Diabetes Care Quality in the Veterans Affairs Health Care System and Commercial Managed Care: The TRIAD Study

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Background: No studies have compared care in the Department of Veterans Affairs (VA) with that delivered in commercial managed care organizations, nor have studies focused in depth on care comparisons for chronic, outpatient conditions.

Objective: To compare the quality of diabetes care between patients in the VA system and those enrolled in commercial managed care organizations by using equivalent sampling and measurement methods.

Design: Cross-sectional patient survey with retrospective review of medical records.

Setting: 5 VA medical centers and 8 commercial managed care organizations in 5 matched geographic regions.

Participants: 8205 diabetic patients: 1285 in the VA system and 6920 in commercial managed care.

Measurements: We compared scores on identically specified quality measures for 7 diabetes care processes and 3 diabetes intermediate outcomes and on 4 dimensions of satisfaction. Scores were expressed as the percentage of patients receiving indicated care and were adjusted for patients' demographic and health characteristics.

Results: Patients in the VA system had better scores than patients in commercial managed care on all process measures (for example, 93% vs. 83% for annual hemoglobin A_{1c}; $P = 0.006$; 91% vs. 75% for annual eye examination; $P < 0.001$). Blood pressure control was poor in both groups (52% to 53% of persons had blood pressure < 140/90 mm Hg), but patients in the VA system had better control of low-density lipoprotein cholesterol and hemoglobin A_{1c} (for example, 86% vs. 72% for low-density lipoprotein cholesterol level < 3.37 mmol/L [<130 mg/dL]; $P = 0.002$). Satisfaction was similar in the 2 groups.

Limitations: Our results may not be generalizable to all regions or health plans, and some of the differences in performance could reflect differences in documentation.

Conclusions: Diabetes processes of care and 2 of 3 intermediate outcomes were better for patients in the VA system than for patients in commercial managed care. However, both VA and commercial managed care had room for improvement, especially for blood pressure control.

Type 2 diabetes mellitus affects approximately 17 million people and contributes to more than 200 000 deaths annually in the United States (1). Despite many cost-effective treatments (2–6), diabetes care remains suboptimal (5). As a result, the Institute of Medicine (IOM) labeled diabetes as a priority area for quality improvement (7) and suggested that changes in how we deliver health care services, such as more effectively using information technology, aligning payment policies with quality improvement, and reengineering care processes, may close the gap between our knowledge of effective management strategies and the implementation of those processes into practice (8).

More than 800 000 patients with diabetes receive care through the Department of Veterans Affairs (VA) health care system (9). Beginning in 1995, the VA system embarked on a nationwide effort to reengineer many of its organizational policies in order to improve both the efficiency and effectiveness of its services. Many changes reflected recommendations of the IOM and treatment standards already espoused by commercial managed care organizations (10–12). In contrast to previous criticisms about the quality of VA care, most recent studies compar-

ing care received by patients in the VA system with that received by Medicare recipients suggest that the VA system may provide similar or even better care for certain conditions and procedures (11, 13, 14). However, most comparison studies have examined only inpatient care (13, 15, 16), compared care in the VA system to care received by fee-for-service Medicare recipients but not those covered by other insurance types (11, 14), and examined only a few aspects of care for each condition. Jha and colleagues (11) compared the quality of chronic disease care between patients in the VA system and fee-for-service Medicare recipients. Rates of all 3 measures of diabetes care processes that they examined were better in patients in the VA system than in Medicare recipients, but the measures reflected only a small subset of diabetes quality and the data collection methods differed between the VA and Medicare samples (11). To date, no published studies have examined care quality for chronic, primarily outpatient conditions by using equivalent data collection methods and measures or have compared care in the VA system with commercial or Medicare managed care. Therefore, we compared the quality of diabetes care among patients in the VA system and

commercial managed care organizations by using similar sampling, data collection, and quality measurement methods.

METHODS

Overall Design

We collected data for the current study as part of the Translating Research into Action for Diabetes (TRIAD) initiative, a collaborative effort to evaluate the quality of diabetes care in commercial managed care organizations and in the VA system, funded jointly by the Centers for Disease Control and Prevention (CDC); the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK); and the VA Health Services Research and Development Service (HSR&D). The design of the TRIAD study has been previously described (17). Briefly, a cohort of patients with diabetes was identified from 6 translational research centers collaborating with 10 health plans that serve approximately 180 000 people with diabetes in 6 geographic regions (central Indiana, northern California, southern Texas, New Jersey and Pennsylvania, southeastern Michigan, and Hawaii). These plans were selected on the basis of an invitation to participate in the TRIAD study from a principal investigator at 1 of the 6 translational research centers. We identified a second cohort that received care through 5 VA facilities serving the same geographic areas as 5 of the 6 previously identified translational research centers. The 2 Hawaii plans participating in the TRIAD study were not included in the current analysis because local institutional review board regulations precluded the collection of similar data from Hawaii VA facilities and patients.

In both the commercial managed care and VA samples, cohort members answered baseline surveys and agreed to have their medical records reviewed. Using equivalent data collection instruments (17), we collected information on quality of diabetes care and satisfaction with care over the previous 12 to 18 months for both the commercial managed care and VA samples. We then compared quality of care between cohorts by using identically specified quality and satisfaction measures. In the current study, we present cross-sectional findings on the quality of care for these 2 groups. The institutional review boards at all translational research centers and at the 5 participating VA facilities reviewed and approved the study protocol, and all participants provided informed consent.

