The 3-Year Clinical and Functional Course of Schizophrenia Among Individuals With and Without Diabetes at Study Entry

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Objective: This prospective observational study compared the 3-year clinical and functional course of schizophrenia among individuals with and without diabetes at study entry.

Method: Data were drawn from a large, 3-year, multisite, prospective, naturalistic study of treatment for schizophrenia-related disorders. The study was conducted in the United States between July 1997 and September 2003 and represented treatment practices in diverse systems of care. Participants were diagnosed with schizophrenia or schizoaffective or schizophreniform disorders based on DSM-IV criteria. Clinical and functional outcomes were assessed at study enrollment and at 12-month intervals using standard psychiatric measures, medical records, and a validated patient-reported questionnaire. Diabetes status was determined by participant interview at enrollment. Statistical analyses used mixed models with repeated measures.

Results: Of 594 participants queried about comorbid medical conditions at enrollment, 76 (12.8%) reported having diabetes. Other comorbid conditions were reported by 79% of the diabetes group (N = 60) and 50% of the nondiabetes group (N = 259). Across the 3-year study, participants with diabetes differed significantly from participants without diabetes on 2 of 36 outcome measures: more contacts with nonpsychiatrist physicians ($p < .001$) and poorer physical health ($p = .015$). Groups did not differ significantly on mental health symptomatology, mental health resource utilization, legal and safety issues, substance use, productivity, activities and relationships, or quality of life.

Conclusions: In this 3-year, prospective, naturalistic study, the course of schizophrenia did not differ significantly between participants with and without diabetes, although persons with diabetes did have poorer physical health and more contacts with nonpsychiatrist physicians. Findings highlight the need for better medical treatment for people with schizophrenia, both with and without comorbid diabetes.

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Comorbid medical conditions are common among people with serious mental illness[1,2] and particularly among people with schizophrenia, who have an increased prevalence of chronic medical conditions such as diabetes mellitus,[3,4] chronic respiratory problems,[5] cardiovascular disease,[6,7] hepatitis B,[8] and HIV disease.[8] Among these chronic medical conditions, diabetes mellitus has received the most attention to date because some studies suggest that treatment with antipsychotics may increase the risk of diabetes in patients with schizophrenia.[9–11]

Although comorbid medical conditions appear to exacerbate the psychiatric status of the chronically and severely mentally ill[12] and to influence prescribing patterns for antipsychotic medications,[13] little is known about how 2 chronic diseases, such as schizophrenia and diabetes, impact one another. Dixon and colleagues[14] assessed the impact of chronic mental illness on the management of diabetes, and compared glycosylated hemoglobin levels (HbA_{1c}) in people with diabetes who did or did not have serious mental illness. People with diabetes and schizophrenia had significantly lower (better) levels of HbA_{1c}, although both groups had mean levels above the 7% recommended by the American Diabetes Association. Dixon

and colleagues[14] concluded that people with schizophrenia were not specifically disadvantaged in their glucose control. Although these findings suggest that schizophrenia may not adversely impact the management of diabetes, it is currently unclear whether diabetes may adversely impact the long-term course of schizophrenia.

To help address this gap and extend previous findings, the present post hoc analysis compares the long-term course of schizophrenia between people with and without diabetes at study enrollment. Using data from a large, prospective, naturalistic, multisite, 3-year study of individuals treated in the United States for schizophrenia-spectrum disorders,[15,16] we compared clinical and functional outcomes associated with schizophrenia between participants who reported having diabetes at enrollment and participants who reported not having a diagnosis of diabetes. Because diabetes, a chronic and burdensome medical condition, is associated with increased prevalence of depression[17] and with reduced quality of life in the general population,[18] we hypothesized that comorbid diabetes would adversely impact clinical and functional outcomes during the 3-year study period. Specifically, we hypothesized that across the 3 years, participants with diabetes at study enrollment would experience more severe psychotic and depressive symptoms, poorer levels of functioning, poorer quality of life, and higher rates of acute psychiatric care such as hospitalization and emergency psychiatric services. We also expected diabetic participants to have a poorer level of physical health and more contacts with nonpsychiatrist physicians to help address their special medical needs.

