

# Quality and Predictors of Diabetes Care Among Patients With Schizophrenia: A Danish Nationwide Study

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**Objective:** Patients with schizophrenia have a high prevalence of diabetes, but data on diabetes care quality for these patients are limited. This nationwide study compared the quality of diabetes care among individuals with and without schizophrenia and identified predictors of care quality.

**Methods:** In a population-based cohort study, 83,813 individuals with diabetes seen at hospital outpatient clinics between 2005 and 2013, including 669 with comorbid schizophrenia, were identified from Danish registries. High-quality diabetes care was defined as having received  $\geq 80\%$  of guideline-recommended process performance measures. Variables assessed as predictors of diabetes care included patient-specific (sex, age, smoking, substance abuse, Global Assessment of Functioning score, and duration of schizophrenia), provider-specific (quality of schizophrenia care), and system-specific (annual patient contact volume of the diabetes clinic) factors.

**Results:** Compared with individuals with diabetes only, those with diabetes and schizophrenia were less likely to receive

high-quality diabetes care (relative risk [RR]=.91, 95% confidence interval [CI]=.88–.95) and less likely to receive several individual process performance measures of diabetes care, including blood pressure monitoring (RR=.98, CI=.96–.99), treatment with antihypertensive drugs (RR=.83, CI=.70–.97) and angiotensin-converting enzyme/angiotensin II receptor inhibitors (RR=.72, CI=.55–.93), screening for albuminuria (RR=.96, CI=.93–.99), eye examination at least once every second year (RR=.97, CI=.94–.99), and foot examination (RR=.96, CI=.93–.99). Predictors of poor diabetes care among individuals with schizophrenia included documented drug abuse and low contact volume of the diabetes clinic.

**Conclusions:** Individuals with schizophrenia received lower-quality diabetes care compared with those without schizophrenia. However, absolute differences in care were modest.

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Schizophrenia represents a major global health challenge and is associated with excess mortality (1,2). About one-third of the mortality excess is attributed to unnatural causes, including suicide and accidental death, and two-thirds is attributed to natural causes, including chronic medical comorbidities (2–4). Diabetes appears to be a particularly important contributor to the 10 to 20 years of shortened life expectancy among patients with schizophrenia (3–8). Therefore, special health care attention is warranted, focusing on early diagnosis and effective treatment of diabetes. Increasing evidence, however, indicates deficient diabetes care among patients with schizophrenia compared with the general population (9–12). Although studies have suggested disparities, the magnitude varies, and methodological limitations, including non-population-based study designs and lack of detailed data on the provided care, have been noted. Variation between studies not only emerges from methodological limitations but may also emerge from differences in the organization and financing of health care systems.

In Denmark, health equity is a stated priority in the public health care system, which is funded mainly through taxes. The universal health coverage provides all Danish residents regardless of their socioeconomic status equal access to care at public hospitals (13,14). The quality and equity of care provided by the Danish health care system have been routinely monitored for nearly two decades by a nationwide multidisciplinary initiative (15,16). This setting offers a unique opportunity to examine whether equal access also implies equivalent and sufficient diabetes care for individuals with serious comorbidities, such as schizophrenia, and if not, whether specific factors predict potential quality gaps in such vulnerable populations. Thus we conducted a nationwide population-based cohort study to examine the quality of diabetes care as reflected by its meeting specific process performance measures of care among Danish individuals with and without schizophrenia and to identify potential patient-, provider-, and system-specific predictors of quality of diabetes care among individuals with schizophrenia.

## METHODS

In Denmark, patients with schizophrenia are exclusively treated at public psychiatric hospitals, whereas individuals with diabetes are managed by general practitioners (GPs) or in specialized outpatient hospital clinics. Each patient contact with the health care system is recorded in public registries with a unique civil registration number assigned to all Danish residents. This number provides unambiguous linkage of information at the individual level among various data sources (13,14). We used data from the following population-based registries: the Danish Clinical Registries and the Danish Psychiatric Central Research Register (PCRR). Reporting to the registries is mandatory for all Danish hospitals.