Constructing the Commercial Managed Care and VA Samples

The commercial managed care cohort was a stratified random sample of English- or Spanish-speaking adults with diabetes who had been continuously enrolled in 1 of 8 health plans for at least 18 months, were living in the community, were not pregnant, and had filed claims with the participating TRIAD health plan during the 18 months before start of study. The VA cohort consisted of community-dwelling adult patients with diabetes who re-

Context

Few studies have compared the quality of care between the Veterans Affairs (VA) and commercial managed care systems.

Contribution

In this study, diabetes care, assessed through patient surveys and medical record reviews, was compared between 1285 patients in 5 VA systems and 6920 patients in 8 commercial managed care sites. Compared with patients in commercial managed care, the patients in the VA system more often received hemoglobin A_{1c} testing, counseling about aspirin use, and eye and foot examinations; they also had better lipid control. Patients in both systems had poor blood pressure control but reported high satisfaction with care.

Implications

The VA system delivered better diabetes care than did several commercial managed care organizations.

–The Editors

ceived care from 1 of the 5 main VA facilities or their associated community-based outpatient clinics and who had documented care between 1 October 1998 and 30 September 1999. For both cohorts, diabetes diagnosis was based on data from the year before enrollment and included the following criteria: diagnostic code for diabetes (for example, ≥ 2 outpatient visits with an associated diabetes code [International Classification of Diseases, Ninth Revision, 250.xx] or ≥ 1 inpatient stay with an associated diabetes code); a laboratory value suggesting diabetes (for example, ≥ 2 hemoglobin A_{1c} tests or diagnostic hemoglobin A_{1c} or fasting blood glucose levels); or a prescription for medications for diabetes (for example, insulin or an oral antidiabetic agent). At the time of the survey, patients who met these initial criteria were included only if they verified that they had diabetes and received most of their diabetes care through the participating TRIAD health plan or through a participating VA facility.

Participants completed either a written survey or a computer-assisted telephone interview. We collected additional health care information by reviewing participants' medical records. The **Figure** shows details of the patient recruitment process. Of the 10 285 contacted and eligible persons in the commercial managed care sample, 9160 (89%) responded to the survey (5753 by computer-assisted telephone interview and 3407 by written survey). Of the 2009 contacted and eligible persons in the VA sample, 1694 (84%) completed the survey (1397 by computer-assisted telephone interview and 297 by written survey). However, we could not reach a substantial fraction of individuals in the commercial managed care and VA samples. By using a calculation endorsed by the Council of American Survey Research Organizations (18), which assumes

Figure. **Description of sampling and response rate.**
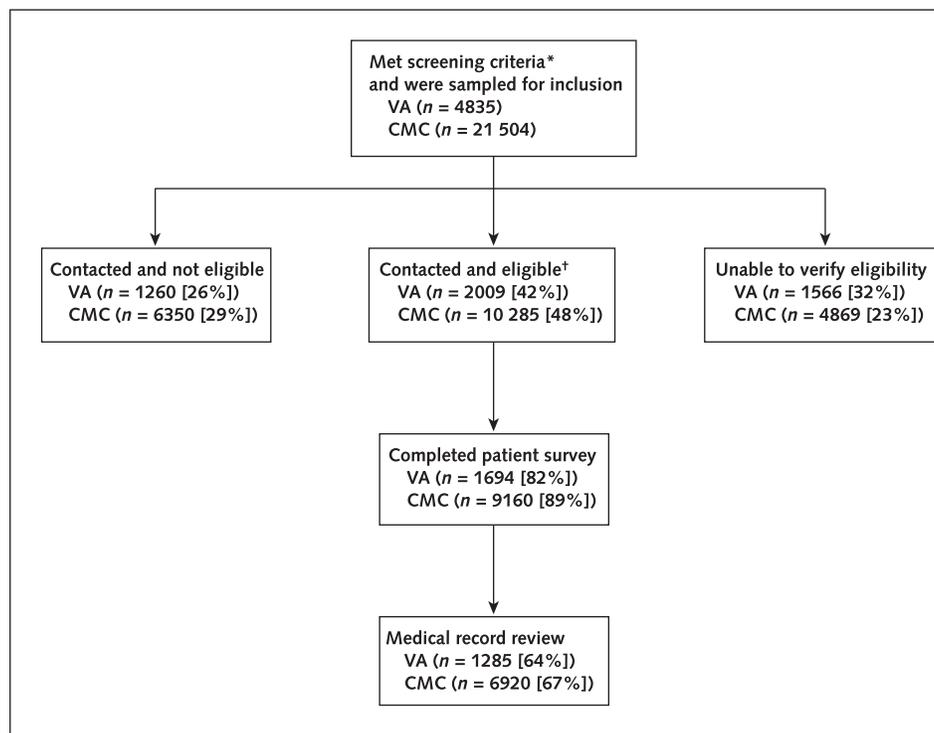
*Patients receiving care in one of the Translating Research into Action for Diabetes (TRIAD) study health plans or Department of Veterans Affairs (*VA*) health care systems and who had diabetes diagnosis based on the following criteria: a diagnostic code for diabetes (for example, 2 or more outpatient visits with an associated diabetes code [International Classification of Diseases, Ninth Revision, 250.*xx*] or 1 or more inpatient stays with an associated diabetes code); a laboratory value suggestive of diabetes (for example, 2 or more hemoglobin A_{1c} tests or diagnostic levels of hemoglobin A_{1c} or fasting blood glucose); or a prescription for medications for diabetes (for example, insulin or an oral antidiabetic agent). †At the time of the survey, patients who met the initial criteria were included only if they verified that they had diabetes and received most of their diabetes care through the participating TRIAD health plan or a participating VA facility. CMC = commercial managed care.

that persons whom we could not contact or for whom we could not confirm eligibility had the same rate of eligibility as those contacted, the survey response rates were 69% in the commercial managed care sample and 57% in the VA sample. This analysis includes participants who responded to the survey and for whom medical records were available to document diabetes processes of care (6920 participants in the commercial managed care sample, and 1285 participants in the VA sample). Mean duration of diabetes, body mass index (BMI), and physical and mental health status did not meaningfully differ between persons whose records were not available and persons whose records were available.

