

Diabetes Treatment Among VA Patients With Comorbid Serious Mental Illness

Sarah L. Krein, Ph.D., R.N.

C. Raymond Bingham, Ph.D.

John F. McCarthy, Ph.D., M.P.H.

Allison Mitchinson, M.P.H.

Jonathan Payes, M.A.

Marcia Valenstein, M.D., M.S.

Objective: Patients with serious mental illnesses, such as schizophrenia, bipolar disorder, and other psychoses, may be less likely to receive adequate care for chronic medical conditions than patients without serious mental illness. The quality and outcomes of diabetes care were compared in an observational study among patients with and without serious mental illness. **Methods:** National data were studied for 36,546 individuals receiving care within the U.S. Department of Veterans Affairs (VA) health care system. Widely used diabetes quality-of-care measures and intermediate outcomes were compared for patients with diabetes and serious mental illness and age-matched patients with diabetes who did not have a serious mental illness. Patients' use of health services was also examined. **Results:** During fiscal year 1998, patients with diabetes and serious mental illness were as likely as patients with diabetes alone to have their hemoglobin A1c, low-density lipoproteins (LDL), and cholesterol measured; both groups had comparable A1c, LDL, and cholesterol values. Patients with diabetes and serious mental illness had more outpatient visits, both primary care and specialty visits, and made more multiclinic visits, including visits to both primary care and mental health services on the same day. **Conclusions:** In the VA, patients with diabetes and serious mental illness appear to receive diabetes care that is comparable with the care that other patients with diabetes receive, possibly because of increased levels of contact with the health system and the VA's integration of medical and mental health services. (*Psychiatric Services* 57:1016–1021, 2006)

Individuals with serious mental illnesses, such as schizophrenia, bipolar disorder, and other psychoses, represent a high-risk patient subpopulation, with complex, ongoing treatment service needs. Many of these individuals also have comorbid medical illnesses and are at increased risk for poor health outcomes. High rates of morbidity and mortality have been reported among patients with serious mental illness and have sometimes been attributed to health system characteristics, including inadequate integration of the delivery of psychiatric and nonpsychiatric services. Patients with serious mental illness also may be at increased risk for poor outcomes because of decreased access to providers or poorer health habits and treatment adherence.

The U.S. Department of Veterans Affairs (VA) health care system provides the ideal context for examining characteristics of health services treatment among large samples of patients with serious mental illness. The VA information system is regarded as one of the best in the nation, and VA administrative data include detailed diagnosis and treatment measures. Moreover, the VA has transformed itself over the past decade, substantially enhancing its integration of services. We evaluated the hypothesis that patients with serious mental illness are less likely to receive adequate treatment for nonpsychiatric illnesses. Specifically, we compared processes of care for diabetes and intermediate disease outcomes (hemoglobin A1c levels), which influence later health outcomes (for exam-

Dr. Krein is affiliated with the Center for Practice Management and Outcomes Research, Department of Veterans Affairs Ann Arbor Healthcare System, and with the Department of General Medicine, University of Michigan. Dr. Bingham is with the Transportation Research Institute, University of Michigan. Dr. McCarthy and Dr. Valenstein are with National Serious Mental Illness Treatment Research and Department of Veterans Affairs, Ann Arbor, and with the Department of Psychiatry, University of Michigan. Ms. Mitchinson is with the Center for Practice Management and Outcomes Research, Department of Veterans Affairs Ann Arbor Healthcare System. Mr. Payes is with the Department of Psychiatry, Case Western Reserve University, Cleveland, Ohio. Send correspondence to Dr. Krein at HSR&D Center of Excellence, HSR&D/SMITREC, Department of Veterans Affairs, P.O. Box 130170, Ann Arbor, Michigan 48113-0170 (e-mail, skrein@umich.edu).

ple, risk of blindness) among VA patients with diabetes with and without serious mental illness.

As a chronic condition requiring ongoing care and often complex treatment, diabetes can pose substantial management challenges for patients and health care providers. Conditions associated with reduced functioning, especially mental, cognitive, and emotional functioning, may particularly complicate diabetes treatment and worsen health and other outcomes. For example, several previous studies have reported that depression is associated with poorer adherence to dietary and self-management recommendations (1,2), poorer glycemic control (3), greater social and vocational impairments (4), and increased health care cost and utilization of services (2,5–8).