### The Danish Clinical Registries

In 2000, a nationwide multidisciplinary initiative was launched with the objective of systematically monitoring and continuously auditing the quality of care provided by the Danish health care system. In the following years, population-based clinical registries were established to document care for important diseases, including schizophrenia (the Danish Schizophrenia Registry [DSR]) and diabetes (the Danish Adult Diabetes Registry [DADR]). These registries hold data on disease-specific performance measures of care and several prognostic factors (15–18). An expert board representing national scientific societies and professional organizations followed a structured process to develop these performance measures on the basis of recommendations from national clinical guidelines with the highest strength of evidence. The DSR documents the following areas: diagnostic evaluation; antipsychotic treatment, including side effects; screening for cardiovascular risk factors, including, for example, glycated hemoglobin (HbA1c); family intervention; psychoeducation; suicide risk assessment; and postdischarge care. Referral of patients with schizophrenia who have increased levels of HbA1c to GPs or to specialized clinics varies. The DADR covers domains of cardiometabolic control and screening for complications. All data are prospectively collected on the basis of documentation in medical records by use of standardized registration forms with detailed instructions. The registration form is completed for all inpatients with schizophrenia at discharge from psychiatric hospitals and once a year for patients with schizophrenia followed at hospital outpatient clinics. For individuals with diabetes, quality-of-care data are recorded annually at all hospital outpatient clinics; similar diabetes care data are collected from GPs; however, completeness of data collection remains low.

The registries include records for 93% of all hospital inpatients, 92% of all hospital outpatients with schizophrenia, and approximately 90% of all hospital outpatients with diabetes in the Danish health care system (17,18). Almost all patients with schizophrenia who have been in contact with the secondary health care system can thus be identified from the DSR since its initiation in 2004, and most individuals with diabetes treated at hospital outpatient clinics can be identified from the DADR since 2005.

### The PCRR

The PCRR has maintained a systematic collection of all psychiatric diagnoses and contacts, including dates of each admission to and discharge from Danish psychiatric hospitals, since 1969 and the start and end dates of all hospital outpatient and emergency room contacts since 1995 (19–21).

### Study Population

*Individuals with diabetes.* The study population included all individuals ( $\geq 18$  years) treated for diabetes at hospital outpatient clinics and recorded in the DADR between January 1, 2005, and December 31, 2013. The DADR includes individuals with the following *ICD-10* codes for diabetes: E10.0–E11.9 and E13.0–E14.9 (22).

*Individuals with diabetes and schizophrenia.* Using the DSR, outpatients with diabetes and comorbid schizophrenia were identified (*ICD-10* codes F20.0–F20.99). We included inpatients and outpatients with schizophrenia recorded in the DSR between January 1, 2004, and December 31, 2011. Patients were excluded if the diagnosis of schizophrenia was not recorded before their first diabetes contact ( $N=29$ ) or if more than five years elapsed between the recording of the schizophrenia diagnosis and the subsequent diabetes contact ( $N=23$ ), which left 83,813 individuals with diabetes—for a total of 302,638 diabetes contacts to be included in the analysis. A total of 106 hospital outpatient clinics were represented. Within this sample, 669 (.8%) individuals with 1,681 diabetes contacts had schizophrenia recorded before their diabetes contact.

### Predictors of Diabetes Care

Patient-, provider-, and system-specific factors were examined as potential predictors of the quality of diabetes care among individuals with diabetes and schizophrenia. Drawn from the DADR, DSR, and PCRR, the patient-specific predictors included age, sex, smoking, alcohol or drug abuse (illegal drugs, benzodiazepines, or central stimulants), duration of schizophrenia at the time of the hospital outpatient contact for diabetes, and score on the Global Assessment of Functioning (GAF), ranging from 1 to 100, to evaluate the overall psychosocial functioning of individuals with schizophrenia (23,24).