METHOD

Data Source

This study used data from the United States Schizophrenia Care and Assessment Program (US-SCAP),[15,16,19–22] a large (N = 2327), naturalistic, 3-year, prospective, multisite study conducted between July 1997 and September 2003 and funded by Eli Lilly and Co. The goal of US-SCAP was to understand the treatment for schizophrenia-spectrum disorders in usual care settings. Participants were diagnosed with schizophrenia or schizoaffective or schizophreniform disorders based on DSM-IV criteria and were at least 18 years of age. Participants were excluded if they were unable to provide informed consent or had participated in a clinical drug trial within 30 days prior to enrollment. Approximately 400 participants were enrolled at each of the study's 6 regional sites (California, Colorado, Connecticut, Florida, Maryland, and North Carolina) and represented treatment in diverse systems of care, including community mental health centers, university health care systems, the Department of Veterans Affairs (VA) Health Services, and community and state hospitals. Institutional Review Board (IRB) approval was received at each regional site, and informed consent was received from all participants. Further details about US-SCAP are available elsewhere.[15,16]

Initial design of US-SCAP did not capture information on participants' diabetes status or other comorbid medical conditions. Beginning in 2000, a query concerning medical conditions was added to the standard screening interview for all subsequently enrolled participants. As a result, enrollment information regarding diabetes was available for 594 US-SCAP participants.

Measures

The presence or absence of diabetes was assessed at enrollment by trained research examiners, who administered a standard structured questionnaire that included questions on medical history. Participants reporting a physician diagnosis of diabetes were defined as having diabetes at study enrollment (DM group), and those who reported not having a physician diagnosis of diabetes were defined as not having diabetes at study enrollment (non-DM group). No other information was collected regarding participants' diabetes (e.g., type of diabetes, duration, glucose blood level, use of antidiabetic agents). Participants were also queried about additional comorbid medical conditions, including hypertension, asthma and respiratory problems, stroke, heart attack, other heart conditions, vascular problems, arthritis, cancer, kidney/renal problems, and "other." Patient-reported questionnaires have been demonstrated to be a valid method of collecting information about medical comorbidities in the general population.[23]

Participants with and without diabetes at study enrollment were compared on measures of psychiatric symptoms, psychiatric resource utilization, legal and safety issues, substance use, productivity, activities and relationships, and quality of life. These clinical and functional domains were assessed with 36 variables using 6 instruments that were administered at enrollment and at 12-month intervals thereafter. These instruments were (1) the Positive and Negative Syndrome Scale (PANSS),[24] providing total score and subscale scores for positive symptoms, negative symptoms, and general psychopathology; (2) the Montgomery-Asberg Depression Rating Scale (MADRS)[25]; (3) the Quality of Life Scale[26] and its 4 domains: interpersonal role, instrumental ("occupational"), intrapsychic foundations ("motivational"), and common object and activities ("common activities"); (4) the Global Assessment of Functioning scale[27]; (5) participants' medical records, which systematically assessed mental health resource utilization for each previous 6-month interval and provided information on psychiatric medications, psychiatric hospitalizations, and use of emergency rooms; and (6) the SCAP Health Questionnaire (SCAP-HQ),[28] a 102-item, patient-reported measure developed and validated for the US-SCAP study. SCAP-HQ items were

drawn from existing measures, such as Lehman's Brief Quality of Life Interview[29] and the Medical Outcomes Study 12-Item Short-Form Health Survey (SF-12).[30] The psychometric properties of the SCAP-HQ were found to be acceptable for application to large-scale studies in routine care based on a study of its internal consistency, convergent validity, test-retest reliability, and responsiveness to change.[28]

The SCAP-HQ provided information about legal and safety issues (violent behaviors, arrested/jailed, victimized, suicidal thinking, and suicidal attempts), substance use (alcohol, illicit drugs), productivity (work for pay, number of days worked, any productive activity), activities (daily and leisure activities), relationships (family relationships and frequency of social interactions), and quality of life (mental health as assessed by the SF-12, physical health as assessed by the SF-12, general life satisfaction, independent housing, and medication adherence). The SCAP-HQ also provided information on participants' use of emergency psychiatric services and contacts with nonpsychiatric physicians.