Diabetes is a prevalent condition among patients with schizophrenia (9–11), and second-generation antipsychotic medications commonly used to treat psychosis may further increase patients' risk for diabetes (12–15). Among VA patients who received a diagnosis of serious mental illness in a given year, one in five also received a diagnosis of diabetes. Serious mental illnesses may cause additional difficulties in diabetes management and make positive outcomes harder to achieve. However, two recent studies (16,17) found little evidence of poorer quality of diabetes care for patients with a co-occurring serious mental illness. These studies focused only on the receipt of recommended care processes, such as having a foot sensory exam, or on a single intermediate outcome (A1c). In addition, they did not explore mechanisms that might account for or promote good-quality care for these patients.

In this study, we compared large national samples of patients who had diabetes and a serious mental illness with patients who had diabetes and no diagnosis of mental illness using several diabetes-specific process measures and intermediate outcomes. We also examined inpatient and outpatient health care utilization and patterns of care to better understand how the organization of care delivery might influence these processes and outcomes.

Methods

Study design and setting

Approval for this study was obtained from the institutional review board at the Ann Arbor VA Healthcare System. Data were obtained from two VA health services registries: the National Psychosis Registry (18) and the Healthcare Analysis and Information Group/QUERI-DM (Quality Enhancement Research Initiative for Diabetes Mellitus) diabetes registry (19). We examined data for patients receiving care in fiscal year (FY) 1998 (October 1, 1997–September 30, 1998). Serious mental illness was operationally defined as having a diagnosis in one of five *ICD-9-CM* (20) mental health diagnostic categories: all diagnoses of schizophrenia except latent schizophrenia, schizoaffective disorder, bipolar disorder, other nonorganic psychoses, paranoid states, and affective psychoses. The National Psychosis Registry contains utilization data, including diagnoses and procedures for inpatient stays and outpatient visits.

The FY 1998 diabetes registry contains pharmacy, laboratory, and utilization information for individuals with diabetes who used VA health services during the fiscal year. Patients with diabetes were identified as those who received a prescription for insulin, an oral hypoglycemic agent, or blood glucose monitoring supplies or who had at least one inpatient encounter or two outpatient encounters with a diabetes-related diagnosis code (*ICD-9-CM* codes 250.0–250.9, 357.2, 362.0, and 366.41).

The two registries were used to identify two mutually exclusive groups of patients. The first group included 18,273 patients with both diabetes and a comorbid serious mental illness in FY 1998. The second group consisted of a randomly selected age-matched set of 18,273 patients with diabetes who did not have a diagnosis of serious mental illness. To screen out individuals who might have used the VA to receive medication only, all patients needed to have had at least one primary care or mental health care visit during the year to be included in the study. Also, because the utilization part of the study primarily focused on ambulatory care, patients with an inpatient stay longer than 150 contiguous days were excluded.

Measures

Indicators of diabetes management.

Our selection of diabetes process and outcome measures for the analysis was based on recommended clinical standards for diabetes management. Specifically, we used the set of measures (both technical process and intermediate outcome) proposed for diabetes care monitoring and quality improvement through the Diabetes Quality Improvement Project (21). The indicators used for this study were the percentage of patients who had at least one hemoglobin A1c level obtained in the past year, the hemoglobin A1c level and the percentage of patients with a high-risk hemoglobin A1c level (A1c ≥ 9.5 percent) based on the last value obtained, the percentage of patients who had a low-density lipoprotein (LDL) cholesterol measure in the past year, the LDL level and the percentage of patients with high-risk LDL values based on the most recent test using a cutoff of 130 mg/dl, and the percentage of patients who had a total cholesterol test (because an LDL level could not be calculated for some patients because of elevated triglyceride levels). For quality measures related to having had a test in the past year, higher percentages indicated higher quality, whereas for measures based on test values, such as mean A1c value, lower values or percentages indicated better quality.

Inpatient and outpatient utilization.

