone, 2008; Kanaya, Grady, & Barrett-Connor, 2002; Saydah, Fradkin, & Cowie, 2004; Shalev, Chodick, Heymann, & Kokia, 2005; Tseng et al., 2006; Wexler, Grant, Meigs, Nathan, & Cagliero, 2005; Winston, Barr, Carrasquillo, Bertoni, & Shea, 2009). This is an important quality issue because hyperlipidemia is a risk factor for cardiovascular disease, and women with diabetes have a considerably higher risk of fatal coronary heart disease compared to men with diabetes (Huxley, Barzi, & Woodward, 2006). Furthermore, treatment of hyperlipidemia with statins in diabetes is associated with a 20% to 29% reduction in cardiovascular disease risk in both men and women. (Cholesterol Treatment Trialists' Collaborators et al., 2008, Zhang et al., 2007).

The reasons for worse lipid control among women with diabetes are unclear, but may be due in part to differences in treatment patterns. Gender disparities have been noted in the treatment of other chronic conditions. Compared with men, women receive less aggressive diagnostic workups and therapy for cardiovascular disease (Ayanian & Epstein, 1991; Chang et al., 2007; Correa-de-Araujo et al., 2006), less aggressive HIV treatment (Gebo et al., 2005), fewer high-technology treatments such as kidney transplants (Brittle & Bird, 2007), and less colon cancer screening (Kosiak, Sangl, & Correa-de-Araujo, 2006). In the U.S.

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Department of Veterans Affairs (VA) system, women are less likely to have blood pressure controlled (Jha, Perlin, Steinman, Peabody, & Ayanian, 2005), women smokers are less likely to receive prescriptions for nicotine patches (Sherman, Fu, Joseph, Lanto, & Yano, 2005), and older women are less likely than their male counterparts to receive influenza and pneumococcal immunizations (Bean-Mayberry et al., 2009).

We undertook this study to assess whether there are differences in the use and initiation of lipid-lowering therapy among female and male veterans with diabetes.

## Methods

### *Data Sources*

Approval was obtained from the Bedford VA Medical Center Institutional Review Board. Data were drawn from the Veterans Health Administration (VHA) Diabetes Epidemiologic Cohort (DEpiC) database (Miller, Safford, & Pogach, 2004). DEpiC is a national, longitudinal dataset including information on all diabetes patients in the VHA since 1998. It is constructed from data using a variety of national computerized data files in the VHA (medical encounters, prescriptions, laboratory tests, and mortality files), Medicare claims data for VHA patients through 2004, and VHA patient survey data. Individuals with diabetes are identified on the basis of two inpatient or outpatient ICD-9-CM codes or presence of a prescription for diabetes medication.

### *Study Population*

We identified veteran patients over 18 years old with diabetes who were in DEpiC in fiscal year (FY) 2006 (October 2005 to September 2006) and alive at the end of that year. We excluded those who died within the study year because they may have had serious comorbidities that affected treatment goals for lipid control. We excluded those with conditions that might reasonably preclude prioritization of lipid treatment: a history of rhabdomyolysis, chronic liver disease or cirrhosis, end-stage hepatic disease, end-stage renal disease, and recent primary malignancy. We restricted the study population to those who had hyperlipidemia, defined either by an ICD-9-CM code of 272.x registered at an outpatient visit or hospital stay or by any LDL greater than 100 mg/dL during FY 2005 or 2006. Because women made up about 2% of this study population, and because the mean age of veteran women is much lower than that of men, we matched women to men at a 1:4 ratio on the basis of age $\pm$ 1 year as well the VHA facility (station) at which they most often received care. We counted frequencies of care at each location to identify this station. The final study population consisted of 22,475 women and 89,431 men with diabetes and hyperlipidemia.