The provider-specific predictor included the quality of schizophrenia care preceding the diabetes contact, because inadequate quality of schizophrenia care may be associated with a subsequent deficient quality of diabetes care. Table 1 lists the 12 assessed process performance measures of care, collected from the DSR, for hospital inpatients and outpatients with schizophrenia, including incident patients, defined as individuals who were diagnosed as having schizophrenia within the past year (17). The quality of schizophrenia care was assessed overall by dividing the number of performance measures received by the patient with the number of relevant measures for each individual.

Collected from the DADR, system-specific predictors included contact volume, which was defined as the average

number of contacts in each hospital outpatient diabetes clinic per year from 2005 to 2013. The contact volume was divided into four quartiles; low (quartile 1,  $\leq 519$  diabetes contacts per year), medium (quartile 2,  $> 519-895$ ), high (quartile 3,  $> 895-1,620$ ), and very high (quartile 4,  $> 1,620$ ).

### Quality of Diabetes Care

With data from the DADR, the quality of diabetes care was assessed with 11 process performance measures of care relevant to hospital outpatients with diabetes (18) (Table 2). Furthermore, we summarized the quality of diabetes care overall by dividing the number of performance measures of care received by the patient with the number of relevant measures for each individual.

### Statistical Analyses

Binary regression was used to examine the association between schizophrenia and the quality of diabetes care by estimating the relative risk (RR) of receiving the individual process performance measures of diabetes care and the overall quality of care among individuals with and without schizophrenia. A high quality of diabetes care was defined by using a pragmatic cut point as having received  $\geq 80\%$  of the relevant measures. To assess the robustness of our findings, we also repeated the analysis by using alternative thresholds ranging from 60% to 90%. The analyses were stratified according to sex, age, and HbA1c level.

Binary regression was used to elucidate the effect of patient-, provider-, and system-specific predictors on quality of diabetes care among individuals with diabetes and schizophrenia.

The potential predictors included sex, age, smoking, substance abuse, GAF score, duration of schizophrenia, quality of schizophrenia care, and clinic contact volume. A high quality of schizophrenia care was defined as having received  $\geq 80\%$  of the relevant measures. This analysis was repeated with different cut points of 70% and 90% to evaluate the strength of the results. The adjusted analysis adjusted for predictors that were significantly associated with the outcome of interest in the unadjusted analysis. Clustering of individuals within hospital outpatient diabetes clinics was taken into account in all analyses by correcting the 95% confidence intervals (CIs) for robust estimates of the variance. A two-sided  $p$  value  $\leq .05$  was considered to be significant. Stata, version 11.2 special edition, was used for all analyses.

## RESULTS

Compared with individuals with diabetes only, those with diabetes and schizophrenia were younger and a larger

**TABLE 1. Definitions of process performance measures of care for patients with schizophrenia<sup>a</sup>**

Measure	Definition <sup>b</sup>
Assessment of psychopathology by a specialist in psychiatry	Incident patients who are assessed for psychopathological characteristics by a psychiatrist or specialist clinical psychologist to ensure a valid diagnosis
Assessment of psychopathology by interview form	Incident patients who receive a diagnostic interview with an established interview instrument, such as the Schedules for Clinical Assessment in Neuropsychiatry or the Operational Criteria Checklist for Psychotic Illness
Assessment of cognitive function	Incident patients who are administered cognitive testing by a psychologist
Assessment by a social worker	Incident patients who are assessed for need for social support by a social worker, for example, financial help to purchase medicine or help with changing housing or applying for disability benefits
Antipsychotic medical treatment	Patients who are prescribed antipsychotic medical treatment
Outpatient antipsychotic medical treatment	Outpatients in medical treatment who are receiving more than one antipsychotic
Benzodiazepine medical treatment	Outpatients in medical treatment with benzodiazepines, exclusive of benzodiazepine-related drugs (zolpidem, zopiclone, and zaleplon)
Contact with relatives	Staff contact with the patient's relatives
Psychoeducation	Patients who receive psychoeducation
Professional support	Patients with a Global Assessment of Functioning score $\leq 30$ who are referred to postdischarge professional support in their own home, a residential facility, or a care home
Psychiatric aftercare	Patients who are referred to psychiatric aftercare, including outpatient treatment or contact with a general practitioner or a private specialist after discharge
Suicide risk assessment	Patients who are assessed for suicide risk at discharge

<sup>a</sup> Process performance measures apply to both inpatient and outpatient care.

