Is Metabolic Syndrome On the Radar?

Improving Real-Time Detection of Metabolic Syndrome and Physician Response by Computerized Scan of the Electronic Medical Record

Kingwai Lui, DO[a]; Gagandeep Randhawa, MD[a]; Vicken Totten, MD, MS[b]; Adam E. Smith, PhD[c]; and Joachim Raese, MD[a,*]

ABSTRACT

Objective: Metabolic syndrome is a common underdiagnosed condition among psychiatric patients exacerbated by second-generation antipsychotics, with the exception of aripiprazole and ziprasidone. This study evaluated the prescribing and treating behavior with regard to antipsychotics and metabolic syndrome of psychiatrists before and after implementation of a mandatory admission order set and electronic notification of results.

Method: Baseline data from 9,100 consecutive psychiatric admissions to a mental health hospital (July 2013–July 2014) were compared to postintervention data (July 2014–January 2015), which included 1,499 consecutive patient records. The intervention initiated standardized admission testing with electronic notification to psychiatrists when patients met metabolic syndrome criteria (according to Axis III of the *DSM-IV*). Charts were examined for inclusion of this diagnosis at discharge and for treatment changes.

Results: At baseline, only 2.4% of patients (n = 214) were evaluated for metabolic syndrome. Of these, 34.5% (0.8% of the total sample) met metabolic syndrome criteria. Only 15 patients (0.16%) were comprehensively treated. No chart listed metabolic syndrome under Axis III of the *DSM-IV*. After the intervention, the diagnosis of patients meeting the criteria for metabolic syndrome increased from 0% to 29.3%. Less than 3% of patients were switched to drugs with a more benign metabolic profile. All patients who continued on second-generation antipsychotics had metabolic retesting. Thirty-eight experienced a significant and rapid increase in triglyceride levels after only 3 to 17 days.

Conclusions: Mandatory intake testing increases the number of patients evaluated for metabolic syndrome. Electronic alerts increase the inclusion of metabolic syndrome among discharge diagnoses but rarely affect prescribing practices.

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[a]Department of Psychiatry, [b]Department of Emergency Medicine, [c]Statistical and Research Consultant, Kaweah Delta Health Care District, Visalia, California

**Corresponding author:* Joachim Raese, MD, Department of Psychiatry, Kaweah Delta Health Care District, 400 W Mineral King Ave, Visalia, CA 93291 (jraese@gmail.com).

Mental illness is associated with an increased relative risk of mortality of 2.2 or 10 years of life lost.[1] This excess mortality is multifactorial including the disorganizing effects of the mental illness, unaddressed side effects of treatment, and concomitant physical illnesses (often inadequately treated). Psychiatric patients have reduced life spans, more medical diseases, and more frequent contact with the health care system than non–mentally ill people. Common but rarely addressed problems among the mentally ill are obesity, hypertension, dyslipidemia, and glucose abnormalities.[2] One might expect the mentally ill to receive more regular medical monitoring and treatment.[3] Unfortunately, patients with psychiatric disorders receive lower quality medical care.[4] Metabolic syndrome contributes heavily to this excess morbidity.

Metabolic syndrome is an energy utilization disorder characterized by increased waist circumference, elevated fasting glucose and triglyceride levels, reduced high-density lipoprotein (HDL) levels, and elevated blood pressure. Metabolic syndrome is diagnosed when 3 or more criteria are present.[5] Metabolic syndrome itself is associated with cognitive decline in adolescents and adults[6] and accelerated decline in the elderly.[7] One hypothesized mechanism is arteriosclerotic brain damage from untreated hypertension[8]; another is the microvascular inflammation caused by excess serum glucose.[9]