Data Sources

The VA and commercial managed care patient surveys assessed participants' sociodemographic characteristics, diabetes care services, duration of diabetes, health status, and satisfaction with care (17). The survey was administered between July 2000 and October 2001 for the commercial managed care sample (75% of surveys were completed before mid-May 2001) and between August 2001 and March 2002 for the VA sample (75% of surveys were completed before late December 2001). Medical record review included data abstracted from paper and electronic medical

records for the 18 months before the patient survey. Abstraction elements included dates and findings from physical examinations (for example, visual foot inspection) and laboratory tests (for example, hemoglobin A_{1c} test), as well as the identification of comorbid diagnoses. Medical record abstractors had successfully completed a 2-day training session. Inter-rater reliability (κ) for the main quality measures derived from medical record data ranged from 0.85 to 0.92 for the commercial managed care sample and from 0.70 to 1.00 for the VA sample.

Quality-of-Care Measures

We examined the process of care quality by using measures such as whether a hemoglobin A_{1c} test was performed, and we examined intermediate outcomes by using measures such as the proportion of patients with hemoglobin A_{1c} values below a specified value (**Table 1**). All measures were derived from the Diabetes Quality Improvement Project (DQIP) accountability and quality improvement measurement set (5, 19). The Centers for Medicare & Medicaid Services, the National Committee for Quality Assurance, and the American Diabetes Association founded the DQIP to develop a comprehensive performance measurement set for diabetes. These measures were incorporated into the Health Plan Employer Data and In-

formation Set (HEDIS), the American Diabetes Association Provider Recognition Program, the American Medical Association Diabetes Measures Group, the VA performance monitoring program, and other measurement activities. Measures for this study were chosen before investigators knew about the quality improvement programs in place at the health plans, provider groups, and VA sites. We chose measures that could be reliably collected from medical records, patient surveys, or both. Recognizing the multitude of complex factors that influence ideal hemoglobin A_{1c} values (19), as well as the differences between clinical practice guidelines and performance indicators (20), we report the proportion not in poor glycemic control for 2 different hemoglobin A_{1c} values (**Table 1**). For each quality measure, we calculated the percentage of patients who met the recommended quality standard in the previous year (365.5 days), with higher percentages indicating higher quality.

Satisfaction with care was measured within 4 separate domains, 3 of which are based on scales developed for the Consumer Assessment of Health Plans Survey (CAHPS) (21): getting needed care (4 questions about ease of receiving and choices in primary and specialty care; range, 1 to 6); courteous and helpful office staff (2 questions about respect and helpfulness showed by office staff; range, 1 to 6); and how well doctors communicate (4 questions about the effectiveness of communication by doctors and time spent by doctors; range, 1 to 12). We also included a question that asked: "Over the past 12 months, how would you rate the quality of care you received for your diabetes?"

Responses ranged from 1 (poor) to 5 (excellent). In all cases, higher scores represented higher satisfaction.

Measures Used To Adjust for Patient-Level Differences

In comparing the quality of care between VA and commercial managed care, we adjusted for patients' demographic characteristics (age, race, education, and income), self-reported clinical characteristics (duration of diabetes and general health status), self-reported number of doctor visits in the past year, and date of survey completion. We also adjusted for 3 additional health measures obtained from medical records: BMI, number of prescription medications for specific conditions (diabetes, cardiovascular conditions, hyperlipidemia, and depression), and number of medical comorbid conditions defined by using the Charlson index (22). Comorbid conditions included congestive heart failure, ischemic heart disease, dementia, chronic pulmonary disease, connective tissue disease, peptic ulcer disease, hemiplegia or cerebrovascular disease, leukemia, lymphoma, liver disease, cancer, end-stage renal disease, and peripheral vascular disease.

Statistical Analysis

We used t-tests for continuous variables and chi-square tests for categorical variables to examine differences in demographic and health-related characteristics between the 2 cohorts. We used hierarchical mixed-effects logistic regression models to examine differences between VA and commercial managed care systems in diabetes quality, adjusting for demographic and health characteristics as previ-

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Table 1. **Specification of Quality-of-Care Measures for Both Veterans Affairs and Commercial Managed Care***