Statistical Analysis

Comparisons between the DM and non-DM groups on sociodemographic and clinical characteristics at enrollment were made using χ^2 tests for categorical variables and t tests for continuous variables. Mixed model with repeated measures[31] was used to test for group differences in mean scores across the 3-year study period in each of the continuous outcome measures, whereas generalized estimating equations[32] were used for the binary variables. Age, gender, marital status, and ethnicity were included in the models as adjusting variables in order to reduce bias due to differences between the 2 comparative groups in baseline sociodemographics. There were no adjustments for additional variables, because the purpose of these analyses was to assess differences in outcomes for patients with and without diabetes; these analyses were not intended to assess any kind of causal effect. All differences of effects were tested at a 2-sided α level of .05. Because our analyses included 36 comparisons, and a few may be statistically significant by chance, we opted to report the findings with and without Bonferroni correction for multiple comparisons (threshold: .05 / 36 = .0014).

RESULTS

Of the 594 participants queried about comorbid medical conditions at enrollment, 76 (12.8%) reported a physician diagnosis of diabetes (DM group), and 518 (87.2%) reported not having been diagnosed with diabetes (non-DM group). The DM group was older, less likely to be single or male, and less likely to lack health insurance (Table 1). Compared with the non-DM group, the DM group had a significantly higher prevalence of hypertension (63.2% vs. 24.7%), kidney dysfunction (12.0% vs. 5.5%), and heart conditions other than heart attack (17.1% vs. 9.2%) (Table 1). There were no significant differences between the groups in use of psychiatric medications during the 6 months prior to enrollment (Table 1). The rate of study attrition (48 participants [63.2%] for the DM group and 376 participants [72.6%] for the non-DM group) was not significantly different across the 3-year period (p = .089). In addition, there were no significant differences in mortality rates between the groups throughout the 3-year study (2 participants [2.6%] in the DM group and 19 participants [3.7%] in the non-DM group, p = .648).

At enrollment, there were statistically significant differences between DM and non-DM participants on 9 of the 36 outcome measures examined (Table 2). The DM group had significantly lower PANSS positive scores, more contacts with nonpsychiatrist physicians, and lower likelihood of having a psychiatric hospitalization in the 6 months prior to enrollment. They were less likely to use alcohol or any illicit substance and had fewer paid working days, less frequent social interactions, and poorer physical

Table 1. Characteristics at Study Enrollment of Participants With and Without Diabetes[a]

Demographic	Non-DM[b] (N = 518)	DM[c] (N = 76)	p Value
Age, mean ± SD	39.69 ± 11.3	48.55 ± 10.5	< .001
Male, N (%)	319 (62.1)	33 (43.4)	.002
Ethnicity, N (%)			.088
White	290 (56.3)	38 (50.0)	.294
Black	119 (23.1)	26 (34.2)	.033
Hispanic	65 (12.6)	10 (13.2)	.901
Other	41 (8.0)	2 (2.6)	.095
Single marital status, N (%)	358 (70.1)	31 (40.8)	< .001
Health insurance, N (%)			.031
Medicare	176 (34.2)	31 (40.8)	.275
Medicaid	235 (45.6)	35 (46.1)	.983
Department of Veterans Affairs	12 (2.3)	2 (2.6)	.700
Private	27 (5.2)	2 (2.6)	.567
Other	7 (1.4)	4 (5.3)	.042
No insurance	48 (9.3)	1 (1.3)	.018
Comorbid medical conditions, N (%)			
Hypertension	127 (24.7)	48 (63.2)	< .001
History of stroke	16 (3.1)	5 (6.7)	.123
History of heart attack	20 (3.9)	3 (4.0)	.966
Other heart conditions	47 (9.2)	13 (17.1)	.035
Vascular condition	25 (4.9)	7 (9.2)	.121
Kidney dysfunction	28 (5.5)	9 (12.0)	.030
All other physical conditions	123 (24.1)	24 (32.0)	.139
Total, any comorbid condition	259 (50.4)	60 (79.0)	< .001
Medication in prior 6 mo, N (%)			
Any antipsychotic	483 (94.0)	73 (96.1)	.467
Atypical antipsychotic	380 (73.9)	54 (73.6)	.596
Typical antipsychotic	240 (46.7)	38 (50.0)	.590
Mood stabilizer	198 (38.5)	21 (27.6)	.067
Antidepressant agent	201 (39.1)	30 (39.5)	.951

[a]All categories had missing data; therefore, each value was divided by the number of patients for whom data were available, rather than by the total number of patients.
[b]Participants without diabetes at study entry.
[c]Participants with diabetes at study entry.