The increased risk of metabolic syndrome in the severely mentally ill is multifactorial.[10,11] Obesity is 1.5 to 2 times higher among the mentally ill than the general population.[12] Dyslipidemia, hypertension, and diabetes also are common.[12] Mental disorders may have a bidirectional relationship with metabolic syndrome.[13] Obesity is a risk factor for depression.[14] Schizophrenia reduces life expectancy by 20%[15,16] and is associated with a 43% prevalence of metabolic syndrome.[17] Early onset of metabolic syndrome is associated with first-episode schizophrenia spectrum disorders, suggesting a direct relationship.[18] Patients with bipolar disorder have a mean metabolic syndrome prevalence of 37.3%.[3] Patients who develop metabolic syndrome double their 10-year cardiovascular disease risk,[19] primarily because of an increase in cardiovascular disease.[20]

Patients treated with second-generation antipsychotics (SGAs) rarely receive complete laboratory workups,[21–23] and when such tests are done, the results rarely change therapy.[24] Therefore, increased attention to metabolic screening for hospitalized psychiatric patients is a pending quality of care measure .[25,26] Unfortunately, treatment for mental illness also may increase metabolic syndrome risk. Although SGAs may have fewer extrapyramidal effects,[27] they have a metabolic cost. Clozapine and olanzapine directly impair glucose metabolism and induce insulin resistance compared with risperidone[28] and are associated with diabetes.[29] Clozapine and olanzapine are associated with significant

Clinical Points

- Metabolic syndrome is a common underdiagnosed condition among psychiatric patients that even when diagnosed is rarely completely treated.
- Mandatory intake testing increases the number of patients evaluated for metabolic syndrome.
- Electronic alerts increase the inclusion of metabolic syndrome among discharge diagnoses but rarely affect prescribing practices.

weight gain. Olanzapine was discontinued due to excessive weight gain twice as often as other antipsychotics in the Clinical Antipsychotic Trials of Intervention Effectiveness (CATIE) trial.[27] Quetiapine and risperidone have less effect on weight. Aripiprazole and ziprasidone cause the least weight gain.[30] The chance of SGA-induced weight gain appears to be polygenetic.[31,32]

METHOD

Ethics Review

The institutional review board of Kaweah Delta Health Care District (Visalia, California) approved this study. Study participants were inpatients of Kaweah Delta Mental Health Hospital. Because all data were deidentified before analysis and reported in aggregate, the institutional review board determined that no individual consent was required.

Design Summary

This was an observational study of the effects of a natural experiment on the prescribing and treating behavior of psychiatrists before and after implementation of a mandatory admission order set and electronic notification of results.

Criteria for Metabolic Syndrome

1. Body mass index (BMI) was used as a criterion for diagnosis of metabolic syndrome until November 2014, when waist circumference was added to the intake procedure. Thereafter, a waist circumference > 88 cm for women and > 102 cm for men was used instead when available.[33,34]
2. Hypertension: systolic blood pressure > 130 mm HG and diastolic blood pressure > 85 mm Hg.
3. BMI > 25 kg/m^2.
4. Fasting glucose > 110 mg/dL.
5. Hyperlipidemia with either fasting HDL < 40 mg/dL (< 50 mg/dL in females) or fasting triglycerides > 150 mg/dL.

Population

Electronic medical records (EMRs) of mental health admissions were reviewed. Baseline data from 9,100 consecutive psychiatric admissions (July 2013–July 2014) were compared to postintervention data (July 2014–January 2015), which included 1,499 consecutive patient records.

Interventions

In response to a pending federal quality of care requirement, in July 2014 a mandatory admission order set was changed to include fasting glucose, triglyceride, and HDL levels; BMI; and a complete set of vital signs, which included weight and, later, waist circumference. A computer algorithm that scanned the EMR for metabolic syndrome criteria was implemented. The algorithm sent a secure, personal e-mail within 24 hours of admission to the treating psychiatrist. The e-mail included the supporting data and an advisory to include the diagnosis under Axis III of the *DSM-IV* in both the progress note and discharge summary and suggested that appropriate interventions for metabolic syndrome might include switching to a different antipsychotic, treatment with a antihypertensive, or treatment with lipid or glucose-lowering drugs. The algorithm also added a new progress note template to the EMR that required the psychiatrist to respond and acknowledge the presence of metabolic syndrome and describe planned interventions. For patients who continued to receive the SGAs clozapine, risperidone, olanzapine, and quetiapine after the diagnosis of metabolic syndrome, a second lipid panel and glucose level were obtained after 3 to 17 days to monitor acute changes in these metabolic indices. Aripiprazole and ziprasidone were not included in the list of SGAs that triggered the additional tests because they do not carry significant increased metabolic risk.[31,35,36]