Quality-of-Care Measure (Data Source)	Criterion for Meeting Quality Measure
Processes of care†	
Annual eye examination (hybrid)	Dilated eye examination in study period documented in medical record or on survey
Eye examination (medical record)	Dilated eye examination in study period documented in medical record
Eye examination (survey)	Dilated eye examination in study period reported on survey
Annual hemoglobin A_{1c} test (medical record)	≥1 hemoglobin A_{1c} test in study period
Annual lipid screening (medical record)	≥1 LDL cholesterol test in study period
Annual foot examination (hybrid)	Visual foot inspection in study period documented in medical record or on survey
Foot examination (medical record)	Visual foot inspection in study period documented in medical record
Foot examination (survey)	Visual foot inspection in study period reported on survey
Annual proteinuria screening (medical record)	Documented urine protein assessment or prescription of ACE inhibitor or ARB medication or presence of nephropathy in study period
Aspirin use counseling (survey)	Reported counseling about regular aspirin use
Influenza vaccination (survey)	Reported receipt of influenza vaccination in study period
Intermediate outcomes‡	
Blood pressure < 140/90 mm Hg	Last blood pressure documented in study period < 140/90 mm Hg
Blood pressure < 130/85 mm Hg	Last blood pressure documented in study period < 130/85 mm Hg
Hemoglobin A_{1c} value < 9.5%	Last hemoglobin A_{1c} value documented in study period < 9.5%
Hemoglobin A_{1c} value < 8.5%	Last hemoglobin A_{1c} value documented in study period < 8.5%
LDL cholesterol level < 3.37 mmol/L (<130 mg/dL)	Last LDL cholesterol level documented in study period < 3.37 mmol/L (<130 mg/dL)
LDL cholesterol level < 2.59 mmol/L (<100 mg/dL)	Last LDL cholesterol level documented in study period < 2.59 mmol/L (<100 mg/dL)

* The study period is defined as the 365.5 days before the date of the patient survey. The annual dilated eye examination and the annual lipid screening closely resemble the Diabetes Quality Improvement Project (DQIP) accountability measures. In DQIP, the eye examination is annual only for those at high risk; the lipid screen is biannual. The annual hemoglobin A_{1c}, annual foot examination, and annual proteinuria screening and blood pressure, hemoglobin A_{1c}, and LDL cholesterol determinations match DQIP accountability or quality improvement measures (19). ACE = angiotensin-converting enzyme; ARB = angiotensin-receptor blocker; LDL = low-density lipoprotein.
† For processes of care, all patients were eligible for each item.
‡ For intermediate outcomes, eligible patients were those with a documented value in the study period.

ously specified. We used similar linear models to examine differences in satisfaction. Each model accounted for clustering in the health plans and VA sites. From the models, we calculated adjusted percentages for process measures and intermediate outcomes and adjusted satisfaction scores on the basis of the model least-squares means by using the observed margins. Appendix 2 (available at www.annals.org) provides further model details. We did not control for sex because the VA sample was 98% male. However, models that compared outcomes for VA male patients with those for male patients in commercial managed care showed that the observed differences between the 2 groups did not vary by sex (**Appendix Tables 1** and **2**, available at www.annals.org.). Analyses were performed by using SAS, version 8.2 (SAS Institute, Inc., Cary, North Carolina).

In both the VA and commercial managed care survey data, 5% or less of the values for the education, general state of health, BMI, age, and race variables were missing. The largest percentages of missing data were for income (4% and 11% for VA and commercial managed care, respectively), diabetes duration (7% and 5%, respectively), and number of office visits (12% and 10%, respectively). Missing values for all survey covariates were imputed by single imputation by using the transcan 20 function in S-PLUS 21, S-PLUS software, version 6.1 (Insightful Corp., Seattle, Washington). Each covariate was predicted as a function of all other covariates in the model. Imputation was not performed for variables constructed from medical record data, which had missing values of less than 1%, or for the dependent variables.

We performed several sensitivity analyses to examine whether factors other than VA and commercial plan status influenced the observed differences in quality between VA and commercial managed care patients. Specifically, we examined the influence of individual health plan results on overall differences, whether the presence of electronic medical records in the VA system accounted for some of the observed differences, and whether the type of survey completed by the commercial managed care cohort (computer-assisted telephone interview or written survey) contributed to observed differences. All VA respondents with medical record data completed the survey by computer-assisted telephone interview.

Role of the Funding Source

This study was funded through cooperative agreements from the CDC and the NIDDK and from a service-directed research grant from the VA HSR&D. As is common in cooperative agreements, co-investigators from the CDC collaborated with the principal investigators in the design of the study and data analysis. For major decisions about the conduct of TRIAD, the CDC had 1 of 7 votes; the other 6 votes came from the principal investigators. The VA funding program had no role in study design or data analysis. Study authors were given full access to analyses of the data files.

RESULTS

Respondent Characteristics

Table 2 lists demographic and health-related characteristics for VA and commercial managed care study participants. Compared with commercial managed care patients, patients in the VA system were older (65 vs. 61 years of age; $P < 0.001$), were more likely to be male (98% vs. 46%; $P < 0.001$), and had lower incomes ($P < 0.001$). Patients in VA care were also more likely to report fair or poor health and had more prescribed medications (5.2 vs. 4.4 medications; $P < 0.001$).

Comparisons of Quality of Care

Unadjusted results (not shown) suggested that patients in the VA system were statistically significantly more likely to receive all recommended processes of care than patients in commercial managed care and met intermediate outcome goals more often for 2 of the 3 intermediate outcome measures. These results persisted after adjustment, ranging from a 10% difference on performance of an annual hemoglobin A_{1c} test (93% vs. 83%; $P = 0.006$) to a 26% difference on counseling for aspirin use (75% vs. 49%; $P < 0.001$) (**Table 3**). Adjusted results showed no difference in blood pressure control between VA and commercial managed care patients, but patients in the VA system were more likely to achieve the low-density lipoprotein (LDL) cholesterol level (86% vs. 72% for LDL cholesterol level < 3.37 mmol/L [<130 mg/dL]; $P = 0.002$) and hemoglobin A_{1c} value examined (92% vs. 80% for hemoglobin A_{1c} value $< 9.5\%$; $P = 0.006$).