<sup>b</sup> An incident patient was one given a diagnosis of schizophrenia within the past year.

proportion had type 2 diabetes, and they were more likely to be smokers and to have a higher body mass index and a higher HbA1c level (Table 3). In both groups of outpatients, most received 80% to 100% of the relevant recommended process performance measures.

Individuals with diabetes and schizophrenia were less likely than those with diabetes only to receive high-quality diabetes care (receipt of  $\geq 80\%$  of all relevant process performance measures) (RR=.91) (Table 4). This pattern was also evident when the analysis used alternative thresholds between 60% and 90% for defining high-quality care, with RRs ranging between .94 (CI=.91-.97) and .82 (CI=.76-.88) (data not shown). Moreover, those with diabetes and schizophrenia were less likely than those with diabetes only to receive several individual process performance measures, including blood pressure monitoring (RR=.98), treatment with antihypertensive drugs (RR=.83) and ACE (angiotensin-converting enzyme) /ATII (angiotensin II receptor) inhibitors (RR=.72),

**TABLE 2. Definitions of process performance measures of diabetes care<sup>a</sup>**

Measure	Definition
Glycemic monitoring	Individuals who have their glycated hemoglobin (HbA1c) level monitored at least once a year
Antidiabetic medication	Individuals with type 2 diabetes with HbA1c $\geq 53$ mmol/mol (7%) who are treated with antidiabetic medication
Blood pressure monitoring	Individuals who have their blood pressure monitored at least once a year
Antihypertensive medication	Individuals with a blood pressure of $>140/90$ mmHg who are treated with antihypertensive medication
Cholesterol monitoring	Individuals over age 30 who have their low-density lipoprotein (LDL) cholesterol monitored at least once every second year
Lipid-lowering medication	Individuals with type 2 diabetes over age 40 with LDL cholesterol $>2.5$ mmol/l who are treated with lipid-lowering medication
Screening for albuminuria	Individuals who are screened for albuminuria at least once every second year
ACE/ATII inhibitors medication	Individuals with micro- or macroalbuminuria who are treated with angiotensin-converting enzyme (ACE)/angiotensin II receptor (ATII) inhibitors
Eye examination I	Individuals receiving an eye examination at least once every second year
Eye examination II	Individuals receiving an eye examination at least once every fourth year
Foot examination	Individuals receiving a foot examination at least once every second year

<sup>a</sup> For treatment of diabetes at hospital outpatient clinics

screening for albuminuria (RR=.96), eye examination at least once every second year (RR=.97), and foot examination (RR=.96). No clear associations were found for the remaining measures (Table 4). We found no evidence of systematic interaction when stratifying the analyses according to sex, age, and HbA1c (data not shown).

In particular, age, drug abuse, duration of schizophrenia, and contact volume were associated with the quality of diabetes care [see online supplement]. The clearest associations were found for drug abuse and contact volume. In this case, drug abuse was significantly associated with a reduced likelihood of receiving a foot examination (adjusted RR=.88). Moreover, drug abuse was not significantly associated with a reduced chance of receiving high-quality diabetes care (unadjusted RR=.89, CI=.73–1.09), including a lower chance of receiving antihypertensive medication (unadjusted RR=.15, CI=.02–1.03) and several other measures.

In clinics with very high contact volume, the likelihood of receiving high-quality diabetes care was significantly greater than in clinics with low contact volume (adjusted RR=1.44), including treatment with ACE/ATII inhibitors (adjusted RR=3.19). When the analysis used cut points of 70% and 90% for defining high-quality schizophrenia care, the pattern remained, showing no clear association between a high level of quality of schizophrenia care and deficient diabetes care (data not shown).

