Electronic Order Sets and Reminders Significantly Improve Ordering of Monitoring Parameters for Antipsychotic Medications

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When drug use evaluation results showed that monitoring for metabolic complications in patients taking second generation antipsychotic medications was suboptimal at their facility, these authors collaborated to design order sets and reminders. Here, they share the results of their work.

Antipsychotic medications are being used more frequently, not only in the United States but also worldwide.[1–3] The first antipsychotics introduced in the United States in the 1950s were called typical, or first generation, antipsychotics (FGAs). These medications helped many people lead more fulfilling lives by alleviating positive symptoms, such as hallucinations or delusions. Unfortunately, these medications have unpleasant adverse effects, such as drug-induced parkinsonism, dystonic reactions, akathisia, and tardive dyskinesia.[4]

Beginning in the late 1980s and early 1990s, atypical, or second generation, antipsychotics (SGAs) became available. These medications were more effective for treating the negative and cognitive symptoms of schizophrenia and had fewer adverse effects than the FGAs at clinically effective doses. Today, SGAs are used as first-line treatment for schizophrenia and are increasingly used for other psychiatric conditions, including bipolar disorder.[1,3]

Although SGAs are better tolerated than FGAs, their adverse effects include weight gain, elevated blood glucose and blood pressure levels, and dyslipidemia (Table 1).[4] Patients treated with SGAs should be monitored for these adverse effects.[4] Often, it is difficult to determine if these adverse effects are caused by the medication, the psychiatric condition the medication is treating, unhealthy choices (such as poor diet or a sedentary lifestyle), or a mixture of these and comorbidities, such as diabetes.

Most of these effects could be based on 1 factor: weight gain. During the first few months of therapy, SGAs may cause a rapid increase in body weight and may not reach a peak until after 1 year of therapy. After 10 weeks of therapy, the average estimated weight gain is 0.5 kg to 5 kg. Patients may become overweight (body mass index [BMI] of 25 kg/m^2 to 29.9 kg/m^2) or obese (BMI of 30 kg/m^2 or greater); insulin resistant or have impaired glucose tolerance (glucose levels of 100 mg/dL to 125 mg/dL), which may, in some instances, resolve after medication discontinuation; or hypertensive (blood pressure levels greater than 140/90 mm Hg).[4] Appropriate monitoring for these adverse effects is important to providing safe and effective pharmacotherapy.

In 2005, the Office of Inspector General issued performance measures consistent with the recommendations of the 2004 consensus development conference on antipsychotics.[4] Accordingly, patients taking these medications should have their weight, waist circumference, blood pressure, fasting plasma glucose levels, and fasting lipid levels monitored (Table 2). A drug utilization evaluation (DUE) was completed at the Erie VA Medical Center (VAMC), Erie, Pennsylvania, in March 2006, to determine if clinicians were properly monitoring those patients prescribed SGA medications. This review identified 15

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Table 1. Incidence of adverse effects according to medication[4,a]

Medication	Weight gain	Risk for DM	Worsening lipid levels
Clozapine, olanzapine	↑↑↑[b]	↑[c]	↑
Risperidone, quetiapine	↑↑[d]	Conflicting data	Conflicting data
Aripiprazole,[e] ziprasidone[e]	↑/↓[f]	–	–

DM = diabetes mellitus.
[a]Paliperidone, asenapine, and iloperidone are excluded from this table due to lack of data. [b]↑↑↑ = significant increase. [c]↑ = some increase. [d]↑↑ = moderate increase. [e]Newer agent with limited long-term data. [f]↑/↓ = may increase or decrease.

Table 2. Appropriate monitoring for patients taking an SGA[4]

	Baseline	4 weeks	8 weeks	12 weeks	Quarterly	Annually	Every 5 years
History	X					X	
Weight (BMI)[a]	X	X	X	X	X		
Waist circumference	X					X	
BP	X			X		X	
FPG	X			X		X	
FLP	X			X			X[b]

SGA = second generation antipsychotic; BMI = body mass index; BP = blood pressure; FPG = fasting plasma glucose; FLP = fasting lipid panel.
[a]If a patient gains > 5% of initial weight at any time during therapy, consider switching the SGA. [b]FLP is tested every 5 years if levels are within normal range and every year if results are abnormal.

patients without diabetes who had a fasting plasma glucose value between 100 mg/dL and 126 mg/dL, with 8 of these patients not receiving interventions for their glucose levels. Additionally, a BMI assessment showed that 41 of the 50 patients reviewed were either overweight or obese.