Data Collection

The automated algorithm was used to detect criteria of metabolic syndrome in the EMRs. The algorithm extracted patient age, gender, blood pressure, BMI, glucose, HDLs, triglycerides, and waist circumference. Admission diagnoses were extracted and categorized as psychotic disorder, bipolar disorder, depressive disorder, or other diagnoses. Use of the SGAs clozapine, olanzapine, risperidone, and quetiapine was noted. When laboratory and biometric criteria for metabolic syndrome were met, the algorithm searched for metabolic syndrome in the discharge summary. It also searched for changes made to patient therapy.

Calculated Variables

Diagnosis (per *DSM-IV* criteria) was grouped into 4 categories: psychotic disorders (psychotic disorder not otherwise specified, schizophrenia, and schizoaffective disorder), depressive disorders (major depressive disorder and depressive disorder not otherwise specified), bipolar disorder, and adjustment/mood disorder not otherwise specified.

Patients were stratified by number of metabolic syndrome criteria met (3–5). The triglyceride/HDL ratio was calculated because higher ratios are associated with increased risk of coronary artery disease.[36] Completeness of treatment of the components of metabolic syndrome was scored as 1 = no treatment, 2 = partial treatment, and 3 = complete treatment (all components of metabolic syndrome were addressed).

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Table 1. Patients Meeting Criteria for Metabolic Syndrome Postintervention (n = 454)[a]

Variable	Patients
Age, mean (median [SD]), range, y	40.7 (39.0 [13.1]), 18–87
Gender	
Male	254 (55.9)
Female	200 (44.1)
Axis I diagnosis at admission	
Psychotic disorder	216 (47.6)
Bipolar disorder	80 (17.6)
Depression	122 (26.9)
Other[b]	36 (7.9)
No. of metabolic syndrome criteria met[c]	
3	249 (54.8)
4	165 (36.3)
5	40 (8.8)
SGA prescribed at admission (n = 209)	
Clozapine	7 (3.3)
Olanzapine	75 (35.9)
Quetiapine	52 (24.9)
Risperidone	75 (35.9)
SGA prescribed at discharge (n = 199)	
Clozapine	8 (4.0)
Olanzapine	68 (34.2)
Quetiapine	48 (24.2)
Risperidone	75 (37.7)

[a]Data are presented as n (%) unless otherwise specified.
[b]Other (mood disorder not otherwise specified, adjustment disorder).
[c]Metabolic syndrome criteria: (1) hypertension: systolic blood pressure > 130 mm Hg and diastolic blood pressure > 85 mm Hg, (2) body mass index > 25 kg/m^2, (3) fasting glucose > 110 mg/dL, (4) fasting high-density lipoproteins < 40 mg/dL in males (< 50 mg/dL in females), and (5) fasting triglycerides > 150 mg/dL.
Abbreviation: SGA = second-generation antipsychotic.

Medications were recorded by category: antihypertensive, lipid-lowering agents, and hypoglycemic agents. Discharge summaries were for metabolic syndrome in Axis III of the *DSM-IV*.

RESULTS

Baseline

Prior to initiating the enhanced admission order set, 9,100 consecutive charts were evaluated. Most patients (97.6% or 8,886/9,100) did not have the complete recommended admission orders. Of the 214 patients who did, 34.5% (74/214) met metabolic syndrome criteria, consistent with the literature. Only 15 patients (20.0% of patients meeting criteria for metabolic syndrome) were comprehensively treated. Another 50.0% of the 74 patients were partially treated, while 30.0% received no treatment. At baseline, no patient had metabolic syndrome recorded under Axis III of the *DSM-IV*.