Table 2. Clinical and Functional Outcome Measures for Schizophrenia Participants With and Without Diabetes at Enrollment

Measure	Enrollment		End of Year 1		End of Year 2		End of Year 3		p Value Across 3-Yr Study
	Non-DM[a] (N = 518)	DM[b] (N = 76)	Non-DM[a] (N = 411)	DM[b] (N = 62)	Non-DM[a] (N = 317)	DM[b] (N = 54)	Non-DM[a] (N = 142)	DM[b] (N = 28)	
Clinical assessment									
PANSS total score, mean ± SD	67.9 ± 18.7	65.9 ± 17.0	67.4 ± 19.4	65.7 ± 18.7	65.9 ± 19.6	66.6 ± 18.0	69.7 ± 15.5	68.3 ± 15.4	.259
PANSS positive symptoms subscale score, mean ± SD	16.1 ± 6.1	14.5 ± 5.2[c]	15.7 ± 6.1	14.4 ± 6.2	15.3 ± 5.9	14.6 ± 5.0	15.7 ± 5.5	14.7 ± 4.4	.070
PANSS negative symptoms subscale score, mean ± SD	17.6 ± 6.8	17.2 ± 6.4	18.2 ± 6.8	17.7 ± 5.7	17.5 ± 6.4	18.5 ± 5.7	19.7 ± 5.4	19.5 ± 5.3	.942
PANSS general psychopathology subscale score, mean ± SD	34.8 ± 9.8	34.0 ± 9.1	34.1 ± 9.9	33.6 ± 10.2	33.4 ± 10.0	33.6 ± 9.9	34.8 ± 8.5	33.7 ± 8.7	.298
MADRS total score, mean ± SD	12.3 ± 10.0	12.8 ± 10.5	10.7 ± 9.3	11.9 ± 10.2	10.0 ± 9.2	10.5 ± 8.7	11.5 ± 10.0	9.4 ± 8.2	.652
Resource utilization									
Psychiatric hospitalization, past 6 mo, N (%)	127 (24.7)	10 (13.2)[c]	40 (9.7)	5 (8.1)	28 (8.8)	2 (3.7)	11 (7.8)	3 (10.7)	.714
Emergency psychiatric services use, past 4 wk, N (%)	41 (8.0)	8 (10.5)	18 (5.0)	2 (3.6)	13 (4.5)	3 (6.0)	14 (11.1)	1 (4.2)	.989
Emergency room visit, past 6 mo, N (%)	67 (19.5)	6 (11.6)	47 (12.2)	6 (10.0)	27 (9.0)	4 (7.7)	13 (10.2)	3 (11.5)	.782
Contacts with psychiatrist, past 4 wk, mean ± SD	1.6 ± 1.7	1.4 ± 0.98	1.8 ± 3.0	1.6 ± 2.3	1.5 ± 1.2	1.7 ± 2.3	1.8 ± 2.4	1.8 ± 1.7	.0865
Contacts with nonpsychiatrist physician, past 4 wk, mean ± SD	0.4 ± 0.8	1.1 ± 1.3[c]	0.4 ± 0.8	0.9 ± 1.3	0.4 ± 0.9	1.1 ± 2.0	0.3 ± 0.7	1.0 ± 1.6	< .001
Legal and safety issues									
Violent behaviors, past 6 mo, N (%)	26 (5.1)	3 (4.0)	17 (4.7)	5 (8.9)	15 (5.2)	2 (4.0)	6 (4.8)	0 (0.0)	NA
Arrested/jailed, past 4 wk, N (%)	31 (6.1)	3 (4.0)	15 (4.1)	2 (3.6)	5 (1.7)	2 (4.0)	1 (0.8)	1 (4.2)	.527
Victim of crime, past 6 mo, N (%)	46 (9.0)	11 (14.5)	28 (7.7)	4 (7.1)	18 (6.3)	4 (8.0)	8 (6.4)	1 (4.2)	.499
Suicidal thinking, past 6 mo, N (%)	83 (16.2)	10 (13.2)	46 (12.6)	8 (14.3)	32 (11.2)	2 (4.0)	10 (7.9)	1 (4.2)	.928
Suicide attempts, past 6 mo, N (%)	9 (1.8)	2 (2.6)	8 (2.2)	2 (3.6)	5 (1.7)	0 (0.0)	2 (1.6)	0 (0.0)	NA
Substance use									
Alcohol use, past 4 wk, N (%)	110 (21.5)	8 (10.5)[c]	70 (19.3)	5 (8.9)	46 (16.0)	5 (10.0)	18 (14.3)	3 (12.5)	.112