Another evaluation was performed in 2006 as part of a VISN 4 DUE to examine indications for use of SGAs and to determine if appropriate monitoring for metabolic abnormalities was being performed. This DUE showed that more than 60% of the patients reviewed were monitored appropriately at baseline for weight and blood pressure measurement and lipid, blood glucose, and hemoglobin A_{1c} levels, but less than 50% of the patients had appropriate follow-up monitoring for these same parameters.

Based on the suboptimal results of these 2 DUEs, computerized order sets and reminders were designed at the Erie VAMC in early 2007. A comparison of clinician adherence to the SGA monitoring recommendations from before and after the order sets and reminders were implemented was carried out. Here, we report the results of that retrospective analysis.

DESIGNING THE ORDER SET

Providers from the Behavioral Health Department and Pharmacy Department and a clinical applications coordinator (CAC) discussed the requirements for monitoring in accordance with the consensus guidelines. The CAC built the order sets (which are defined as a group of orders that can be entered together, often through the selection of 1 item rather than many) and reminders in the electronic medical record (EMR). These were then reviewed with the providers and pharmacy staff and revised as necessary for ease of use.

In the process of prescribing an SGA through the order set, the provider is prompted to enter an order to obtain the patient's baseline height, weight, blood pressure, fasting plasma glucose level, and a fasting lipid panel (Figure 1). Additionally, they are prompted to enter an order to obtain the patient's weight at 4 and 8 weeks; schedule an on-site appointment at week 12 to obtain weight, blood pressure, fasting plasma glucose level, and a fasting lipid panel; and enter an order to obtain the patient's weight at 6 and 9 months. Once the order set is complete, the computerized patient record system (CPRS) creates reminders in the EMR to assist the provider with follow-up monitoring (Figure 2). The baseline data and the 12-week follow-up data are obtained during an on-site appointment with the patient. Follow-up weight measurements at 4 and 8 weeks and 6 and 9 months are retrieved by calling the patient at home.

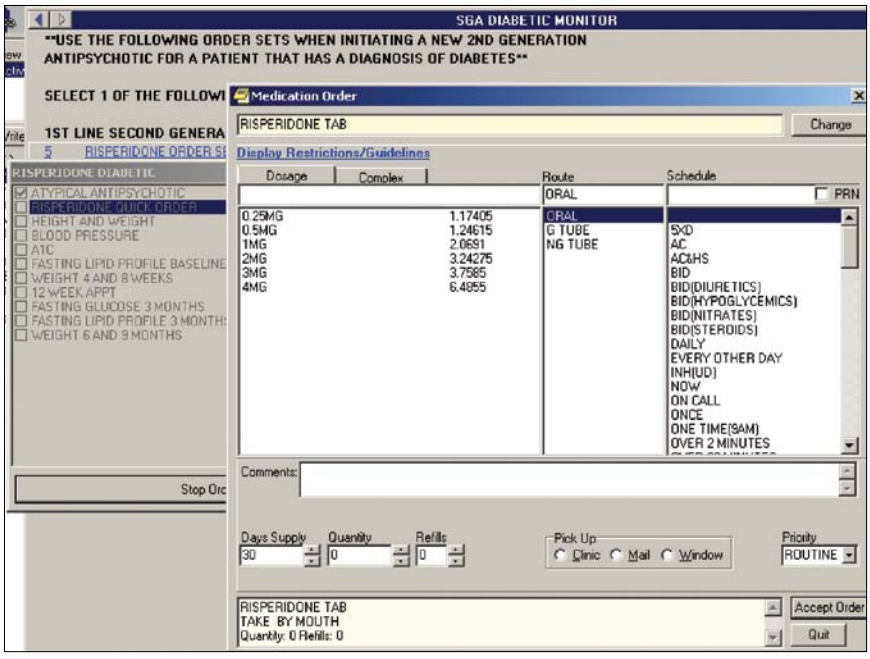

Figure 1. Order set example.