Postintervention

Of 1,499 consecutively admitted patients, 454 were diagnosed with metabolic syndrome (Table 1). Among metabolic syndrome patients, psychotic disorders accounted for the largest group with 47.6% (216/454). Depressive disorder was next with 26.9% (122/454), followed by bipolar disorder with 17.6% (80/454) and adjustment/mood disorder not otherwise specified with 7.9% (36/454). Almost half (54.8%, 249/454) of metabolic syndrome patients met 3 criteria for metabolic syndrome, 36.3% (165/454) met 4 criteria, and 8.8% (40/454) met 5 criteria. This finding is similar to other mental health populations in the literature.

Table 2. Interventions for Metabolic Syndrome[a]

Variable	Phase 2[b] (n = 232)	Phase 3[c] (n = 222)
Axis III diagnosis	0 (0)	65 (29.3)
Change in antipsychotic use[d]		
Removal	8 (3.4)	6 (2.7)
Addition	7 (3.0)	6 (2.7)
Medication prescribed treatment for components of metabolic syndrome		
Hypertension	79/217 (36.4)	74/154 (48.1)
Hyperlipidemia	43/77 (55.8)	23/102 (22.5)
Hyperglycemia	44/63 (69.8)	36/55 (65.5)
Metformin use		
At admission	13/63 (20.6)	24/55 (43.6)
At discharge	25/63 (39.7)	21/55 (38.2)
Completeness of metabolic syndrome treatment		
Not treated	122 (52.6)	133 (60.0)
Partially treated	52 (22.4)	37 (16.7)
Completely treated	58 (25.0)	52 (23.4)

[a]Data are presented as n (%).
[b]Phase 2: without e-mail notification of physicians of the diagnosis of metabolic syndrome.
[c]Phase 3: with e-mail notification of physicians of the diagnosis of metabolic syndrome.
[d]Second-generation antipsychotic of interest (clozapine, risperidone, olanzapine, quetiapine).

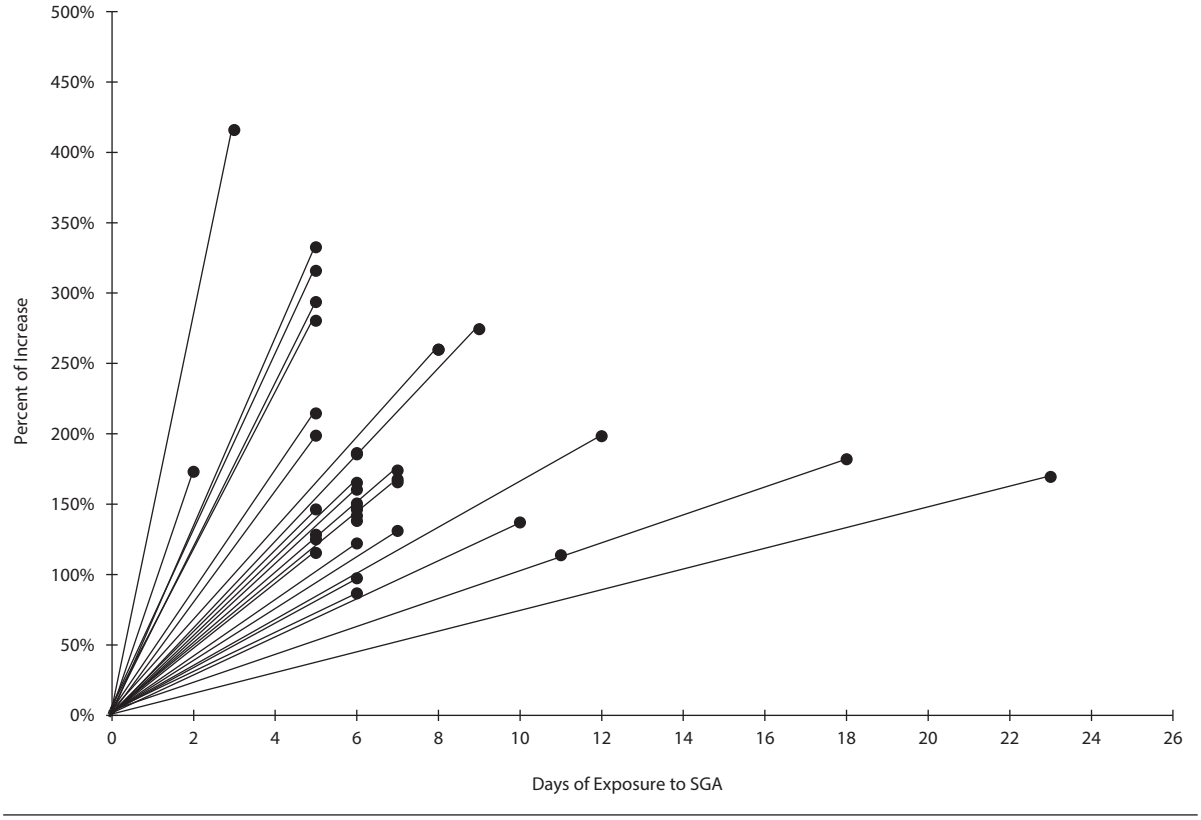
Three measures of intervention effectiveness were used.