Comparisons of Satisfaction with Care

In general, there were few differences in satisfaction with care between VA and commercial managed care respondents (**Table 4**), but patients in the VA system were slightly more satisfied with overall quality of diabetes care ($P = 0.02$).

Sensitivity Analyses

The predicted differences in quality of care between VA and commercial managed care were almost unaltered in our sensitivity analyses. First, we examined whether overall results were driven by differences in any one participating health plan and found that eliminating any one TRIAD site did not appreciably affect the predicted quality differences between VA and commercial managed care. Second, because VA facilities use only electronic medical records, which may have better documentation of services performed, we compared VA quality scores with the scores from 2 commercial managed care health plans that also extensively used electronic medical records. The differences between VA quality and commercial managed care quality essentially did not change. Finally, predicted differences between VA and commercial managed care did not change when VA quality scores were compared with scores from only the commercial managed care computer-assisted telephone interview respondents.

Table 2. **Demographic and Health-Related Characteristics for Veterans Affairs and Commercial Managed Care Participants***

Characteristic	VA Participants	CMC Participants	P Value
Mean age ± SD, y	65.1 ± 10.5 (1285 patients)	61.4 ± 13.0 (6616 patients)	<0.001
Men, n (%)	1254 (98)	3187 (46)	<0.001
Race, n (%)			<0.001
Non-Hispanic white	849 (67)	3371 (51)	
Non-Hispanic black	139 (11)	1342 (20)	
Hispanic	168 (13)	1249 (19)	
Asian or Pacific Islander	9 (1)	269 (4)	
Other	107 (8)	399 (6)	
Education, n (%)			<0.001
8th grade or less	90 (7)	803 (12)	
Some high school	183 (14)	975 (14)	
High school or GED	383 (30)	1896 (28)	
Some college	430 (34)	1921 (28)	
4-year college graduate or more	197 (15)	1224 (18)	
Annual household income, n (%)			<0.001
<$15 000	439 (36)	2070 (33)	
$15 000–$39 000	563 (46)	1889 (31)	
$40 000–$74 999	174 (14)	1404 (23)	
≥$75 000	56 (4)	837 (13)	
Diabetes treatment, n (%)			<0.001
Diet and exercise only	57 (4)	477 (7)	
Oral medication only	752 (59)	4175 (60)	
Insulin and oral medication	239 (19)	873 (13)	
Insulin only	237 (18)	1403 (20)	
Mean duration of diabetes ± SD, y	12.6 ± 10.1 (1194 patients)	12.2 ± 10.3 (6551 patients)	<0.001
Self-reported health status, n (%)			<0.001
Excellent	50 (4)	289 (4)	
Very good	194 (15)	1205 (17)	
Good	423 (33)	2659 (39)	
Fair	432 (34)	2121 (31)	
Poor	181 (14)	600 (9)	
Medical comorbid conditions, n (%)			<0.001
0	434 (34)	3490 (50)	
1–2	644 (51)	2775 (40)	
3–4	178 (14)	600 (9)	
5–7	17 (1)	63 (1)	
Reported visits to doctor in past year, n (%)			0.02
0–1	188 (17)	698 (11)	
2–4	253 (22)	1506 (24)	
5–9	405 (36)	3030 (49)	
≥10	282 (25)	1020 (16)	
Mean medications ± SD, n	5.2 ± 2.0 (1285 patients)	4.4 ± 2.7 (6928 patients)	<0.001
Mean body mass index ± SD, kg/m²	31.0 ± 6.3 (1277 patients)	31.3 ± 7.3 (6704 patients)	0.03

* CMC = commercial managed care; GED = general educational development; VA = Veterans Affairs.

DISCUSSION

We believe that this is the first study to use equivalent instruments and methods to compare quality of diabetes care for patients treated in the VA system with quality for those in commercial managed care systems. We should note that the average results for diabetes quality among the commercial managed care plans participating in this study are at or near the top of diabetes performance when compared with national results for commercial plans participating in the National Committee for Quality Assurance accreditation process (23). Despite this relatively high level of performance in the commercial plans, we found that the processes of care and 2 intermediate outcomes for VA study participants were better than or as good as those for commercial managed care participants. These results are consistent with findings by Jha and colleagues (11), who demonstrated that VA quality improved during the period that the VA system embarked on reengineering strategies. The findings further suggest that efforts to improve the quality of care in the VA system, achieved partly by emulating managed care practices (10), have been successful.

In many cases, the observed differences in quality of care between VA and commercial managed care were large. In fact, the difference between mean LDL cholesterol levels for our 2 cohorts (2.5 mmol/L [97 mg/dL] in the VA sample and 2.9 mmol/L [113 mg/dL] in commercial managed care sample) was approximately half of the absolute difference in LDL cholesterol levels between intervention and control groups achieved in the Heart Protection Study

(24), which showed a mortality benefit from treatment with simvastatin. Nonetheless, for both VA and commercial care, there was still clinically significant potential for improvement of blood pressure control (25). This suggests that further quality improvement and monitoring mechanisms must be instituted in both VA and commercial managed care plans to improve treatment methods that may affect intermediate outcomes. These mechanisms should not be restricted to screening and should focus particularly on promoting appropriate treatment for patients with poor control or with diabetes complications (26).