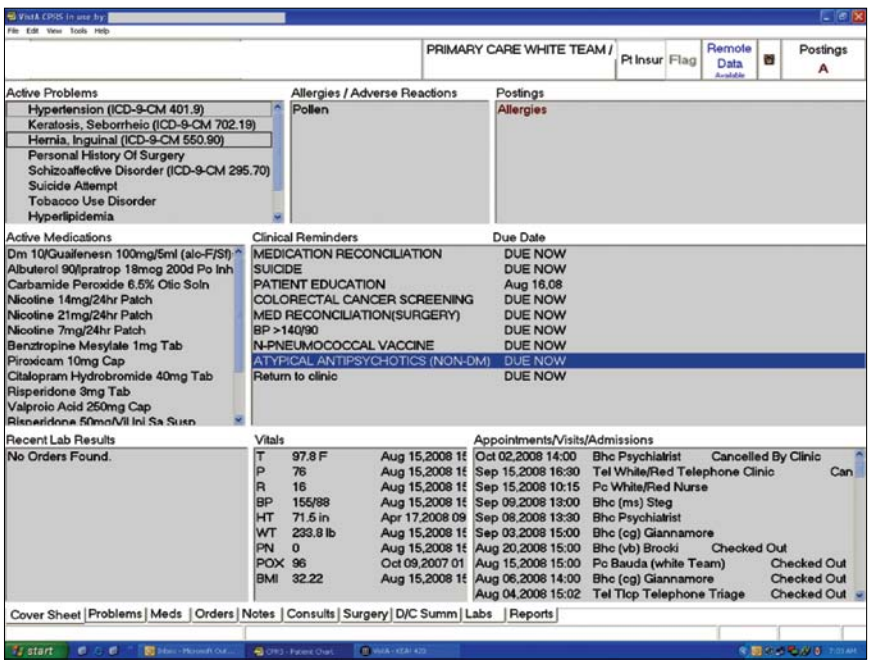

Figure 2. Example reminders in electronic medical record.

METHODS

Use of the order sets and reminders at Erie VAMC was phased in over a 6-month period. They were fully implemented in October 2007. To determine whether the tools served to improve follow-up monitoring, a retrospective review of the CPRS was conducted. The study was approved by the VISN 4 Multi-Site Institutional Review Board.

Study inclusion parameters were outpatients prescribed SGA therapy prior to the implementation of the order sets (January 2005 to October 2007) or outpatients prescribed SGA therapy after the implementation of the order sets (May 2007 to February 2008). Patients were assigned to the postimplementation group if the reminders were used to order the monitoring parameters during the phase-in period (May 2007 to October 2007). Patients who were not continued on the same SGA therapy for at least 12 weeks were excluded from the analysis.

Data collected for both the preimplementation and postimplementation groups included date of birth, gender, SGA used, and the date the SGA was prescribed. The EMR was reviewed retrospectively to determine if providers had ordered the following data when initiating the SGA prescription: weight at baseline, 4, 8, and 12 weeks and blood pressure, fasting plasma glucose level, and fasting lipid panel at baseline and at 12 weeks. The presence or absence of the data prior to implementation of the order sets and reminders was compared to the presence or absence of the data after implementation. We additionally assessed whether patients were adherent to the monitoring that was ordered by their provider.

Statistical analysis

A χ^2 test/Fisher exact test was performed using the cross tabulations from the Statistical Package for Social Sciences (SPSS) version 15 software (SPSS, Inc., Chicago, Illinois) to compare the ordering and completion of monitoring parameters before and after the implementation of the order sets. To have a power of 80% and a 30% change in the follow-up data,

Table 3. Preimplementation and postimplementation results for ordering and completion of baseline monitoring parameters

Parameter	Ordered, no. (%)		*P* value	Completed, no. (%)		*P* value
	Preimplementation (n = 68)	Postimplementation (n = 36)		Preimplementation (n = 68)	Postimplementation (n = 36)	
Weight	31 (46)	35 (97)	< .001	31 (46)	35 (97)	< .001
BP	37 (54)	36 (100)	< .001	37 (54)	36 (100)	< .001
FPG	22 (32)	28 (78)	< .001	19 (28)	12 (33)	NS
FLP	22 (32)	29 (81)	< .001	19 (28)	14 (39)	NS

BP = blood pressure; FPG = fasting plasma glucose; FLP = fasting lipid panel; NS = not significant.