### *Outcome Measures*

For the purposes of assessing lipid-lowering therapy, we first examined whether patients in our sample received a prescription for any lipid-lowering medication in FY 2006. This included drugs in the classes of statins, fibrates, or bile-acid binding resins, or other specific drugs, such as high-dose niacin, ezetamibe, or any combination lipid-lowering pill. We then examined treatment initiation by limiting the sample to patients with an LDL greater than 100 mg/dL in the first 6 months of FY 2006 and no lipid-lowering therapy in the 12 months before that LDL test. Evidence of treatment initiation was considered to be a new prescription for lipid-lowering therapy in the 6 months after the high LDL measurement.

### *Independent Variables*

Demographic characteristics considered in the analysis included age, race, and priority status. Priority status is a measure of a veteran's eligibility for VHA services. To use priority status as an approximation for economic and disability status, we grouped the levels into four categories based on group consensus: Full disability (no co-pay for prescriptions and visits, priority groups 1 and 4), poverty (no co-pay, priority group 5), part disability (variable co-pay, priority groups 2, 3, 6, and 9), and co-pay (priority groups 7 and 8, with neither disability nor poverty). Health care utilization included the number of outpatient and inpatient days of VHA use in FY 2006. Comorbidities were ascertained by inpatient and outpatient ICD-9-CM codes listed during FY 2005.

### *Analysis*

We conducted all analyses on the age- and station-matched study sample. Because we did not have access to Medicare data from 2006, we conducted the analysis for the overall group as well as stratified by age, namely, younger than 65 or 65 or older. This allowed us to separate out the patients for whom we may have had incomplete information. To more fully explore the effect of age in the younger women and men, we further stratified the group of veterans younger than 65 years old into those younger than 45, those 45 to 54, and those 55 to 64 years old.

We calculated the unadjusted proportions of female and male patients with hyperlipidemia who had a prescription for lipid-lowering therapy, regardless of their LDL value. We performed similar calculations for treatment initiation among the group with high LDL in the first 6 months of FY2006 and no treatment in the 12 months prior. Sequential logistic regression models were used to evaluate whether any of a number of covariates affected any observed associations of gender with use of lipid-lowering medication and initiation of lipid-lowering therapy. Covariates included race, priority status, health care utilization, and comorbidities. We grouped comorbidities into three categories: cardiovascular disease, mental illness (including substance abuse), and other comorbidities, which comprised a comprehensive list of other diabetes- and non–diabetes-related medical conditions. Each category was added separately to the model. We performed a formal test of interaction between sex and age in the unadjusted and the fully adjusted models.

Finally, because accounting for dual health care system use can have significant effects on findings related to disparities (Halanych et al., 2006), we explored the possibility that gender differences in non-VA use might bias our results. We repeated our analyses with patients stratified according to whether there were indicators of non-VA care coverage present. We used indicators of coverage by Medicaid, Medicare, or other non-VA health insurance from the VA enrollment file and VA outpatient data. Overall, 73.2% of diabetes patients in VA in 2006 had some form of non-VA insurance, with a slightly higher proportion in men (73.4%) than in women (66.0%).

## Results

We identified 22,475 women and matched them with 89,431 men on the basis of age and station (Table 1). The mean age of