## DISCUSSION

Our results indicate that individuals with diabetes and schizophrenia were less likely than those with diabetes only to receive overall high-quality diabetes care. Furthermore, those with diabetes and schizophrenia were less likely to receive several individual process performance measures of care, including blood pressure monitoring and screening for albuminuria; treatment with antihypertensive drugs, including ACE/ATII inhibitors; eye examination at least once every second year; and foot examination. Among those with diabetes and schizophrenia, patient- and system-specific factors were associated with the deficient quality of diabetes care, including young age, drug abuse, short duration of schizophrenia, and low clinic contact volume.

### Strengths and Limitations

The strengths of the study include the nationwide population-based design, a large sample, and detailed information about the quality of diabetes care. Nevertheless, the data in the DSR and DADR are collected in routine clinical settings by various clinicians; thus variations by practice and errors may occur. However, thorough efforts are made to ensure data uniformity and accuracy by providing detailed instructions

for the data collection in standardized registration forms, with explicit data definitions. In addition, regular multidisciplinary structured audits are conducted locally, regionally, and nationally to critically assess data validity and provide continuous feedback to hospitals. To ensure high validity, data collection for the DSR and DADR focuses on a limited set of variables. Organizations are not required to maintain extensive data sets for reporting; such data sets may include incomplete and poor-quality data. Because of the limited data, however, unmeasured factors may have influenced the quality of diabetes care, including, for example, measures of disease severity other than the GAF score and racial-ethnic background, although the Danish population is in general considered to be homogeneous.

Confounding was of minor concern because the included process performance measures were considered relevant for all included individuals independent of psychiatric diagnosis, patient characteristics, and the treating hospital clinic.

This study included only hospital outpatients diagnosed as having diabetes and being treated for diabetes. The impact of schizophrenia on diabetes care may thus be considerably larger than reflected by our findings because individuals with diabetes and schizophrenia are commonly undiagnosed, not in treatment, or treated only by GPs.

### Comparison With Previous Studies

The diabetes performance measures used in our study are similar to those used elsewhere, including the HEDIS



measures in the United States (9–12). However, none of the prior studies were based on a nationwide population, and variation in the examined psychiatric disorder makes direct comparison difficult. Also, our results are from a system that provides universal health care, and they may not be generalizable to other health services, such as the U.S. system, which indicates the need for further studies of the quality of diabetes care among patients with schizophrenia in various settings. The limited number of studies of the association between mental illness and possible predictors of diabetes care have methodological inconsistencies (10,11). Previous U.S. studies reported that patient-specific (gender, age, race-ethnicity, and number of general medical comorbidities), provider-specific (primary care workforce), and state-specific (reimbursement rates) factors predicted the quality of care (10,11). Financial incentives may, nonetheless, further complicate comparison of results with findings from a system with universal coverage. To our knowledge, only studies in cardiovascular care have assessed the association between mental illness and the organizational structure of a health care system as a potential predictor of quality of care (25–27). U.S. studies reported that patients with mental illness were more likely than those without mental illness to be admitted to low-quality hospitals and treated by low-quality cardiac surgeons for their cardiovascular comorbidities (25–27).

This study demonstrated that the quality disparities experienced by individuals with diabetes and schizophrenia are a nationwide problem, even in a country with free access to care. Despite the younger age of individuals with diabetes and schizophrenia, their general medical health status was worse than that of individuals with diabetes alone, and those with schizophrenia were more likely to demonstrate unfavorable lifestyle behaviors, including smoking. These findings indicate possible suboptimal prophylactic medical services. Even though the sample with diabetes and schizophrenia had exacerbated general medical problems, our results indicate that they were less likely than those with diabetes alone to receive high-quality diabetes care and several individual process performance measures, including treatment with antihypertensive drugs, blood pressure monitoring, screening for albuminuria, and eye and foot examination. In this context, the relatively long intervals between diabetes follow-up checks may constitute a particular challenge in maintaining contact and providing

**TABLE 3. Characteristics of contacts by patients with diabetes and schizophrenia or with diabetes only who were seen in outpatient clinics in Danish hospitals between 2005 and 2013**