Illicit drug use, past 4 wk, N (%)	28 (5.5)	2 (2.6)	16 (4.4)	1 (1.8)	11 (3.8)	3 (6.0)	3 (2.4)	1 (4.2)	NA
Any substance use, past 4 wk, N (%)	122 (23.9)	10 (13.2)[c]	76 (20.9)	5 (8.9)	51 (17.8)	6 (12.0)	19 (15.1)	3 (12.5)	.063
Productivity									
Work for pay, past 4 wk, N (%)	119 (23.2)	13 (17.1)	89 (24.5)	6 (10.7)	68 (23.7)	4 (8.0)	26 (20.6)	1 (4.2)	.086
Work days, past 4 wk, mean ± SD	10.6 ± 7.3	6.5 ± 4.9[c]	11.0 ± 7.7	9.2 ± 4.4	10.2 ± 7.5	12.0 ± 5.7	9.2 ± 7.4	5.0[d]	.611
Occupational functioning, past 4 wk, mean ± SD	9.4 ± 7.2	9.7 ± 6.1	7.6 ± 7.2	9.6 ± 6.1	7.4 ± 7.3	8.0 ± 6.2	9.7 ± 6.6	9.4 ± 6.2	.955
Any productive activity, past 4 wk, N (%)	339 (66.2)	54 (71.1)	248 (68.1)	36 (64.3)	187 (65.2)	32 (64.0)	83 (65.9)	14 (58.3)	.250
Activities and relationships									
Daily activity, mean ± SD	3.5 ± 1.2	3.4 ± 1.3	3.5 ± 1.3	3.2 ± 1.4	3.5 ± 1.3	3.3 ± 1.5	3.3 ± 1.4	3.0 ± 1.7	.110
Leisure activity, mean ± SD	2.7 ± 1.2	2.7 ± 1.1	2.7 ± 1.2	2.4 ± 1.3	2.9 ± 1.1	2.7 ± 1.2	2.7 ± 1.3	2.0 ± 1.5	.108
Common activities, mean ± SD	6.4 ± 2.4	6.4 ± 1.9	6.2 ± 2.3	6.1 ± 1.9	6.4 ± 2.2	6.2 ± 1.7	6.6 ± 2.2	5.3 ± 2.3	.090
Frequency of social interactions, mean ± SD	2.8 ± 1.2	3.1 ± 1.2[c]	2.9 ± 1.2	2.8 ± 1.1	3.0 ± 1.1	2.7 ± 1.3	3.0 ± 1.2	2.5 ± 1.2	.753
Interpersonal relationships, mean ± SD	21.4 ± 10.7	23.7 ± 9.5	20.0 ± 11.2	20.3 ± 7.9	20.7 ± 10.8	17.8 ± 8.9	22.3 ± 9.3	20.1 ± 7.9	.610
Family relationships, mean ± SD	4.5 ± 1.7	4.3 ± 1.7	4.6 ± 1.6	4.9 ± 1.4	4.7 ± 1.5	5.1 ± 1.3	4.8 ± 1.5	4.8 ± 1.4	.059
Quality of life									
Overall quality of life, mean ± SD	59.7 ± 23.6	63.8 ± 18.3	56.8 ± 23.9	55.9 ± 16.1	56.9 ± 22.4	54.4 ± 17.5	61.2 ± 20.3	55.8 ± 15.4	.680
Motivation level, mean ± SD	22.6 ± 8.8	23.0 ± 7.1	21.7 ± 8.2	20.7 ± 7.3	21.4 ± 7.5	20.6 ± 6.6	21.5 ± 7.5	19.4 ± 5.5	.383
Global level of functioning, mean ± SD	41.6 ± 13.0	42.1 ± 11.5	42.4 ± 13.4	41.9 ± 12.7	44.1 ± 12.2	42.4 ± 11.7	44.0 ± 12.0	43.2 ± 10.8	.552
Mental health, mean ± SD	40.9 ± 13.6	42.6 ± 12.6	42.1 ± 13.0	45.7 ± 11.7	42.0 ± 13.1	42.2 ± 14.0	42.4 ± 13.3	42.7 ± 15.3	.344
Physical health, mean ± SD	47.0 ± 10.0	43.5 ± 11.4[c]	46.9 ± 9.8	40.0 ± 12.5	47.1 ± 9.9	42.5 ± 11.0	46.3 ± 10.1	39.5 ± 12.2	.015
Medication adherence, mean ± SD	1.4 ± 0.7	1.3 ± 0.6	1.3 ± 0.7	1.4 ± 0.8	1.4 ± 0.7	1.3 ± 0.7	1.3 ± 0.6	1.1 ± 0.3	.149
Independent housing, N (%)	312 (61.9)	42 (56.8)	235 (64.7)	35 (62.5)	198 (69.5)	34 (68.0)	81 (64.8)	14 (58.3)	.164
General life satisfaction, mean ± SD	4.5 ± 1.6	4.9 ± 1.3[c]	4.7 ± 1.6	4.9 ± 1.3	4.7 ± 1.5	5.0 ± 1.3	4.7 ± 1.4	4.5 ± 1.4	.104