**Table 1**
Patient Characteristics*

| | Women ($n$ = 22,475) | Men ($n$ = 89,431) | $p$-Value |
|---|---|---|---|
| Age, yrs (mean ± SD) | 59.3 ± 12.9 | 59.5 ± 12.7 | .04 |
| Race (%) | | | |
| White | 64 | 66 | <.0001 |
| Black | 21 | 19 | <.0001 |
| Hispanic | 5 | 6 | <.0001 |
| Other | 3 | 3 | <.0001 |
| Unknown | 7 | 6 | .02 |
| Marital status (%) | | | |
| Married | 43 | 60 | <.0001 |
| Not married | 58 | 40 | |
| Priority status (%) | | | |
| Full disability | 23 | 25 | <.0001 |
| Part disability | 19 | 23 | <.0001 |
| Poverty | 56 | 51 | <.0001 |
| Co-pay | 2 | 2 | <.0001 |
| Healthcare utilization | | | |
| Outpatient days in year (mean ± SD) | 16.1 ± 18.2 | 13.8 ± 16.5 | <.0001 |
| Inpatient days in year (mean ± SD) | 21.3 ± 52.8 | 23.3 ± 53.0 | .35 |
| Number of LDL tests in year (mean ± SD) | 1.7 ± 0.9 | 1.6 ± 0.9 | <.0001 |
| LDL mg/dL (mean ± SD) | | | |
| All ages | 110 ± 38 | 101 ± 36 | <.0001 |
| <65 yrs | 113 ± 38 | 104 ± 37 | <.0001 |
| <45 yrs | 121 ± 41 | 114 ± 41 | <.0001 |
| 45–54 yrs | 114 ± 38 | 107 ± 38 | <.0001 |
| 55–64 yrs | 109 ± 37 | 99 ± 35 | <.0001 |
| ≥65 yrs | 102 ± 35 | 91 ± 30 | <.0001 |
| Comorbidities (%) | | | |
| Cardiovascular conditions† | 16 | 27 | <.0001 |
| Mental health conditions‡ | 53 | 46 | <.0001 |
| Diabetes-related medical conditions§ | 35 | 37 | <.0001 |
| Non–diabetes-related medical conditions‖ | 87 | 84 | <.0001 |

*Abbreviations:* LDL, low-density lipoprotein cholesterol; SD, standard deviation.
* Percents may not total 100 owing to rounding.
† Cardiovascular conditions include myocardial infarction, acute coronary syndrome, coronary artery bypass graft, percutaneous coronary intervention, stroke, ischemic heart disease, transient ischemic attack, and peripheral vascular disease.
‡ Mental health conditions include major depression, bipolar disorder, schizophrenia, posttraumatic stress disorder, other anxiety disorder, alcohol abuse, and substance abuse.
§ Diabetes-related medical conditions include diabetic eye disease, chronic renal disease, peripheral neuropathy and lower limb ulcer and gangrene.
‖ Non–diabetes-related medical conditions include a comprehensive list of medical comorbidities.

both samples was 59 years, and the racial distribution between genders was similar. Fifty-six percent of women and 51% of men qualified for services owing to poverty. Women and men had a similar number of LDL tests in the study year (1.7 ± 0.9 vs. 1.6 ± 0.9), but women had a higher mean LDL value (110 ± 38 vs. 101 ± 36 mg/dL). LDL values were worse for both genders as age decreased, but women had a higher mean LDL than did men in every age group. All $p$-values except that for inpatient utilization were significant at the .05 level. The absolute differences by gender were not large in every case, however, and in these cases significant $p$-values likely reflect the large sample size.

Unadjusted and adjusted results are presented in Table 2. Women with a diagnosis of hyperlipidemia were less likely than men to be on any lipid-lowering therapy (80% vs. 84%), and previously untreated women with an LDL greater than 100 mg/dL were less likely than their male counterparts to have lipid-lowering therapy initiated (37% vs. 42%). The greatest differences were seen among the younger age groups for both outcomes.

We calculated adjusted odds ratios (AOR) for each comparison and present results for both the unadjusted and fully adjusted models. In general, adjustment made little difference in the odds ratio estimates. Among those younger than 45, women were much less likely than men to be on any lipid-lowering therapy (AOR, 0.50; 95% confidence interval [CI], 0.45–0.56). This effect was present but less strong among those 65 years or older (AOR, 0.91; 95% CI, 0.83–0.99). Women younger than 45 were much less likely to receive a prescription for a lipid-lowering medication when the LDL was greater than 100 mg/dL (AOR, 0.55; 95% CI, 0.42–0.73), whereas this difference was not apparent among women 65 years or older (AOR, 0.98; 95% CI, 0.77–1.24). The $p$-value for the interaction between gender and age was .0024.