1. Documentation of metabolic syndrome under Axis III of the *DSM-IV* discharge summary, which improved significantly from 0% to 29.3%.
2. Prescription of SGAs from admission to discharge, which showed little change (Table 1). At admission, 35.9% of patients were prescribed olanzapine compared to 34.2% at discharge. Risperidone was the initial drug of choice for 35.9% at admission compared to 37.7% at discharge. Quetiapine accounted for 24.9% at admission and 24.2% at discharge. Psychiatrists did not switch patients with metabolic syndrome to drugs with a more benign metabolic profile. Despite e-mail alerts, 2.7% (6/222) of patients received a new prescription for an SGA (Table 2).
3. Comprehensiveness of treatment for the components of metabolic syndrome, which failed to improve (Table 2). Most noticeably, the percentage of patients with metabolic syndrome who did not receive any medication treatment did not change (52.6% prior to the use of e-mail notifications and 60.0% after the implementation of e-mail alerts). Prescriptions for metformin did not increase after e-mail notifications to psychiatrists alerting them to the diagnosis of metabolic syndrome (Table 2).

Effects of Continued SGAs on Patients

Fasting lipid and glucose serum levels were automatically reordered for subjects with metabolic syndrome who continued to receive SGAs. Of these, 38 patients experienced

Figure 1. Triglyceride Level Increase Associated With Continued Use of a Second-Generation Antipsychotic (SGA) (olanzapine, risperidone, quetiapine, or clozapine)



a rapid increase in triglycerides after only 3 to 17 days. The magnitude of the triglyceride increase of 3 patients is of particular interest (Figure 1 and Table 3). Two patients prescribed olanzapine at admission exhibited a 3-fold increase in triglycerides, while 1 patient had a nearly 15-fold increase in triglycerides after 9 days of taking olanzapine.

In 2 of these 3 patients, atorvastatin appeared to attenuate this effect. One patient taking olanzapine showed a decrease of triglyceride level from 468 mg/dL to 268 mg/dL after the addition of atorvastatin 40 mg. A second patient who received quetiapine had a decrease in triglyceride level from 428 mg/dL to 266 mg/dL within 9 days after starting atorvastatin 20 mg.

These responses suggest that some patients have an increased vulnerability to the metabolic effects of SGAs. A single nucleotide polymorphism near the melanocortin 4 receptor gene (*MC4R*) has been linked in a recessive fashion ($P = 5.59 \times 10^{-12}$) to rapid excessive weight gain, increased body fat, and triglyceride levels in pediatric patients undergoing first exposure to SGAs.[38]

Severity of Metabolic Syndrome by Psychiatric Diagnosis

The patients (n = 454) were divided into 4 diagnostic groups: psychotic disorder (n = 216), bipolar disorder (n = 80), depressive disorder (n = 122), or other (n = 36). Number of metabolic syndrome criteria met produced 3 groups: met 3 criteria (n = 249), met 4 criteria (n = 165), or met 5 criteria (n = 40). A χ^2 analysis revealed no evidence of a predictable, consistent relationship between diagnosis group and metabolic syndrome score ($\chi^2_{6,450} = 3.052$, $P = .802$; Table 4).