Table 4. Preimplementation and postimplementation results for ordering and completion of follow-up weights at 4, 8, and 12 weeks

Follow-up interval	Ordered, no. (%)		*P* value	Completed, no. (%)		*P* value
	Preimplementation (n = 68)	Postimplementation (n = 36)		Preimplementation (n = 68)	Postimplementation (n = 36)	
4 weeks	17 (25)	36 (100)	< .001	17 (25)	30 (83)	< .001
8 weeks	19 (28)	35 (97)	< .001	19 (28)	29 (81)	< .001
12 weeks	21 (31)	33 (92)	< .001	21 (31)	23 (64)	.004

Table 5. Preimplementation and postimplementation results for ordering and completion of BP, FPG, and FLP at 12 weeks

Parameter	Ordered, no. (%)		*P* value	Completed, no. (%)		*P* value
	Preimplementation (n = 68)	Postimplementation (n = 36)		Preimplementation (n = 68)	Postimplementation (n = 36)	
BP	23 (34)	32 (89)	< .001	23 (34)	22 (61)	.012
FPG	10 (15)	29 (81)	< .001	8 (12)	12 (33)	.017
FLP	15 (22)	31 (86)	< .001	13 (19)	14 (39)	.036

BP = blood pressure; FPG = fasting plasma glucose; FLP = fasting lipid panel.

102 patients were required for inclusion. The patient population was selected based on a 2:1 ratio to increase the power of the study. A *P* value less than .05 was defined as statistically significant.

RESULTS

A total of 122 patients initiated SGA treatment and continued this treatment for at least 12 weeks between January 2005 and February 2008. Eighty-six of these patients initiated treatment in the preimplementation period and 36 of them initiated treatment in the postimplementation period. From this total, 104 patients were selected for analysis—68 were selected randomly for the preimplementation group and all 36 were included in the postimplementation group.

Orders for baseline monitoring parameters were placed significantly more often after implementation of the order sets (*P* < .001), with 32% to 54% of providers ordering the monitoring parameters preimplementation and 78% to 100% of providers ordering these same parameters postimplementation (Table 3).

In the preimplementation group, 28% to 54% of patients had the ap-

propriate baseline monitoring completed, compared with 33% to 100% of patients in the postimplementation group. Significantly more patients in the postimplementation group than in the preimplementation group completed the baseline weight and blood pressure measurements. Although providers placed more orders for baseline fasting plasma glucose and lipid levels postimplementation compared with preimplementation, more patients did not complete the tests in the postimplementation group (15 to 16 of patients [42% to 44%]) compared with the preimplementation group (3 patients [4%]).

Follow-up weight measurements were ordered 25% to 31% of the time for the preimplementation group, compared with more than 90% of the time in the postimplementation group ($P < .001$, Table 4). Weight measurements were completed at 4, 8, and 12 weeks for 25% to 31% of patients in the preimplementation group, compared with greater than 60% of patients in the postimplementation group ($P < .005$).

Appropriate follow-up laboratory monitoring was ordered less than 35% of the time for patients in the preimplementation group, compared with greater than 80% of the time for patients in the postimplementation group ($P < .001$, Table 5). Less than 35% of patients in the preimplementation group, compared with 33% to 61% of patients in the postimplementation group, had the follow-up laboratory monitoring at week 12 completed ($P < .04$).