### *Sensitivity Analysis*

In a sensitivity analysis, we stratified our sample according to coverage for non-VA care. Women still had lower use of lipid-lowering therapy compared with men, both among those with non-VA care (81% in women versus 85% in men) and among those without such care (78% vs. 83%). Likewise, treatment initiation was lower among women than men in both strata, although differences were greater in those without non-VA coverage (37% vs. 44%) as compared with those with such coverage (37% vs. 40%). For use and initiation of therapy, the odds ratios in each stratum were similar to the overall estimates (data not shown).

## Discussion

Female veterans with diabetes and hyperlipidemia have higher mean LDL levels but receive less aggressive lipid-lowering therapy compared with their male counterparts. This gender disparity in LDL levels and treatment is greater among younger veterans. These findings are a cause for concern, particularly because women with diabetes are at increased risk of cardiovascular disease compared with men with diabetes (Huxley et al., 2006).

In veterans with diabetes and hyperlipidemia, the prevalence of lipid-lowering treatment was lower among women than men. Our unadjusted findings describe a difference of 4% in the overall sample, with a gradient by age ranging from a difference of 2% in the group 65 years or older to 14% in the group younger than 45. After adjustment, the odds of being on lipid-lowering therapy were 21% lower for women as compared with men, and the odds were lower in every age group. For those younger than 45, the odds of treatment were 50% lower in women. These findings are in contrast with studies conducted in non-VHA populations. There were no differences in the likelihood of statin treatment in studies of diabetic patients in managed care plans (Ferrara et al., 2004), academic internal medicine practices (Wexler et al., 2005), or in a population-based study (Tonstad, Rosvold, Furu, & Skurtveit, 2004). Among those younger than 55 years old, we also found a gender disparity in lipid-lowering therapy as measured by treatment initiation. This is in contrast with a study of managed care patients that examined lipid-lowering medication management among diabetic patients (Kim, Kerr, Bernstein, & Krein, 2006). That all of the odds ratios remained stable after adjustment indicates that either there are other explanatory factors that were not included in our model, or that

**Table 2**
Comparison of Provision and Initiation of Lipid-Lowering Therapy Before and After Adjustment, and Stratified by Age

| | Women Treated (%) | No. of Women Eligible for Treatment* | Men Treated (%) | No. of Men Eligible for Treatment* | Crude OR (95% CI) | Adjusted Odds Ratio (95% CI)† |
|---|---|---|---|---|---|---|
| Use of lipid-lowering therapy | | | | | | |
| All ages | 80 | 22,475 | 84 | 89,431 | 0.76 (0.74–0.79) | 0.79 (0.76–0.82) |
| <65 yrs | 78 | 16,141 | 83 | 64,127 | 0.73 (0.70–0.76) | 0.75 (0.71–0.79) |
| <45 yrs | 61 | 2,177 | 75 | 8,217 | 0.53 (0.48–0.59) | 0.50 (0.45–0.56) |
| 45–54 yrs | 78 | 6,363 | 82 | 25,059 | 0.80 (0.75–0.85) | 0.76 (0.70–0.82) |
| 55–64 yrs | 83 | 7,601 | 87 | 30,851 | 0.77 (0.72–0.83) | 0.82 (0.76–0.89) |
| ≥65 yrs | 84 | 6,334 | 86 | 25,304 | 0.88 (0.82–0.95) | 0.91 (0.83–0.99) |
| Treatment initiated | | | | | | |
| All ages | 37 | 2,817 | 42 | 8,766 | 0.81 (0.75–0.89) | 0.82 (0.74–0.90) |
| <65 yrs | 38 | 2,292 | 43 | 7,196 | 0.79 (0.72–0.87) | 0.80 (0.71–0.89) |
| <45 yrs | 26 | 499 | 38 | 1,477 | 0.60 (0.47–0.75) | 0.55 (0.42–0.73) |
| 45–54 yrs | 37 | 961 | 44 | 3,118 | 0.74 (0.64–0.86) | 0.71 (0.59–0.84) |
| 55–64 yrs | 45 | 832 | 45 | 2,601 | 0.97 (0.83–1.14) | 1.03 (0.86–1.25) |
| ≥65 yrs | 33 | 525 | 34 | 1,570 | 0.95 (0.77–1.17) | 0.98 (0.77–1.24) |