DISCUSSION

This study suggests that psychiatrists infrequently consider metabolic syndrome. Testing is rarely ordered. When testing becomes automated, the results are rarely examined. When the diagnostic criteria for metabolic syndrome are met, the diagnosis is rarely entered into the psychiatric discharge summary. The component metabolic disorders are rarely addressed or treated in the inpatient psychiatric setting. Potential barriers that may contribute to psychiatrists' passivity include lack of familiarity, lack of urgency, and lack of agreement. Barriers to change may include lack of knowledge, historical prescribing practices, and cognitive dissonance.

Lack of Familiarity

Studies[25,39] indicate that the majority of psychiatrists are aware of the direct relationship between antipsychotic use and obesity and even the relationship to metabolic syndrome. However, their understanding may be superficial. For example, according to Newcomer et al,[39] only 22% of the

Table 3. Rapid Increase in Triglycerides With Use of Second-Generation Antipsychotics (SGAs)[a]

Age (y)	Gender	Duration of SGA Treatment (d)	Triglyceride Level Before (mg/dL)	Triglyceride Level After (mg/dL)	SGA	Intervention
48	Male	6	173	286	Olanzapine	None
46	Male	6	105	145	Olanzapine	None
58	Male	5	142	417	Quetiapine	None
44	Female	6	153	187	Clozapine	None
36	Male	3	101	420	Olanzapine	None
34	Female	6	63	101	Risperidone	None
46	Male	9	21	349	Olanzapine	None
51	Male	2	52	90	Olanzapine	None
48	Male	7	131	228	Olanzapine	None
31	Male	10	116	159	Olanzapine	None
20	Male	5	89	296	Olanzapine	None
53	Female	18	249	453	Quetiapine	None
18	Female	6	122	180	Olanzapine	None
59	Male	5	145	186	Quetiapine	None
50	Male	5	148	185	Olanzapine	None
24	Male	5	61	171	Risperidone	None
28	Female	7	132	173	Risperidone	None
18	Male	5	62	133	Olanzapine	None
37	Male	9	428	266	Quetiapine	Atorvastatin 20 mg
34	Male	4	161	135	Risperidone	Fenofibrate 160 mg
44	Female	2	468	268	Quetiapine	Atorvastatin 40 mg
38	Male	39	152	173	Risperidone	None
28	Female	28	132	173	Risperidone	None
50	Female	17	195	225	Quetiapine	None
50	Female	10	195	201	Quetiapine	None
38	Male	8	226	259	Olanzapine	None
18	Male	12	126	250	Haloperidol,	None
18	Male	12	87	226	Risperidone	None
30	Male	7	194	168	Olanzapine	None
25	Male	1	85	144	Haldol	None
39	Female	2	132	193	Olanzapine	None
37	Male	5	154	255	Olanzapine	None
21	Female	16	82	152	Olanzapine	None
21	Male	13	63	199	Quetiapine	None
21	Male	9	153	224	Quetiapine	None
59	Male	35	125	343	Quetiapine	Simvastatin 10 mg
47	Female	15	206	292	Risperidone	Atorvastatin 20 mg
33	Male	8	108	181	Quetiapine	None

[a]Thirty-eight patients with metabolic syndrome received repeat lipid panels during continuation of SGA treatment with length of treatment from 3 to 39 days. A subset of 30 patients showed a greater than 20% increase in triglyceride level. Atorvastatin, fenofibrate, and simvastatin may have a protective effect on SGA-induced hypertriglyceridemia.