DISCUSSION

The experience of another VA facility helped the Erie VAMC design an effective approach for this process improvement. A clinical pharmacy specialist at the William S. Middleton Memorial Veterans Hospital, Madison, Wisconsin, conducted a project to evaluate an ordering template to improve the monitoring of low-dose quetiapine. The template provided guidance on what laboratory tests to order and when to order them and an option to display recent patient-specific laboratory results. Unfortunately, the template did not significantly improve the monitoring process at the facility.[5] At the time of this presentation, the Erie VAMC pharmacy staff already had begun working with the Behavioral Health Department to create order sets and reminders. With the benefit of the reminders, leadership at the Erie VAMC believed the electronic order sets would lead to improvement. Staff from pharmacy and behavioral health and the CAC continued to work together to create tools and processes to improve the monitoring of SGAs.

Although there was an overlap of dates for the preimplementation and postimplementation data during the phase-in period, these data were included in the study because each patient could be assessed to determine whether the order set had been used. Clearly, when the order set was used, the patient belonged in the postimplementation group.

The order sets and reminders implemented at the Erie VAMC have significantly improved the monitoring of SGAs at the facility. Some of the success may be due to the interactions and input from behavioral health staff and their desire to increase the quality of patient care. For instance, as part of the follow-up monitoring, a nurse from the Behavioral Health Department called patients for the 4- and 8-week follow-up weight measurements. Unfortunately, many patients did not have scales to weigh themselves at home, did not have an answering machine for the nurse to leave a message, or failed to return messages left by the nurse. Some of the comments noted in the EMR included that the patient could not afford a scale.

This study shows that patients do not always adhere to obtaining laboratory tests and weight and blood pressure measurements; however, the only monitoring parameters without statistically significant improvement were the completion of baseline tests for fasting plasma glucose and lipid levels. The reason for the lower adherence rate with baseline laboratory tests in the postimplementation group compared with the preimplementation group is not clear. Perhaps health care providers ordered baseline laboratory tests only for patients who they thought would adhere to their completion during the preimplementation period. Perhaps patient inconvenience, due to the requirement to fast prior to appointments, contributed to the lack of difference in these baseline laboratory results.

Nonadherence to scheduled appointments also was observed. Patients were expected to return at week 12 for an on-site evaluation to obtain blood pressure and weight measurements and fasting laboratory tests. In some cases, patients said they were unable to find transportation to the hospital.

Patient nonadherence to monitoring parameters had an impact in this study. Unfortunately, when treating patients with a psychiatric condition, there is little question that adherence plays a role in the success or failure of many psychopharmacologic treatments. Nonadherence is probably the single greatest modifiable risk factor affecting outcomes of psychiatric pharmacotherapy.[6] Therefore, a means of improving adherence with completing monitoring parameters in patients taking SGAs is highly recommended. Specific suggestions

for improvement include providing an incentive, such as providing gas reimbursement for those patients who drive to the facility to complete blood work and providing scales for patients who cannot afford to purchase them. Patient education is also extremely important to the success of follow-up monitoring. A meeting with the behavioral health staff was conducted to discuss and attempt to implement some of these suggestions.

Some limitations of this study should be recognized. First, the study population was primarily male (approximately 90%) and the sample size was relatively small. Second, this study did not evaluate whether all the specified monitoring parameters were completed for individual patients. Rather, each monitoring parameter and time point was analyzed to identify whether the order set and reminders aided clinicians in ordering the desired monitoring. Third, although the order sets included 9 months of monitoring, the study only assessed ordering of monitoring parameters for metabolic adverse effects from baseline to 12 weeks.

This study did not attempt to evaluate the outcomes once the data were available. The plan is for the primary care provider to address metabolic issues if the patient needs to continue taking the SGA. This requires increased teamwork among the providers to achieve the best outcome, but it is to everyone's benefit since the primary care providers are evaluated on how well their patient panel meets guidelines for the management of such chronic conditions as diabetes and hypertension.

CONCLUSION

The results of this research demonstrate significant improvement in the ordering and completion of monitoring parameters for SGAs using the order set template and reminders as tools to assist providers caring for the veteran patient population. The order sets and reminders could benefit any health care institution that uses an EMR. Further study is required to investigate methods to improve patient adherence with follow-up monitoring and to identify whether order sets consistently achieve the desired baseline and follow-up values for individual patients. ●

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