Inpatient utilization measures included the number and percentage of patients with at least one inpatient stay and the average length of stay per patient. Outpatient care was measured by the total number of outpatient visits and the average number of visits per patient. An outpatient visit was defined as all outpatient encounters occurring on the same day, and each visit was classified according to the types of clinics visited by the patient: primary care only; mental health care only; specialty care only; or a multi-clinic visit, which was a visit to more than one type of clinic on the same day—for example, visits to both primary care and mental health care clinics. Primary care included general internal medicine, diabetes clinic, geriatrics clinic, and primary care. Mental health care included encounters for

Table 1

Diabetes care processes and intermediate outcomes stratified by treatment regimen for 36,546 Veterans Affairs patients

Treatment and measure	Diabetes and serious mental illness (N=18,273)		Diabetes only (N=18,273)		Diabetes and serious mental illness versus diabetes only	
	N	%	N	%	Pooled SE	Effect size ^a
No hypoglycemic medication	3,605		2,667			
HbA1c measured in the past year	2,308	64	1,709	64	.48	.00
HbA1c value (mean±SD) ^b	6.8±1.68		7.2±1.74		1.72	-.22
HbA1c >9.5 percent		7		10	.28	-.08
LDL measured in past year ^c	944	26	728	27	.44	-.03
LDL value (mean±SD mg/dl) ^d	118±34.58		119±33.53		34.12	-.03
LDL >130 mg/dl		35		37	.48	-.03
Cholesterol measured in the past year	1,694	47	1,253	47	.50	.00
Oral agents only	8,963		9,453			
HbA1c measured in the past year	6,213	69	6,123	65	.47	.10
HbA1c value (mean±SD %) ^b	7.5±1.91		7.8±1.92		1.92	-.15
HbA1c >9.5 percent		13		16	.35	-.07
LDL measured in the past year	3,108	35	3,274	35	.48	.00
LDL value (mean±SD mg/dl) ^d	118±35.05		118±33.29		34.16	.01
LDL >130 mg/dl		33		32	.47	.02
Cholesterol measured in the past year	5,736	64	5,672	60	.48	.08
Insulin	5,705		6,153			
HbA1c measured in the past year	3,960	69	4,005	65	.47	.09
HbA1c value (mean±SD %) ^b	8.4±2.18		8.5±2.13		2.16	-.09
HbA1c >9.5 percent		25		27	.44	-.03
LDL measured in the past year	1,935	34	1,907	31	.47	.06
LDL value (mean±SD mg/dl) ^d	118±41.55		117±37.12		39.41	.01
LDL >130 mg/dl		33		32	.47	.03
Cholesterol measured in the past year	3,765	66	3,507	57	.49	.18

^a Cohen's d was used to estimate the effect size for differences in independent means, and Cohen's h was used as an estimate of the effect size for differences in independent proportions (22).

^b Values range from 3.0 to 22.3, with higher values indicating poorer HbA1c control.

^c Low-density lipoprotein. To convert LDL cholesterol to millimoles per liter, multiply by .02586.

^d Values range from 47 to 217, with higher values indicating poorer LDL control.

mental illness treatment (individual and group), substance abuse treatment and rehabilitation, intensive case management, and intensive individual programs. Specialty care included encounters at clinics offering specialized care, such as dermatology, ophthalmology, and neurology. Outpatient encounters that did not fall into one of the three classes, such as visits for laboratory tests, were disregarded.

Statistical analysis

Group comparisons were initially conducted using one-way analysis of variance (ANOVA) and chi square tests. Because of the large sizes of the groups being compared in this study, however, conventional tests of statistical significance were not necessarily clinically meaningful, as small differences were often statistically significant. Thus, instead of using statistical significance as a primary tool in identifying potentially important results, es-

timates of effect size were used to aid in data interpretation. Cohen's d (22) was used to estimate effect sizes for the ANOVA models, and odds ratios (ORs) (23) represented the effect size for chi square tests. Small, medium, and large effects were .20, .50, and $\geq .80$ for Cohen's d; 1.2, 1.5, and ≥ 2.0 for positive ORs; and .83, .67, and $\leq .5$ for negative ORs. All comparisons of diabetes care processes and intermediate outcomes were stratified by treatment regimen as a proxy for disease severity. Specifically, patients were categorized as to whether they were treated without any hypoglycemic agents (indicating milder disease), treated with oral hypoglycemic agents only, or treated with insulin (indicating more severe disease).