Characteristic	Diabetes and schizophrenia (N=1,681)		Diabetes only (N=300,957)	
	N	%	N	%
Sex				
Female	688	41	125,016	42
Male	993	59	175,941	58
Age				
18–39	423	25	43,487	15
40–44	220	13	22,144	7
45–49	260	15	25,429	8
50–54	260	15	30,363	10
55–59	245	15	35,377	12
≥60	273	17	144,157	48
Diabetes type				
Type 1	423	25	117,595	39
Type 2	1,189	71	174,097	58
Other types of diabetes and diabetes without specification	44	3	6,175	2
Missing	25	1	3,090	1
HbA1c (mmol/mol) (%)				
9–<46 (3–<6.4)	260	16	32,895	11
46–<53 (6.4–<7)	216	13	45,247	15
53–<64 (7–<8)	358	21	90,501	30
64–<75 (8–<9)	308	18	67,335	22
75–195 (9–20)	484	29	58,802	20
Other (<9 and >195) (<3 and >20)	1	<1	48	<1
Missing	54	3	6,129	2
Smoking habits				
Smoker	909	54	69,571	23
Smoking occasionally	16	1	5,178	2
Previous smoker	213	13	70,789	23
Nonsmoker	392	23	125,295	42
Missing	151	9	30,124	10
Body mass index (kg/m <sup>2</sup> )				
>0–<20	37	2	9,065	3
20–<25	270	16	73,199	24
25–<30	442	26	98,330	33
30–<50	808	48	106,619	35
50–100	40	3	1,949	1
Other (≤0 and >100)	0	—	4	<1
Not relevant	23	1	3,633	1
Missing	61	4	8,158	3
Percentage of relevant diabetes performance measures received				
0–<20%	184	13	26,503	10
20–<40%	28	2	2,859	1
40–<60%	88	6	13,251	5
60–<80%	198	13	34,055	12
80–100%	956	66	197,412	72

sufficient treatment. Moreover, the mental disorder itself may affect medication adherence and awareness of diabetes complications, including reduced sight and incipient foot ulcers. Cognitive and communicative limitations may prevent this vulnerable population from seeking and receiving care.

However, it must be acknowledged that the observed differences in diabetes care were modest, which may indicate that outpatient clinics are capable of accommodating

**TABLE 4. Relative risk (RR) of receipt of individual process performance measures of diabetes care during contacts by patients with diabetes and schizophrenia versus patients with diabetes only<sup>a</sup>**

Variable	Diabetes and schizophrenia (N=1,681)		Diabetes only (N=300,957)		Unadjusted analysis	
	N	%	N	%	RR	95% CI
High overall quality of care <sup>b</sup>	956	66	197,412	72	.91	.88–.95
Individual measure						
Glycemic monitoring	1,227	96	241,955	97	.98	.96–1.00
Antidiabetic medication	321	98	48,533	98	1.00	.99–1.02
Blood pressure monitoring	1,178	93	234,424	95	.98	.96–.99
Antihypertensive medication	86	66	28,228	80	.83	.70–.97
Cholesterol monitoring	1,108	94	221,457	95	.99	.97–1.01
Lipid-lowering medication	38	70	7,161	64	1.09	.89–1.35
Screening for albuminuria	1,108	88	221,920	91	.96	.93–.99
ACE/ATII inhibitors medication <sup>c</sup>	27	59	7,656	82	.72	.55–.93
Eye examination I <sup>d</sup>	1,075	86	214,593	88	.97	.94–.99
Eye examination II <sup>e</sup>	1,155	92	226,515	93	.99	.96–1.01
Feet examination	1,097	87	220,702	91	.96	.93–.99

<sup>a</sup> Contacts occurred in outpatient clinics in Danish hospitals.<sup>b</sup> High overall quality was defined as receiving 80%–100% of relevant performance measures of diabetes care.<sup>c</sup> Angiotensin-converting enzyme (ACE)/angiotensin II receptor (ATII) inhibitors<sup>d</sup> At least once every second year<sup>e</sup> At least once every fourth year

individuals with diabetes and schizophrenia. Outpatient clinics may primarily treat patients who have mild cases of schizophrenia and who are more likely to attend and receive diabetes checks. The universal health care system and the establishment of the DADR that ensures guideline-recommended care for individuals with diabetes, supported by regular audits, should also be taken into consideration when interpreting the results. The remaining individual process performance measures, including glycemic monitoring, antidiabetic medication, cholesterol monitoring, lipid-lowering medication and eye examination at least once every fourth year, were equally distributed among individuals with and without schizophrenia.