*Abbreviations:* CI, confidence interval; OR, odds ratio.
* Number eligible for use of lipid-lowering therapy includes all patients in the study population. Number eligible for treatment initiation includes patients with low-density lipoprotein cholesterol levels >100 mg/dL in the first 6 months of fiscal 2006 who were not on lipid-lowering therapy for the 12 months before that test.
† Fully adjusted model includes race, priority status, health care utilization, presence of cardiovascular diseases, presence of mental health conditions, and presence of any of a comprehensive list of diabetes-related and non–diabetes-related comorbidities.

there is a true gender-related disparity in lipid-lowering treatment for diabetic patients in the VHA.

There are differences between the VHA and other care systems at the patient, provider, and system levels, and the reasons for a gender disparity in lipid-lowering therapy may lie at one or more of these levels. At the patient level, an increased prevalence of mental health conditions among veteran compared with non-veteran women may worsen the already lower adherence to statin therapy among women noted in the general population (Mann, Woodward, Muntner, Falzon, & Kronish, 2010). Poor adherence may, in turn, lead a provider to delay or discontinue therapy. Providers may also manifest clinical inertia owing to a mistaken perception that women with diabetes are at lower cardiovascular risk than men with diabetes. In the VHA, women make up a small minority of patients, and provider awareness of cardiovascular health issues in women may be even lower than it is in other health care systems, where it has been shown that physicians are less aggressive about treating coronary disease in women compared with men (Ayanian & Epstein, 1991; Chang et al., 2007; Steingart et al., 1991). It is also possible that the system of care in the VHA is more oriented toward men than women, with the consequence that current standards of care for women are more slowly integrated into practice.

A second key finding of this study is that the gender disparity in use and initiation of lipid-lowering therapy is greatest among younger patients. We have not seen an age-related trend specifically noted in prior studies, but this issue is of particular importance and warrants further exploration. Although young women with diabetes are at low short-term cardiovascular risk compared with older women with diabetes, young women with diabetes are at high lifetime risk (Lloyd-Jones, 2006). Using Framingham data and accounting for competing risks, it has been estimated that the lifetime risk of cardiovascular disease in women with diabetes at 50 years of age is nearly 60% (Lloyd-Jones et al., 2006). Among women with diabetes at younger ages, the lifetime risk would be even higher. Preventive measures at an early age are therefore essential. Women and men with diabetes are assessed as having a CHD risk equivalent according to ATPIII guidelines, irrespective of age, and all have an LDL goal of less than 100 mg/dL.

The reasons for lower rates of treatment among younger women may be multifactorial. Younger women veterans with diabetes are even more likely than their older counterparts to have a mental illness or substance abuse disorder (Banerjea, Pogach, Smelson, & Sambamoorthi, 2009), and this increased burden may make it more difficult to meet diabetes performance measures (Desai, Rosenheck, Druss, & Perlin, 2002; Frayne et al., 2005). In addition, women younger than 50 years old are much more likely than older women to report certain barriers to a “heart-healthy” lifestyle, including a low perception of cardiovascular risk, presence of stress, and lack of time (Mosca, Mochari-Greenberger, Dolor, Newby, & Robb, 2010). Competing priorities such as childcare, eldercare, and work obligations may be greater for younger women compared with older women and men, and likely contribute to the reported stress and lack of time for self-care (Khoury & Weisman, 2002). This could, in turn, reduce interest in or adherence to treatment. At the provider level, clinicians may share the perception that younger women are at low risk owing to a lack of knowledge about lifetime cardiovascular disease risk in this newly expanding veteran population. In addition, clinicians may appropriately avoid statins in women of reproductive age because of the teratogenicity of that drug class, or may have concerns about long-term exposure to statin therapy. If this is the case, there is a need to support alternate methods of LDL reduction among young women. At the system level, younger women may receive more fragmented care than older women owing to a higher likelihood of having primary care needs attended to by obstetrician-gynecologists as well as generalists, although in recent years the VA has supported major initiatives to consolidate care for women.