Table 4. Frequency and Percent of Metabolic Syndrome Severity Score by Diagnosis Group (n = 454)[a]

	3 Criteria		4 Criteria		5 Criteria	
Diagnosis Group	n	%	n	%	n	%
Psychotic disorder	116	46.6	79	47.9	21	52.5
Bipolar disorder	48	19.3	25	15.2	7	17.5
Depressive disorder	63	25.3	50	30.3	9	22.5
Other disorder	22	8.8	11	6.7	3	7.5

[a]A χ^2 test of independence was performed to assess the relation between diagnosis group and metabolic syndrome score. The analysis was conducted on 454 patients belonging to 1 of 4 diagnosis groups: psychotic disorder (n = 216), bipolar disorder (n = 80), depressive disorder (n = 122), or other disorder (n = 36). Metabolic syndrome score was the grouping of medical condition into 1 of 3 groups: met 3 criteria (n = 249), met 4 criteria (n = 165), or met 5 criteria (n = 40). A χ^2 analysis revealed no evidence of a predictable, consistent relationship between diagnosis group and metabolic syndrome score ($\chi^2_{6,450} = 3.052$, $P = .802$).

300 psychiatrists surveyed recognized that dyslipidemia was a metabolic complication of SGA use.

Lack of Urgency

Awareness of metabolic syndrome does not necessarily translate into diagnosis or management. Many psychiatrists are unfamiliar with current guidelines and recommendations for diagnosis and treating the "medical" diseases of hypertension, diabetes, hyperlipidemia, and obesity. They prefer to leave these diseases to their medical colleagues. They may know that metabolic syndrome reduces life expectancy, but since its detrimental effects are not immediate, they may leave treatment to a "later" time that never comes. Psychiatrists are more likely to overlook metabolic syndrome as it is considered a low priority in patient management. They may not believe their monitoring makes a difference. Only 20.6% of the 2,534 psychiatrists in the Japanese Psychiatric Hospitals Association believed that the frequency with which they monitored their patients was sufficient to reduce metabolic risks.[40]

Lack of Agreement

Treatment guidelines for individual indices of metabolic syndrome such as hypertension, hyperglycemia, and hyperlipidemia have existed for many years. However, there is no standardized guideline for treating metabolic syndrome, which is secondary to antipsychotic use. There

is dissent about which patients to monitor, the utility of glucose tolerance testing, and the point at which to consider switching antipsychotics.[41] This lack of general agreement might relieve the individual psychiatrist of any impetus to adhere to medical guidelines.[42]

Barriers to Behavior Change

Passive educational interventions have limited effectiveness. Physicians demonstrate a limited response to US Food and Drug Administration (FDA) warnings and recommendations, such as those for suggested laboratory monitoring for troglitazone, pemoline, or antipsychotics and clinical monitoring for antidepressants. Physician responses are generally incomplete or temporary.[43] For example, FDA advisories about potential cardiovascular risks of attention-deficit/hyperactivity disorder medications have had little discernible effect on national prescribing of these medicines.[44] Additionally, antipsychotic polypharmacy remains prevalent despite guideline recommendations for monotherapy.[45]

Lack of Knowledge

Psychiatrists in our hospital, and in the wider psychiatric community, clearly favor SGAs over first-generation antipsychotics (FGAs). At introduction, drug manufacturers' advertisements claimed the SGAs produced fewer extrapyramidal symptoms. SGAs quickly became the treatment of choice for psychotic disorders.[46] Perphenazine (an FGA) has a frequency of movement side effects similar to SGAs.[47] SGAs have a number of other side effects, and in the balance, it remains unclear to what extent SGAs are superior to FGAs.

There is little evidence to support SGAs over FGAs in general.[48] One double-blind, randomized, controlled trial reported that olanzapine (an SGA) might not result in a superior quality of life compared to haloperidol due to its increased risk of weight gain and higher cost.[49] Haloperidol with benztropine may be superior to olanzapine, as the combination can prevent the deleterious metabolic outcomes of SGA use.

The publicly funded CATIE trial also did not support the superiority of SGAs in schizophrenia.[27] CATIE is one of the most influential antipsychotic studies to date. In this study, unfortunately, FGAs were underrepresented, and none were included in the second and final phase of the study, which found olanzapine to be superior to other atypical antipsychotics in regard to symptom reduction and duration of treatment adherence. (FGAs were excluded from the second phase of CATIE on the basis of the assumption that they would cause more side effects.) To conclude, according to CATIE, SGAs may not have a substantial advantage over FGAs.