Although we cannot draw specific conclusions from our study about the mechanisms by which VA performance was better, responses on a survey that was administered to the medical directors and key quality improvement personnel provide some information about which quality improvement strategies may have allowed the VA system to attain better diabetes quality scores than some of the best commercial managed care organizations. For example, of the 8 commercial managed care health plans studied, we have found that 3 maintained a diabetes registry, 2 generated automated feedback to providers on quality of care, 3 generated patient reminders, 5 used guidelines, and 4 had diabetes management programs in place. At the regional health care system level, we have found that 80% to 100% of the 5 VA health care systems had these same care management activities in place. Although these care management strategies seem to have been used more at the VA regional level, variable penetration of these activities occurred down to the practice level in both systems of care, and we do not have data on whether any programs were stopped during the field period. Also, because of the small number of sampling units in the current analysis, we do not have sufficient power to look at the effect of each activity individually on the outcomes of interest.

Moreover, as an integrated health care system, the VA system has implemented several simultaneous, national-level strategies, such as an integrated electronic medical record, unified nationwide guidelines, service integration, alignment of payment incentives, and effective performance monitoring. While almost all commercial managed care plans also had established diabetes quality improvement and monitoring systems, the Chronic Care Model (27) suggests that changes in several domains of care and investment in quality by organizational leaders are necessary to move the quality needle effectively. For example, while both the VA system (through its own quality assessment program, the External Peer Review Program [EPRP] [28]) and the 8 commercial managed care plans (through HEDIS assessments and reporting) have been monitoring quality of care for diabetes by using measures endorsed by DQIP since at least 2000, the VA system has also implemented various other mechanisms that may be enhancing these quality "report cards." The VA facilities are rewarded for high performance on EPRP measures (29). Clinical reminders on performance measures were built into the electronic medical record (30–32), and evidence-based VA diabetes guidelines were developed and actively disseminated through various methods and mechanisms (30, 33, 34), including an easily accessible version through the VA intranet (35). Economies of scales resulting from a national system (and perhaps also from the VA's system of 21 hospital networks) probably facilitated the development and dissemination of these quality improvement initiatives.

This study uses standardized procedures for sampling, data collection, and measure specification in contempora-

Table 3. **Adjusted Quality-of-Care Rates for Veterans Affairs and Commercial Managed Care Participants***

Quality-of-Care Measure (Data Source)	VA Rate (95% CI) ($n = 1273$), %	CMC Rate (95% CI) ($n = 6901$), %	P Value
Processes of care			
Annual eye examination (hybrid)	91 (87–93)	75 (69–80)	<0.001
Eye examination (medical record)	57 (38–75)	28 (16–46)	0.03
Eye examination (survey)	88 (84–92)	72 (67–77)	<0.001
Annual hemoglobin A_{1c} test	93 (89–96)	83 (76–87)	0.005
Annual lipid screening	79 (69–86)	63 (51–73)	0.02
Annual foot examination (hybrid)	98 (96–99)	84 (79–88)	<0.001
Foot examination (medical record)	87 (80–91)	50 (40–60)	<0.001
Foot examination (survey)	92 (88–95)	76 (69–82)	<0.001
Annual proteinuria screening	92 (89–95)	81 (75–86)	0.005
Aspirin use counseling	75 (69–79)	49 (44–53)	<0.001
Influenza vaccination	72 (66–77)	64 (60–68)	0.04
Intermediate outcomes			
Blood pressure < 140/90 mm Hg	53 (46–60) (1222 patients)	52 (47–57) (6161 patients)	>0.2
Blood pressure < 130/85 mm Hg	29 (23–35) (1222 patients)	29 (25–34) (6161 patients)	>0.2
Hemoglobin A_{1c} value < 9.5%	92 (87–95) (1173 patients)	80 (72–86) (5769 patients)	0.006
Hemoglobin A_{1c} value < 8.5%	83 (75–89) (1173 patients)	65 (54–75) (5769 patients)	0.009
LDL cholesterol level < 3.37 mmol/L (<130 mg/dL)	86 (81–90) (995 patients)	72 (68–76) (4398 patients)	0.002
LDL cholesterol level < 2.59 mmol/L (<100 mg/dL)	52 (45–59) (995 patients)	36 (32–40) (4398 patients)	0.003

* Higher rates represent higher quality. Models are adjusted for all covariates reported in Table 2 except for sex and date of survey administration. CMC = commercial managed care; LDL = low-density lipoprotein; VA = Veterans Affairs.

Table 4. **Adjusted Satisfaction Scores for Veterans Affairs and Commercial Managed Care Participants***

Satisfaction Measure	VA Group		CMC Group		P Value
	Participants, *n*	Score (95% CI)	Participants, *n*	Score (95% CI)	
Getting needed care	1165	5.5 (5.4–5.6)	5973	5.6 (5.5–5.7)	0.07
Courteous and helpful office staff	1180	5.3 (5.2–5.5)	6026	5.4 (5.3–5.5)	>0.2
How well doctors communicate	1177	10.5 (10.3–10.8)	5990	10.5 (10.3–10.6)	>0.2
Overall quality of diabetes care	1260	4.1 (3.9–4.2)	6312	3.8 (3.8–3.9)	0.02

* Higher scores represent higher satisfaction. Models are adjusted for all covariates reported in Table 2 except for sex and date of survey administration. CMC = commercial managed care; VA = Veterans Affairs.

neous, geographically matched cohorts to examine quality of care for VA and commercial managed care patients. Despite its methodologic strengths, our study has several limitations. Our results may not be generalizable to all regions or health plans since this is an observational study in 5 geographic regions. Some of the differences in performance could also reflect differences in documentation because the VA's detailed electronic medical record system (36) may allow for more thorough recording of processes of care. Indeed, there was a greater discrepancy between self-report and medical record data for foot and eye examinations among the commercial managed care participants than among the VA participants. Nonetheless, 2 of the 3 intermediate outcomes, which are less likely to reflect documentation differences, substantially differed. When we compared processes of care between the VA system and those commercial managed care plans with well-developed electronic records, the magnitude of these differences remained.