Results

The study sample was predominantly male (97 percent in the diabetes-only group and 96 percent in the diabetes

and serious mental illness group) with a mean age of 58±12 years. A higher proportion of those in the diabetes-only group were married (29 percent compared with 21 percent). Among patients with an identified race or ethnicity classification, those in the diabetes-only group were slightly more likely than patients with comorbid serious mental illness to be classified as white (69 percent compared with 64 percent) and less likely to be classified as Hispanic (8 percent compared with 11 percent) or black (22 percent compared with 24 percent). Within the diabetes and serious mental illness group, 73 percent were diagnosed as having schizophrenia, 18 percent as having bipolar disorder, and 9 percent as having another type of psychosis.

Quality of diabetes care

Table 1 presents the comparison of diabetes care processes and intermediate outcome measures between the

Table 2

Utilization of inpatient and outpatient health care services among patients with diabetes only and patients with diabetes and a comorbid serious mental illness

Type of utilization	Diabetes only (N=18,273)			Diabetes and serious mental illness(N=18,273)		
	N	%	Mean±SD	N	%	Mean±SD
Inpatient care						
Inpatient stay ^a	3,225	17.6		6,953	38.1	
Length of stay (mean±SD days) ^b			8.2±11.4			12.0±15.9
Outpatient visits per patient						
Primary care only	18,166	99.4 ^c	4.8±3.9	18,175	99.5 ^c	5.8±5.5
Mental health care only	3,617	19.8	2.1±11.6	17,602	96.3 ^c	17.9±35.3
Specialty care only	13,825	75.7	4.2±5.7	14,873	81.4	5.3±7.9
Multiclinic	6,539	35.8	2.2±2.7	12,533	68.6	3.5±5.9
Total visits per patient (mean±SD) ^d			16.4±18.2			36.7±40.1
Total outpatient visits	299,530	100		670,070	100	
Primary care only	76,143	25.4		77,095	11.5	
Mental health care only	34,188	11.4		292,379	43.6	
Specialty care only	64,655	21.6		71,461	10.7	
Multiclinic	14,186	4.7		43,717	6.5	
Other ^e	110,358	36.8		185,418	27.7	

^a OR=2.8 for between-group comparison with approximate 95 percent CI based on Woolf's method of 2.67–2.94.

^b Cohen's d=.26 for between-group comparison.

^c High percentages are an artifact of sampling criteria that included a high proportion of patients with these types of care.

^d d=.62 for between-group comparison.

^e Includes visits for ancillary services such as laboratory tests or physical therapy

two patient groups stratified by diabetes treatment regimen. Only one difference in the quality-of-care measures and intermediate outcomes between patients with diabetes and those with diabetes and serious mental illness reached a small effect size. Among patients who did not receive hypoglycemic medications (who presumably had less severe diabetes), patients with only diabetes had slightly higher A1c levels than their counterparts who also had a serious mental illness.

Otherwise, within each treatment stratum, the two groups of patients had very similar amounts of diabetes care and levels of control.

Utilization of inpatient and outpatient care

Differences in inpatient and outpatient health care utilization between the two groups are shown in Table 2. Patients in the diabetes and serious mental illness group had more total contact with the health care system

than patients with solely diabetes and received both more inpatient and outpatient services. Patients with diabetes and serious mental illness were 2.8 times more likely than the diabetes-only group to have had an inpatient stay and also had a slightly longer length of stay when hospitalized. Patients with comorbid serious mental illness also made far more visits to outpatient care. On average, patients with diabetes and serious mental illness had more than double the

Table 3

Multiclinic visits by type for patients with diabetes with and without comorbid serious mental illness

Type of visit	Diabetes only (N=6,539)		Diabetes and serious mental illness (N=12,533)	
	N	%	N	%
Multiclinic outpatient visits per patient	6,539		12,533	
Primary care and mental health care	1,094	16.7	6,137	49.0
Primary care and specialty care	4,840	74.0	2,986	23.8
Mental health care and specialty care	520	8.0	2,927	23.3
Primary care, mental health care, and specialty care	85	1.3	483	3.9
All multiclinic outpatient visits	14,186		43,717	
Primary care and mental health care	2,756	19.4	19,060	43.6
Primary care and specialty care	9,274	65.4	8,567	19.6
Mental health care and specialty care	1,812	12.8	14,056	32.2
Primary care, mental health care, and specialty care	344	2.4	2,034	4.6

number of outpatient visits per person compared with diabetes-only patients (36.7 compared with 16.4; Cohen's $d=.62$, a moderate effect size).