Cognitive Dissonance

SGAs remain popular among psychiatrists at our facility, mirroring prescribing practices across the nation. The percentage of patients treated with SGAs was unchanged before and after e-mail notifications to the psychiatrists that their patients met criteria for metabolic syndrome. This lack of change may be because psychiatrists about to prescribe SGAs are likely to experience some cognitive dissonance when confronted daily with explicit reminders that a substantial number of their patients either present with metabolic syndrome or may develop it early in the course of treatment with SGAs. Yet, through much of their professional lives, they have been in the habit of prescribing SGAs and have been advised that FGAs are "not as good." Furthermore, although psychiatrists have a general awareness of metabolic syndrome (as evidenced by the reduction in olanzapine prescriptions after the FDA issued a black box warning on the metabolic risks of olanzapine),[24] this awareness may not translate into choice of antipsychotic for a specific patient for whom the treating psychiatrist is about to prescribe medication.

Despite the increase in appropriate documentation of metabolic syndrome in the EMR from 0% to 38%, little improvement was observed in the treatment of hyperlipidemia, hypertension, or hyperglycemia. More than half (53.5%) of patients did not receive treatment targeted to the components of metabolic syndrome before psychiatrists were notified by e-mail that their patient met criteria for metabolic syndrome. After e-mail notification was instituted, this percentage remained at 52.8%. This lack of attention is in stark contrast to the finding that amelioration of metabolic syndrome–associated problems can be obtained with metformin, a well-established and well-tolerated drug that reduces weight and hemoglobin A_{1c} as well as triglycerides in antipsychotic-treated patients.[50–54]

Role of Computer Algorithms in Detection and Treatment of Metabolic Syndrome

Active interventions, such as letters or phone calls to physicians, can decrease the use of antipsychotic polypharmacy but may produce a "big-brother"–like atmosphere.[55] EMRs are powerful tools for changing physician behavior and improving clinical performance in drug dosing and preventive care,[56] resulting in substantial reduction in health care costs.[57] Their potential is not yet fully explored. In our study, an EMR admission order set was instrumental in increasing the detection of metabolic syndrome. Unfortunately, mere detection is insufficient. Placing a metabolic syndrome alert in the EMR, coupled with individual notification of the psychiatrist, resulted in only 38% of qualifying patients actually having the diagnosis listed in the psychiatric discharge summary.

EMRs can be designed to incorporate forcing functions. An example of a forcing function is the requirement to enter a creatinine level in the EMR in order to request a contrast-enhanced radiography. A forcing function, which could potentially be incorporated into an EMR, might present physicians with an order set that changes its options depending on whether the patient meets criteria for metabolic syndrome or not. Ultimately, patient management will improve with elimination of human errors in diagnosis.

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CONCLUSION

Diagnosing and treating metabolic syndrome is of critical importance in psychiatric patients. This study shows that metabolic syndrome is often underdiagnosed and even when diagnosed is rarely completely treated. Switching antipsychotic medications from SGAs to FGAs will decrease the prevalence of metabolic syndrome, yet psychiatrists seem reluctant to use this strategy. More troubling is the reluctance of psychiatrists to acknowledge and document the diagnosis of metabolic syndrome. More intensive education of both psychiatrists and consulting internists may be helpful in changing prescribing behavior, but incorporating forcing functions into the EMR is more likely to have an immediate effect.

In addition, future quality measures such as the Hospital Based Inpatient Psychiatric Services (Specification Manual for National Quality Core Measures version 2015A)[58] may require psychiatrists to document metabolic syndrome. These measures may incentivize physicians to change their prescribing choices.

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Author contributions: Drs Lui and Randhawa collected the data and performed the analysis. Dr Totten assisted in writing and editing the manuscript. Dr Smith consulted on the statistical analysis. Dr Raese conceived the research question and oversaw the project.

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