Although older women are at a higher immediate risk for cardiovascular events, younger women have a longer life expectancy and therefore a longer period of exposure to the adverse cardiovascular effects of hyperlipidemia. Given that the population of young women veterans is significant and rapidly growing, efforts to intervene early and control modifiable risk factors can have a major impact on long-term health and economic costs among the diabetic population.

Control of LDL among those with diabetes is a VA HEDIS measure, and the percentage of VA patients with diabetes who have LDL below 100 mg/dL increased from 58% to 69% between 2006 and 2009 (Office of Quality and Performance & VHA, N.D.). Reduction of the gender disparity in LDL levels is a more recent performance measure, and facility efforts to address this may decrease the extent of the differences that we have reported. Future research should continue to examine the relative roles of patient, provider, and system level factors contributing to this disparity, as interventions that are based on evidence from such studies are more likely to succeed in improving lipid control among women with diabetes.

Strengths of this study include the large sample size, the national population, the ability to adjust for multiple potential confounders, and the ability to study treatment patterns in a health care system that has minimal economic barriers to care. This is the only study of the gender disparity in lipid-lowering medication use among veterans that also investigates a more detailed measure of quality, initiation of therapy. There are several limitations to the study, however. It was conducted among veterans using data from the VHA and the findings may not be generalizable to the general population. Data for patients 65 years or older are incomplete, because a substantial proportion of them use Medicare as well as the VHA for health care and we did not capture Medicare data in this study. However, our sensitivity analysis indicates that dual use did not confound our results. There was also the possibility of misclassifying patients who were included in the sample based not on ICD-9-CM code, but on the basis of metformin, which has several other indications outside of diabetes. We previously examined this possibility in the 2004 DEpiC cohort, however, and found that of 1,045,485 patients with diabetes, only 6 had metformin prescribed for reasons other than diabetes. Last, we did not assess the impact of other patient factors such as treatment preferences, adherence, pregnancy intentions, education level, or health literacy, which may also affect treatment patterns.

In summary, our findings show that gender disparities in the VHA pertain to both prevalence and initiation of lipid-lowering therapy, and persist after controlling for patient characteristics. In addition, we found that younger women have the greatest divergence of LDL from target levels, the greatest disparity in the prevalence of lipid-lowering therapy, and the lowest rates of treatment initiation. Given the increasing number of women veterans and the inevitable increase in diabetes prevalence and cardiovascular disease risk with time, these differences represent a quality of care issue that must be investigated further and addressed.

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## References

Ayanian, J. Z., & Epstein, A. M. (1991). Differences in the use of procedures between women and men hospitalized for coronary heart disease. *The New England Journal of Medicine*, 325, 221–225.

Banerjea, R., Pogach, L. M., Smelson, D., & Sambamoorthi, U. (2009). Mental illness and substance use disorders among women veterans with diabetes. *Women's Health Issues*, 19, 446–456.

Bean-Mayberry, B., Yano, E. M., Mor, M. K., Bayliss, N. K., Xu, X., & Fine, M. J. (2009). Does sex influence immunization status for influenza and pneumonia in older veterans? *Journal of the American Geriatrics Society*, 57, 1427–1432.

Brittle, C., & Bird, C. E. (2007). *Literature review on effective sex- and gender-based Systems/Models of care*. Arlington, VA: Uncommon Insights.

Chang, A. M., Mumma, B., Sease, K. L., Robey, J. L., Shofer, F. S., & Hollander, J. E. (2007). Gender bias in cardiovascular testing persists after adjustment for presenting characteristics and cardiac risk. *Academic Emergency Medicine*, 14, 599–605.