In addition, differences between the VA and commercial managed care populations in severity of diabetes or comorbid conditions, beyond those factors measured in the study, may affect comparisons of care, especially for intermediate outcomes (26, 37) and satisfaction (38). On the other hand, patients in the VA system are more likely to have characteristics associated with receiving worse quality of care and reporting lower satisfaction, making these unmeasured differences an unlikely explanation for better performance among VA respondents (12).

Other study design issues might also have affected our results. The VA data were collected later than the commercial managed care data. Because of this, for most cases the quality of VA care reported was for a later time than the quality of commercial managed care. If care had been improving in the commercial managed care organizations during this time, the differences between VA and commercial managed care could be an overestimate. However, we found no improvement in commercial managed care quality during the 15-month survey collection period and considered it unlikely that the large differences in quality of care that we report resulted from the time lag between the 2 groups. Finally, the response rate in the VA sample was lower than that in the commercial sample, and if VA nonrespondents received substantially worse quality of care than commercial managed care nonrespondents, our re-

sults could be biased. Although institutional review board regulations prohibited us from verifying nonrespondents' quality information, we did compare quality results for the TRIAD VA cohort to similar measures detailed in the national VA quality monitoring report for fiscal year 2002 (39). This report, based on medical record reviews of patients with visits to VA facilities nationwide, is part of system-wide quality improvement efforts, and no consent is required for medical record review. For measures that were specified in a manner similar to those reported in this paper (39), rates of performance for the TRIAD VA sample were similar to or slightly lower than that reported by EPRP. For example, 92% received foot inspection versus 87% in the TRIAD VA sample; 94% received an annual hemoglobin A_{1c} test versus 93% in the TRIAD VA sample; and 58% had blood pressure less than 140/90 mm Hg versus 53% in the TRIAD VA sample. Therefore, it is unlikely that the sampling strategy or response rate in the VA sample biased results toward higher VA quality.

Our results suggest that a federally sponsored national health care organization can provide care that is equivalent to or better than that provided by high-performing commercial managed care plans. If commercial plans are going to achieve the same levels of diabetes process quality as the VA system, they may need to make major parallel investments in several domains of clinical care structure, such as information technology, care integration, performance monitoring, and payment incentives. Comparing the costs of diabetes care in the VA system with those in commercial plans may also help to elucidate the value of such investments. Further research should examine how specific organizational factors are associated with better quality, examine the intensity of treatment of intermediate outcomes, and assess which organizational factors can improve treatment of intermediate outcomes and reduce end-stage diabetes complications.

APPENDIX 1: TRANSLATING RESEARCH INTO ACTION FOR DIABETES (TRIAD) STUDY GROUP

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Consultant: Joseph Humphry, MD. Analysts: Rebecca Glavan; Andrew White, PhD; Ken Forbes; James Cooper, MA; Ruth Baldino.

Indiana University Translational Research Center: Principal Investigator: David G. Marrero, PhD. Co-Investigators: Morris Weinberger, PhD; William M. Tierney, MD; Paris Roach, MD. Project Coordinator: Susanna R. Williams, MSPH.

Kaiser Foundation Research Institute: Principal Investigator and Study Chairman: Joe V. Selby, MD, MPH. Co-Principal Investigator: Andrew J. Karter, PhD, MS. Co-Investigator: Assiamira Ferrara, MD, PhD. Project Director: Bix E. Swain.

University of California, Los Angeles: Principal Investigator: Carol M. Mangione, MD, MSPH. Co-Principal Investigator: Arleen F. Brown, MD. Co-Investigators: Susan Ettner, PhD; Shaista Malik, MD; Martin F. Shapiro, MD, PhD. Data Analysts: Peter R. Gutierrez; Neil Steers, PhD. Project Director: Rebecca Brusuelas. Senior Administrator: Carole Nagy.

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University of Michigan Health System: Principal Investigator: William H. Herman, MD, MPH. Co-Principal Investigator: Catherine Kim, MD, MPH. Project Director: Jennifer Goewey, MHA. Programmer and Analyst: Diane Kennedy. Research Associates: Ray Burke, MA; Bahman Tabaei, MPH. Administrative Assistants: Barbara Pearlman, Kelly Fearer, William Sowa. Central Administrative Data Coordinator: Barb Smith, MHSA.

Department of Veterans Affairs: Principal Investigator: Eve A. Kerr, MD, MPH. Co-Principal Investigator: Rodney A. Hayward, MD. Co-Investigators: Sarah Krein, PhD; John Piette, PhD; Leonard Pogach, MD, MBA; Martin Charns, DBA. Project Managers: Fatima Makki, MPH, MSW; Jill Baker, MSW. Data Managers: Jennifer Davis, MPH; Emily Lipp, MPH.

National Institute of Diabetes and Digestive and Kidney Diseases: Sanford A. Garfield, PhD.

Centers for Disease Control and Prevention: Principal Scientist: K.M. Venkat Narayan, MD, MSc, MBA. Co-Scientists: Theodore Thompson, MS; Edward W. Gregg, PhD; Robert Gerzoff, MS; Michael M. Engelgau, MD, MS; Gloria Beckles, MB, BS, MSc; Patrick Boyle, PhD; David F. Williamson, PhD, MS. Project Administrator: Bernice Moore, MBA.