We observed that drug abuse and contact volume had the clearest association with the quality of diabetes care. Individuals with schizophrenia and documented drug abuse were less likely than those without documented drug abuse to receive a foot examination, and clinics with very high contact volume were more likely than those with low contact volume to provide high-quality diabetes care, including treatment with ACE/ATII inhibitors. Individuals with diabetes and schizophrenia and concomitant drug abuse may have difficulty attending clinics for follow-up checks. Clinics with very high contact volume may have better resources, more specialized treatments, and personnel who have greater clinical experience with psychiatric patients.

We can only speculate about the mechanisms underlying the observed deficiencies in diabetes care and predictors of such deficiencies. For individuals with diabetes and schizophrenia, navigating between the psychiatric and general medical care systems may constitute a particular challenge. Physician barriers may include minimal experience with psychiatric patients and discomfort with or stigmatizing

attitudes toward these patients. In addition, system factors, such as variations in resources by clinic and region, lack of coordination between systems, and time constraints because of the need to attend to patients' comorbid conditions, may underlie disparities. A further intermediary factor may be disengagement from treatment. Individuals with diabetes and schizophrenia may find the treatment unsuitable to their needs or may experience difficulties in their relationship with the treating physician and may thus disengage from care (28–30).

## CONCLUSIONS

This nationwide population-based cohort study demonstrated that schizophrenia was associated with a lower likelihood of receiving high-quality diabetes care and several individual process performance measures of diabetes care. However, the absolute differences in diabetes care between those with and without schizophrenia were modest.

Predictors of the quality of diabetes care among individuals with schizophrenia included patient- and system-specific factors. We encourage further population-based studies of the association between schizophrenia and quality of diabetes care in health care systems with free and equal access to services. To effectively target quality improvement interventions, it is important to identify individuals with diabetes and schizophrenia, who are at particular risk of receiving deficient care.

## AUTHOR AND ARTICLE INFORMATION

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## REFERENCES

1. Saha S, Chant D, McGrath J: A systematic review of mortality in schizophrenia: is the differential mortality gap worsening over time? *Archives of General Psychiatry* 64:1123–1131, 2007
2. Brown S: Excess mortality of schizophrenia: a meta-analysis. *British Journal of Psychiatry* 171:502–508, 1997
3. Laursen TM: Life expectancy among persons with schizophrenia or bipolar affective disorder. *Schizophrenia Research* 131:101–104, 2011