Type of outpatient care

Table 2 also shows the types of outpatient care received by each patient group. Notably, patients with diabetes and serious mental illness not only had more total contact with the health system and more mental health visits than patients with diabetes alone, they also had more primary care, medical specialty, and multiclinic visits than did patients with diabetes only. On average, patients with diabetes and serious mental illness had 1.0 more visit to primary care than patients with diabetes only (mean of 5.8 visits compared with 4.8), 1.1 more specialty medical visits (mean of 5.3 compared with 4.2), and 1.3 more multiclinic visits (mean of 3.5 compared with 2.2).

The frequency of multiclinic visits made by the patients with diabetes and serious mental illness is especially striking, with a total of 43,171 multiclinic visits, compared with 14,186 for the diabetes-only group. On a per-patient basis, 69 percent of those in the group with diabetes and serious mental illness had a multiclinic outpatient visit, compared with 36 percent in the diabetes-only group, and nearly half of the multiclinic visits for patients with diabetes and serious mental illness involved both primary care and mental health services (Table 3).

Discussion

In general, patients with multiple chronic conditions, especially diabetes and comorbid serious mental illness, have challenging health care needs and subsequently may be more likely to receive poorer-quality diabetes care and have poorer outcomes. However, in this large-sample study, diabetes care processes and intermediate outcomes of patients with diabetes and serious mental illness did not differ appreciably from those of patients with diabetes alone. Performance on several of the measures might be considered poor for both groups, as compared with current performance and quality standards in the VA (24), although it is important to recognize that there have been substantial improvements in VA-delivered

diabetes care over the past several years (24–26). Our overall findings of comparable diabetes care processes and A1c values were somewhat unexpected, given prior research that has demonstrated a clear negative effect of concurrent depression on diabetes outcomes (2,3), even though our findings are consistent with two recent studies of individuals with diabetes and comorbid serious mental illness (16,17). Although the causal processes underlying these results remain unclear, this study offers some possible explanations.

Patients with diabetes and serious mental illness had much more contact with the health care system than patients with diabetes alone. Patients with diabetes and serious mental illness used more inpatient care than patients with diabetes only and had much higher levels of outpatient use, both of which, even if not focused specifically or solely on diabetes treatment, provide an increased opportunity to complete important diabetes care processes. Patients who also had serious mental illness not only had a greater number of total outpatient visits, they also had more primary care and specialty medical visits than patients with diabetes only. Patients with diabetes and serious mental illness made, on average, 36.7 outpatient visits compared with 16.4 visits for those with diabetes only. They had one additional primary care visit, 1.1 additional specialty medical care visits, and 1.3 more multiclinic visits during the year compared with visits for those with diabetes only.

The substantial number of visits involving multiple types of health care providers is especially noteworthy. In particular, 69 percent of patients with comorbid serious mental illness had visits involving multiple types of clinic encounters, compared with 27 percent of those with diabetes only, and nearly 50 percent of multiclinic visits for this group involved encounters with both primary care and mental health services. These results indicate that patients with diabetes and serious mental illness not only had more contact with health care providers but also may have received more intensive and integrated outpatient care. Unlike other health care systems that might provide only medical care and contract out for mental health care, the VA is an inte-

grated health care system that provides comprehensive access to health care across the full spectrum of health needs. In many areas this integration includes the actual physical integration of health care services, which allows patients with diabetes and comorbid serious mental illness to visit multiple clinics, receive treatment for both conditions, and have their prescriptions filled during a single visit day.

Integration also may be achieved through better communication among providers and referrals across specialties. The VA maintains an electronic patient record system that contains both medical and mental health care records for all patients treated at that medical center. Seamless access to patients' records gives providers greater insight into their patients' needs and potential conflicts between different aspects of their care, which creates opportunities for improving treatment. In addition, primary care providers can often refer patients for subspecialty care and mental health providers can refer their patients for medical care without requiring the patient to travel to another facility or burdening the patient with the stresses of reconciling conflicts that arise from referrals outside their health care system.