From Veterans Affairs Ann Arbor Healthcare System, Center for Practice Management and Outcomes Research, and University of Michigan, Ann Arbor, Michigan; Centers for Disease Control and Prevention, Atlanta, Georgia; Kaiser Permanente, Oakland, California; Pacific Health Research Institute, Honolulu, Hawaii; Indiana University School of Medicine, Indianapolis, Indiana; University of Medicine and Dentistry of New Jersey–New Jersey Medical School, Newark, New Jersey; and David Geffen School of Medicine, University of California, Los Angeles, Los Angeles, California.

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APPENDIX 2: MODEL DETAILS

Hierarchical modeling (40) is a method for analyzing data with nested sources of variability (for example, patients in a health plan) that allow for correlated observations in a cluster. Using hierarchical logistic regression, we modeled each quality-of-care measure separately:

Let y_{ij} be a quality-of-care measure for the ith person in the jth cluster. X_{ij} is the row vector of covariates, including an indicator for VA versus commercial managed care, for the ith person in the jth cluster. A cluster is defined for each of the 5 VA medical centers and for the 8 commercial managed care organizations grouped into 5 geographic regions. Then:

$$y_{ij} \sim \text{Bernoulli}(\pi_{ij})$$

$$\text{logit}(\pi_{ij}) = X_{ij}\beta + u_j$$

$$u_j \sim \text{Normal}(0, \sigma_u^2).$$

Here β is a column vector of fixed effects and the u_j, $j = 1, \ldots, 10$, are random effects. The models were fit by using quasi-likelihood methods (41) as implemented in the SAS GLIMMIX macro (41). Adjusted rates are expected values for y_{ij} obtained from setting the covariates to their mean value (except the VA–commercial managed care indicator) and setting the random effects to 0.

The satisfaction measures were modeled by using hierarchical linear models. Let y_{ij} be a satisfaction measure for the ith person in the jth cluster and let X and u be defined previously. Then:

$$y_{ij} = X_{ij}\beta + u_j + e_{ij}$$

$$u_j \sim \text{Normal}(0, \sigma_u^2)$$

$$e_{ij} \sim \text{Normal}(0, \sigma_e^2).$$

These models were fit by using (restricted) maximum likelihood methods in SAS Proc MIXED (42). Adjusted scores are expected values for y_{ij} obtained from setting the covariates to their mean value (except the VA–commercial managed care indicator) and setting the random effects to 0.

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Appendix Table 1. **Adjusted Quality-of-Care Rates for Veterans Affairs and Commercial Managed Care Male Participants***

Quality-of-Care Measure (Data Source)	VA Rate (95% CI) (n = 1243), %	CMC Rate (95% CI) (n = 3154), %	P Value
Processes of care			
Annual eye examination (hybrid)	89 (86–92)	74 (70–79)	0.001
Eye examination (medical record)	56 (37–73)	28 (16–45)	0.04
Eye examination (survey)	87 (82–90)	72 (67–77)	0.002
Annual hemoglobin A_{1c} test	93 (89–96)	82 (76–87)	0.006
Annual lipid screening	79 (68–87)	64 (51–74)	0.05
Annual foot examination (hybrid)	97 (95–99)	85 (80–89)	<0.001
Foot examination (medical record)	87 (80–92)	48 (37–59)	<0.001
Foot examination (survey)	92 (89–95)	78 (72–83)	0.001
Annual proteinuria screening	92 (87–95)	81 (74–87)	0.01
Aspirin use counseling	75 (69–80)	55 (50–59)	<0.001
Influenza vaccination	72 (66–78)	65 (61–70)	0.11
Intermediate outcomes			
Blood pressure < 140/90 mm Hg	48 (41–55) (1192 patients)	57 (52–61) (2767 patients)	0.09
Blood pressure < 130/85 mm Hg	25 (20–32) (1192 patients)	33 (28–38) (2767 patients)	0.08
Hemoglobin A_{1c} value < 9.5%	93 (89–96) (1144 patients)	80 (73–85) (2637 patients)	0.004
Hemoglobin A_{1c} value < 8.5%	84 (77–90) (1144 patients)	65 (54–74) (2637 patients)	0.007
LDL cholesterol level < 3.37 mmol/L (<130 mg/dL)	86 (80–90) (971 patients)	75 (69–80) (2090 patients)	0.02
LDL cholesterol level < 2.59 mmol/L (<100 mg/dL)	56 (48–63) (971 patients)	39 (34–44) (2090 patients)	0.007

* Higher rates represent higher quality. Models are adjusted for all covariates reported in Table 2 except for sex and date of survey administration. CMC = commercial managed care; LDL = low-density lipoprotein; VA = Veterans Affairs.

Appendix Table 2. **Adjusted Satisfaction Scores for Veterans Affairs and Commercial Managed Care Male Participants***

Satisfaction Measure	VA Group		CMC Group		P Value
	Participants, n	Score (95% CI)	Participants, n	Score (95% CI)	
Getting needed care	1138	5.5 (5.3–5.6)	2658	5.6 (5.5–5.7)	>0.2
Courteous and helpful office staff	1152	5.4 (5.2–5.5)	2687	5.4 (5.3–5.5)	>0.2
How well doctors communicate	1149	10.5 (10.3–10.9)	2670	10.5 (10.3–10.7)	>0.2
Overall quality of diabetes care	1232	4.1 (4.0–4.3)	2849	3.9 (3.8–4.0)	0.06

* Higher scores represent higher satisfaction. Models are adjusted for all covariates reported in Table 2 except for sex and date of survey administration. CMC = commercial managed care; VA = Veterans Affairs.