[a]Participants without diabetes at study entry.
[b]Participants with diabetes at study entry.
[c]Values at study enrollment were statistically significantly different between DM and non-DM participants ($p < .05$).
[d]Data were available for only 1 participant; therefore, no standard deviation could be calculated.
Abbreviations: MADRS = Montgomery-Asberg Depression Rating Scale, NA = not applicable, PANSS = Positive and Negative Syndrome Scale.

health. The DM participants reported, however, greater general life satisfaction compared with non-DM participants.

To determine whether there was a difference in the course of schizophrenia between the 2 groups, the DM and non-DM participants were compared on each of the 36 outcome measures across the 3-year study period (Table 2). For descriptive purposes, scores for each outcome measure at enrollment and at the end of years 1, 2, and 3 are also presented. Only 2 of 36 outcome measures were significantly different between the 2 groups across the 3-year period, with the DM group reporting significantly more contacts with nonpsychiatrist physicians ($p < .001$) and poorer levels of physical health ($p = .015$). If correcting for multiple comparisons using the Bonferroni method, only the significant group difference on physical health becomes nonsignificant, as its p value is larger than the corrected threshold of .0014.

For 31 of the other outcome measures, the DM and non-DM groups did not significantly differ across the 3-year study period. The 2 groups did not significantly differ in level of core schizophrenia symptomatology, as assessed by the PANSS and its subscale scores, or in severity of depressive symptoms, as assessed by the MADRS. Both groups had MADRS scores consistent with a mild level of depressive symptoms.[33] The groups did not significantly differ on psychiatric hospitalization and use of emergency services, nor did they differ on measures of legal and safety issues, substance use, productivity, activities and relationships, or quality-of-life measures.

For 3 outcome measures—violent behavior, suicide attempts, and illicit drug use—the incidences were too few to allow for statistical comparisons. Therefore, p values could not be calculated, and only summary statistics are shown.

The groups did not significantly differ on psychiatric medication treatment patterns across the 3-year study period. Antipsychotic medications were prescribed for 64 DM participants (94.1%) and 462 non-DM participants (96.1%) ($p = .429$). Among the DM group, 53 (77.9%) were treated with atypical antipsychotics and 39 (57.4%) with typical antipsychotics, compared with 389 (80.9%) and 248 (51.6%), respectively, for DM participants ($p = .927$ and $p = .755$, respectively). The 2 groups also did not differ on use of mood stabilizers (DM: N = 22 [32.4%]; non-DM: N = 220 [45.7%]; $p = .174$) or use of antidepressants (DM: N = 32 [47.1%]; non-DM: N = 241 [50.1%]; $p = .345$).

DISCUSSION

Contrary to study hypothesis, the 3-year course of clinical and functional outcomes in schizophrenia did not significantly differ between participants with and without preexisting diabetes. Of 36 outcome measures assessing various clinical and functional domains, the 2 groups significantly differed only on 2 physical health parameters: diabetic participants had more visits with nonpsychiatrist physicians, and they had poorer physical health. These differences are not surprising, as individuals with diabetes could be expected to utilize services for treatment of diabetes, and they had more comorbid medical conditions at study enrollment.