4. Crump C, Winkleby MA, Sundquist K, et al: Comorbidities and mortality in persons with schizophrenia: a Swedish national cohort study. *American Journal of Psychiatry* 170:324–333, 2013
5. Nielsen RE, Uggerby AS, Jensen SOW, et al: Increasing mortality gap for patients diagnosed with schizophrenia over the last three decades: a Danish nationwide study from 1980 to 2010. *Schizophrenia Research* 146:22–27, 2013
6. Lawrence D, Hancock KJ, Kisely S: The gap in life expectancy from preventable physical illness in psychiatric patients in Western Australia: retrospective analysis of population based registers. *BMJ* 346:f2539, 2013
7. Laursen TM, Wahlbeck K, Hällgren J, et al: Life expectancy and death by diseases of the circulatory system in patients with bipolar disorder or schizophrenia in the Nordic countries. *PLoS One* 8: e67133, 2013
8. Ribe AR, Laursen TM, Sandbaek A, et al: Long-term mortality of persons with severe mental illness and diabetes: a population-based cohort study in Denmark. *Psychological Medicine* 44: 3097–3107, 2014
9. Mai Q, Holman CDJ, Sanfilippo FM, et al: Mental illness-related disparities in diabetes prevalence, quality of care and outcomes: a population-based longitudinal study. *BMC Medicine* 9:118, 2011
10. Druss BG, Zhao L, Cummings JR, et al: Mental comorbidity and quality of diabetes care under Medicaid: a 50-state analysis. *Medical Care* 50:428–433, 2012
11. Mangurian C, Newcomer JW, Vittinghoff E, et al: Diabetes screening among underserved adults with severe mental illness who take antipsychotic medications. *JAMA Internal Medicine* 175: 1977–1979, 2015
12. Mitchell AJ, Malone D, Doebbeling CC: Quality of medical care for people with and without comorbid mental illness and substance misuse: systematic review of comparative studies. *British Journal of Psychiatry* 194:491–499, 2009
13. OECD Reviews of Health Care Quality: Denmark 2013: Raising Standards. Paris, Organisation for Economic Co-operation and Development, 2013
14. Pedersen CB, Göttsche H, Møller JO, et al: The Danish civil registration system: a cohort of eight million persons. *Danish Medical Bulletin* 53:441–449, 2006
15. Mainz J, Hansen AM, Palshof T, et al: National quality measurement using clinical indicators: the Danish National Indicator Project. *Journal of Surgical Oncology* 99:500–504, 2009
16. Mainz J, Krog BR, Bjørnshave B, et al: Nationwide continuous quality improvement using clinical indicators: the Danish National Indicator Project. *International Journal for Quality in Health Care* 16(suppl 1):i45–i50, 2004
17. The Danish National Indicator Project: Audit Schizophrenia 2011. Copenhagen, Danish National Board of Health, 2012
18. The Danish National Indicator Project: Audit Diabetes 2013. Copenhagen, Danish National Board of Health, 2014
19. Mors O, Perto GP, Mortensen PB: The Danish Psychiatric Central Research Register. *Scandinavian Journal of Public Health* 39 (suppl):54–57, 2011
20. Munk-Jørgensen P, Østergaard SD: Register-based studies of mental disorders. *Scandinavian Journal of Public Health* 39(suppl): 170–174, 2011
21. Lynge E, Sandegaard JL, Rebolj M: The Danish National Patient Register. *Scandinavian Journal of Public Health* 39(suppl):30–33, 2011
22. International Statistical Classification of Diseases and Related Health Problems (ICD), 10th Revision. Geneva, World Health Organization, 2011
23. Moos RH, McCoy L, Moos BS: Global Assessment of Functioning (GAF) ratings: determinants and role as predictors of one-year treatment outcomes. *Journal of Clinical Psychology* 56:449–461, 2000
24. Hilsenroth MJ, Ackerman SJ, Blagys MD, et al: Reliability and validity of DSM-IV axis V. *American Journal of Psychiatry* 157: 1858–1863, 2000
25. Li Y, Glance LG, Cai X, et al: Are patients with coexisting mental disorders more likely to receive CABG surgery from low-quality cardiac surgeons? The experience in New York State. *Medical Care* 45:587–593, 2007
26. Li Y, Glance LG, Lyness JM, et al: Mental illness, access to hospitals with invasive cardiac services, and receipt of cardiac procedures by Medicare acute myocardial infarction patients. *Health Services Research* 48:1076–1095, 2013
27. Cai X, Li Y: Are AMI patients with comorbid mental illness more likely to be admitted to hospitals with lower quality of AMI care? *PLoS One* 8:e60258, 2013
28. Blixen CE, Kanuch S, Perzynski AT, et al: Barriers to self-management of serious mental illness and diabetes. *American Journal of Health Behavior* 40:194–204, 2016
29. Welch LC, Litman HJ, Borba CP, et al: Does a physician's attitude toward a patient with mental illness affect clinical management of diabetes? Results from a mixed-method study. *Health Services Research* 50:998–1020, 2015
30. Smith TE, Easter A, Pollock M, et al: Disengagement from care: perspectives of individuals with serious mental illness and of service providers. *Psychiatric Services* 64:770–775, 2013