Cholesterol Treatment Trialists' Collaborators, Kearney, P. M., Blackwell, L., Collins, R., Keech, A., Simes, J., et al. (2008). Efficacy of cholesterol-lowering therapy in 18,686 people with diabetes in 14 randomised trials of statins: A meta-analysis. *Lancet*, 371(9607), 117–125.

Correa-de-Araujo, R., Stevens, B., Moy, E., Nilasena, D., Chesley, F., & McDermott, K. (2006). Gender differences across racial and ethnic groups in the quality of care for acute myocardial infarction and heart failure associated with comorbidities. *Women's Health Issues*, 16, 44–55.

Desai, M. M., Rosenheck, R. A., Druss, B. G., & Perlin, J. B. (2002). Mental disorders and quality of diabetes care in the Veterans Health Administration. *The American Journal of Psychiatry*, 159, 1584–1590.

Ferrara, A., Mangione, C. M., Kim, C., Marrero, D. G., Curb, D., Stevens, M., et al. (2008). Sex disparities in control and treatment of modifiable cardiovascular disease risk factors among patients with diabetes: translating Research Into Action for Diabetes (TRIAD) study. *Diabetes Care*, 31, 69–74.

Ferrara, A., Williamson, D. F., Karter, A. J., Thompson, T. J., Kim, C., & Diabetes (TRIAD) Study Group. (2004). 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*, 27, 2974–2976.

Frayne, S. M., Halanych, J. H., Miller, D. R., Wang, F., Lin, H., Pogach, L., et al. (2005). Disparities in diabetes care: impact of mental illness. *Archives of Internal Medicine*, 165(22), 2631–2638.

Gebo, K. A., Fleishman, J. A., Conviser, R., Reilly, E. D., Korthuis, P. T., Moore, R. D., et al. (2005). Racial and gender disparities in receipt of highly active antiretroviral therapy persist in a multistate sample of HIV patients in 2001. *Journal of Acquired Immune Deficiency Syndromes*, 38, 96–103.

Gouni-Berthold, I., Berthold, H. K., Mantzoros, C. S., Bohm, M., & Krone, W. (2008). Sex disparities in the treatment and control of cardiovascular risk factors in type 2 diabetes. *Diabetes Care*, 31, 1389–1391.

Halanych, J. H., Wang, F., Miller, D. R., Pogach, L. M., Lin, H., Berlowitz, D. R., et al. (2006). Racial/ethnic differences in diabetes care for older veterans: accounting for dual health system use changes conclusions. *Medical Care*, 44, 439–445.

Huxley, R., Barzi, F., & Woodward, M. (2006). Excess risk of fatal coronary heart disease associated with diabetes in men and women: meta-analysis of 37 prospective cohort studies. *BMJ*, 332, 73–78.

Jha, A. K., Perlin, J. B., Steinman, M. A., Peabody, J. W., & Ayanian, J. Z. (2005). Quality of ambulatory care for women and men in the Veterans Affairs health care system. *Journal of General Internal Medicine*, 20, 762–765.

Kanaya, A. M., Grady, D., & Barrett-Connor, E. (2002). Explaining the sex difference in coronary heart disease mortality among patients with type 2 diabetes mellitus: a meta-analysis. *Archives of Internal Medicine*, 162, 1737–1745.

Kearney, P. M., Blackwell, L., Collins, R., Keech, A., Simes, J., et al., Cholesterol Treatment Trialists' (CTT) Collaborators. (2008). Efficacy of cholesterol-lowering therapy in 18,686 people with diabetes in 14 randomised trials of statins: a meta-analysis. *Lancet*, 371, 117–125.

Khoury, A. J., & Weisman, C. S. (2002). Thinking about women's health: the case for gender sensitivity. *Women's Health Issues*, 12, 61–65.