Across the 3-year study, the diabetes and nondiabetes groups did not significantly differ on the course of their psychotic and depressive symptomatology; the use of acute psychiatric care, such as psychiatric hospitalizations and emergency services; legal and safety issues; substance use; productivity; activities; relationships; or quality-of-life measures. These results suggest that the presence of a chronic physical condition did not adversely affect mental health.

Depressive symptoms are more common in people with diabetes than in the general population.[17] Therefore, it is surprising that both groups experienced relatively mild levels of depressive symptoms and did not significantly differ in mean MADRS scores either at study enrollment or across the 3-year study period. In both groups, approximately half of the participants received antidepressant medication at some point during the study. Although the drivers of the current findings are unclear, it is possible that study participants had more stable diabetes. Another possibility is that the participants with diabetes had a less severe psychiatric illness profile at study enrollment, as reflected by slightly lower levels of positive symptoms, fewer psychiatric hospitalizations in the 6 months prior to enrollment, less substance use, and better general life satisfaction.

Interestingly, although fewer days of paid work at study enrollment were reported by those DM participants who had paid employment, there were no statistically significant differences between the 2 groups in the proportion of participants who worked for pay or who engaged in any productive activity.

Notably, participants with and without diabetes differed significantly at enrollment on the prevalence of other comorbid medical conditions, including hypertension, kidney dysfunction, and heart conditions other than heart attack. Most of the diabetic participants (79%) had at least 1 other medical condition, compared with 50% of the non-DM group. In light of the added medical burden associated with diabetes, one would expect participants with diabetes to have more frequent contact with nonpsychiatric physicians to address these medical needs. The current findings are consistent with previous research demonstrating the paucity in quality and quantity of medical care provided to people with chronic and severe mental illness.[34,35]

These data highlight the need to ensure that people with chronic mental illness receive comprehensive medical treatment for both their mental and physical needs. Op-

timal care may require mental health professionals to develop new approaches to manage physical symptoms in mentally ill individuals,[5] including better collaboration with medical colleagues as well as increased attention to programs to prevent or reduce risk factors of common medical comorbidities.[2] Druss and colleagues[34] have shown that patient outcomes and medical care can be improved when medical care is provided on-site in the mental health clinic.

Among the strengths of this study are its naturalistic, long-term, prospective design; its repeated use of valid and reliable psychiatric measures; and its large and diverse sample, which is representative of patients treated in public health care systems across the United States. Study limitations include the fact that information on diabetes status and medical comorbidities was based on participant self-report rather than medical records or laboratory tests. No attempt was made to validate these participant reports, so we cannot rule out the possibility that the findings of no difference in psychiatric course between the 2 groups may have been due to invalid determination of diabetes status. In addition, approximately 5% of people with schizophrenia[36] and 2% of the general population[37] have undiagnosed diabetes, suggesting that some participants in the non-DM group may actually have had diabetes. Information on diabetes status was not collected after study enrollment; therefore, it is unknown who, if anyone, among the non-DM participants developed diabetes during this 3-year study. Furthermore, the current analyses did not assess whether diabetes was the direct cause of the differences between the 2 groups; they only addressed whether between-group differences existed. Lastly, these were secondary analyses and, as such, should be considered exploratory in nature pending replication of these findings in a separate sample.

The present findings, which suggest a similar course of schizophrenia in people with and without diabetes, do not lessen the importance of appropriate treatment for those with diabetes or the need for interventions to help prevent diabetes in people with schizophrenia. Studies have shown that individuals with serious mental illness can reduce symptoms of, and risk factors for, diabetes through diet, exercise, behavioral intervention, and pharmacotherapy.[38–42]

CONCLUSIONS

In this large prospective study of people with schizophrenia treated in usual care settings, the 3-year course clinical and functional outcomes did not significantly differ between participants with and without comorbid diabetes at study enrollment, although diabetic participants had poorer physical health and more contacts with nonpsychiatrist physicians. There is a need for a prospective incidence study to verify these findings. However, the results of this exploratory study highlight the preponderance of comorbid medical conditions in this vulnerable mentally ill population and the need for better collaboration between psychiatrists, primary care physicians, and specialty care physicians to help enhance quality of care for the mentally ill.

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