We note several study limitations. First, this analysis was based on a population of patients who were using the VA health care system. This population was primarily male and likely had a poorer health status than populations in other health care settings (27). Thus these results may not be generalizable to all populations. Second, with the exception of age and type of mental health condition, this analysis did not take into account specific sociodemographic factors, such as race, that may affect diabetes outcomes or utilization.

However, in a separate analysis we compared treatment utilization by the groups with diabetes with an age-matched group of patients with serious mental illness alone for each mental health diagnosis category and found few effects that appeared to be specific to a particular type of mental illness. Also, among patients with staff-identified race and ethnicity information, modest differences were observed by race and ethnicity, with those in the diabetes-only group more likely than pa-

tients with comorbid serious mental illness to be classified as white (69 percent compared with 64 percent) and less likely to be classified as Hispanic (8 percent compared with 11 percent) or black (22 percent compared with 24 percent).

Also, we were unable to assess the use of health services outside the VA system. We used visit-based criteria to restrict our analysis to those who had used the VA system, but this restriction could not ensure that patients did not also use services outside the VA. Consequently, if outside use was more likely among those with diabetes only, then our results may be somewhat overstated. Nonetheless, even with more outside use among those with diabetes only, we feel these results are robust in describing the potential benefits of medical and mental health services integration. Finally, we examined care processes and intermediate outcomes but not costs in this study. Achieving comparable outcomes for vulnerable diabetes patients with serious mental illness may require more health care resources and greater funding.

Conclusions

This study suggests that VA patients with diabetes and serious mental illness are receiving diabetes care of comparable clinical quality and have similar intermediate outcomes as VA patients with diabetes only. This finding could be due, in part, to individuals' with both conditions using considerably more health care services, meaning that there is more opportunity for delivering recommended services. Likewise, the integration of medical and mental health services, which is an inherent part of the VA health care delivery system, may also play an important role in ensuring that patients with diabetes and comorbid serious mental illness receive recommended diabetes care. Further research in this area is warranted, however, including longitudinal analyses to examine patterns of care over time. Adherence to diabetes and antipsychotic medications should also be compared to determine how much adherence might contribute to better diabetes outcomes as well as the interplay between diabetes treatment and mental health treatment. A more thorough understanding of these issues

is paramount to help inform the design of health care systems, both inside and outside the VA, that best meet the needs of patients with multiple complex chronic conditions.

Acknowledgments

This study was supported by grant DIB-98-001 from the Department of Veterans Affairs (VA), Health Services Research and Development Service; by the VA National Serious Mental Illness Treatment Research and Evaluation Center; and by grant NIH-5060 DK-20572 to Michigan Diabetes Research and Training. Dr. McCarthy was funded by Career Development Award Merit Review Entry Program MRP-03-320 from the VA Health Services Research and Development program. The authors thank the VA Healthcare Analysis and Information Group for their assistance with data collection. The views expressed in this article are the opinions of the authors and not necessarily the supporting agencies.

References

1. Carney RM, Freedland KE, Eisen SA, et al: Major depression and medication adherence in elderly patients with coronary artery disease. *Health Psychology* 14:88–90, 1995
2. Ciechanowski PS, Katon WJ, Russo JE, et al: The relationship of depressive symptoms to symptom reporting, self-care and glucose control in diabetes. *General Hospital Psychiatry* 25:246–252, 2003
3. Lustman PJ, Anderson RJ, Freedland KE, et al: Depression and poor glycemic control: a meta-analytic review of the literature. *Diabetes Care* 23:934–942, 2000
4. Wells KB, Stewart A, Hays RD, et al: The functioning and well-being of depressed patients: results from the Medical Outcomes Study. *JAMA* 262:914–919, 1989
5. Katon W: The effect of major depression on chronic medical illness. *Seminars in Clinical Neuropsychiatry* 3:82–86, 1998
6. Katon W, Sullivan MD: Depression and chronic medical illness. *Journal of Clinical Psychiatry* 51(suppl):3–11, 1990
7. Simon GE, VonKorff M, Barlow W: Health care costs of primary care patients with recognized depression. *Archives of General Psychiatry* 52:850–856, 1995
8. Unutzer J, Patrick DL, Simon G, et al: Depressive symptoms and the cost of health services in HMO patients aged 65 years and older: a 4-year prospective study. *JAMA* 277:1618–1623, 1997
9. Dixon L, Weiden P, Delahanty J, et al: Prevalence and correlates of diabetes in national schizophrenia samples. *Schizophrenia Bulletin* 26:903–912, 2000
10. Mukherjee S, Decina P, Bocola V, et al: Diabetes mellitus in schizophrenic patients. *Comprehensive Psychiatry* 37:68–73, 1996
11. Mukherjee S, Schnur DB, Reddy R: Family history of type 2 diabetes in schizophrenic pa-