Kim, C., Kerr, E. A., Bernstein, S. J., & Krein, S. L. (2006). Gender disparities in lipid management: the presence of disparities depends on the quality measure. *American Journal of Managed Care*, 12, 133–136.

Kosiak, B., Sangl, J., & Correa-de-Araujo, R. (2006). Quality of health care for older women: what do we know? *Women's Health Issues*, 16, 89–99.

Lloyd-Jones, D. M. (2006). Short-term versus long-term risk for coronary artery disease: implications for lipid guidelines. *Current Opinion in Lipidology*, 17, 619–625.

Lloyd-Jones, D. M., Leip, E. P., Larson, M. G., D'Agostino, R. B., Beiser, A., Wilson, P. W., et al. (2006). Prediction of lifetime risk for cardiovascular disease by risk factor burden at 50 years of age. *Circulation*, 113, 791–798.

Mann, D. M., Woodward, M., Muntner, P., Falzon, L., & Kronish, I. (2010). Predictors of nonadherence to statins: a systematic review and meta-analysis. *The Annals of Pharmacotherapy*, 44, 1410–1421.

Miller, D. R., Safford, M. M., & Pogach, L. M. (2004). Who has diabetes? Best estimates of diabetes prevalence in the Department of Veterans Affairs based on computerized patient data. *Diabetes Care*, 27(Suppl. 2), B10–B21.

Mosca, L., Mochari-Greenberger, H., Dolor, R. J., Newby, L. K., & Robb, K. J. (2010). Twelve-year follow-up of American women's awareness of cardiovascular disease risk and barriers to heart health. *Circulation. Cardiovascular Quality and Outcomes*, 3, 120–127.

Office of Quality and Performance, Veterans Health Administration. (N.D.). Available: http://vaww.oqp.med.va.gov. Accessed February 18, 2011.

Saydah, S. H., Fradkin, J., & Cowie, C. C. (2004). Poor control of risk factors for vascular disease among adults with previously diagnosed diabetes. *Journal of the American Medical Association*, 291, 335–342.

Shalev, V., Chodick, G., Heymann, A. D., & Kokia, E. (2005). Gender differences in healthcare utilization and medical indicators among patients with diabetes. *Public Health*, 119, 45–49.

Sherman, S. E., Fu, S. S., Joseph, A. M., Lanto, A. B., & Yano, E. M. (2005). Gender differences in smoking cessation services received among veterans. *Women's Health Issues*, 15, 126–133.

Steingart, R. M., Packer, M., Hamm, P., Coglianese, M. E., Gersh, B., Geltman, E. M., et al. (1991). Sex differences in the management of coronary artery disease. Survival and Ventricular Enlargement Investigators. *New England Journal of Medicine*, 325, 226–230.

Tonstad, S., Rosvold, E. O., Furu, K., & Skurtveit, S. (2004). Undertreatment and overtreatment with statins: the Oslo Health Study 2000–2001. *Journal of Internal Medicine*, 255, 494–502.

Tseng, C. L., Sambamoorthi, U., Rajan, M., Tiwari, A., Frayne, S., Findley, P., et al. (2006). Are there gender differences in diabetes care among elderly Medicare enrolled veterans? *Journal of General Internal Medicine*, 21(Suppl. 3), S47–S53.

Wexler, D. J., Grant, R. W., Meigs, J. B., Nathan, D. M., & Cagliero, E. (2005). Sex disparities in treatment of cardiac risk factors in patients with type 2 diabetes. *Diabetes Care*, 28, 514–520.

Winston, G. J., Barr, R. G., Carrasquillo, O., Bertoni, A. G., & Shea, S. (2009). 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). *Diabetes Care*, 32, 1467–1469.

Zhang, Q., Safford, M., Miller, D., Crystal, S., Rajan, M., Tseng, C. L., et al. (2007). Short-term statin exposure is associated with reduced all-cause mortality in persons with diabetes. *Medical Care*, 45, 308–314.

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