tients (ltr). *Lancet* 1:495, 1989

12. Erle G, Basso M, Federspil G, et al: Effect of chlorpromazine on blood glucose and plasma insulin in man. *European Journal of Clinical Pharmacology* 11:15–18, 1977
13. Hagg S, Joelsson L, Mjorndal T, et al: Prevalence of diabetes and impaired glucose tolerance in patients treated with clozapine compared with patients treated with conventional depot neuroleptic medications. *Journal of Clinical Psychiatry* 59:294–299, 1998
14. Lindenmayer JP, Nathan AM, Smith RC: Hyperglycemia associated with the use of atypical antipsychotics. *Journal of Clinical Psychiatry* 62(suppl 23):30–38, 2001
15. Sernyak MJ, Leslie DL, Alarcon RD, et al: Association of diabetes mellitus with use of atypical neuroleptics in the treatment of schizophrenia. *American Journal of Psychiatry* 159:561–566, 2002
16. Dixon LB, Kreyenbuhl JA, Dickerson FB, et al: A comparison of type 2 diabetes outcomes among persons with and without severe mental illnesses. *Psychiatric Services* 55:892–900, 2004
17. Desai MM, Rosenheck RA, Druss BG, et al: Mental disorders and quality of diabetes care in the Veterans Health Administration. *American Journal of Psychiatry* 159:1584–1590, 2002
18. Blow FC, McCarthy J F, Valenstein M, et al: Care for Veterans With Psychosis in the VHA, FY02: 4th Annual Psychosis Registry Report, 2003. Available at www.va.gov/annarbor-hsrd/smitrecdocs/4thannualpsychosisvha.pdf. Accessed Nov 22, 2004
19. Krein SL, Hayward RA, Pogach L, et al: Department of Veterans Affairs' Quality Enhancement Research Initiative for Diabetes Mellitus. *Medical Care* 38:138–148, 2000
20. International Classification of Diseases, 9th Revision, Clinical Modification. Los Angeles, PMIC, 1995
21. Fleming BB, Greenfield S, Engelgau MM, et al: The Diabetes Quality Improvement Project: moving science into health policy to gain an edge on the diabetes epidemic. *Diabetes Care* 24:1815–1820, 2001
22. Cohen, J: A power primer. *Psychological Bulletin* 112:155–159, 1992
23. Wickens TD: *Multiway Contingency Tables Analysis for the Social Sciences*. Hillsdale, NJ, Erlbaum, 1989
24. Kerr EA, Gerzoff RB, Krein SL, et al: Diabetes care quality in the Veterans Affairs Healthcare System and commercial managed care: the TRIAD study. *Annals of Internal Medicine* 141:272–281, 2004
25. Jha AK, Perlin JB, Kizer KW, et al: Effect of the transformation of the Veterans Affairs Health Care System on the quality of care. *New England Journal of Medicine* 348:2218–2227, 2003
26. Asch SM, McGlynn EA, Hogan MM, et al: Quality of care in the Veteran's Health Administration compared with a national sample. *Annals of Internal Medicine* 141:938–945, 2004
27. Agha Z, Lofgren, RP, VanRuiswyk, JV, et al: Are patients at Veterans Affairs Medical Centers sicker? A comparative analysis of health status and medical resource use. *Archives of Internal Medicine* 160:3252–3257, 2000