Original Work

Impact of Electronic Health Record Alerts on Psychiatric Medication Monitoring in the Ambulatory Setting

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Abstract

Introduction: Laboratory monitoring is an important component of the assessment of efficacy, safety, and adherence for many psychiatric medications. Despite the availability of evidence-based guidelines, compliance with recommended monitoring is generally low.

Methods: Targeted clinical decision support for laboratory monitoring recommendations for prescribers of antipsychotics, lithium, and valproic acid/divalproex were incorporated into the electronic health record (EHR). Inclusionary and exclusionary logic was determined based on evidence-based guidelines and clinician preferences.

This retrospective, pre-post quasi-experimental study evaluated the impact of the intervention on compliance with recommended monitoring. The primary study outcome was the difference in the rate of fully compliant medication monitoring pre- and post-intervention for antipsychotic, lithium, and valproic acid/divalproex medications. Secondary outcomes included the difference in mean percentage compliance with antipsychotic, lithium, and valproic acid/divalproex medication monitoring pre- and post-intervention.

Results: The rate of fully compliant antipsychotic, lithium, and valproic acid/divalproex medication monitoring improved from 45.0% in the pre-intervention period to 67.0% in the post-intervention period ($p < 0.001$). The mean percentage compliance with antipsychotic, lithium, and valproic acid/divalproex medication monitoring also improved, from 58.1% to 76.2% (SD 42.4 and 37.4 respectively; $p < 0.001$). This change was driven by improvements in metabolic monitoring for second-generation antipsychotics, whereas changes to lithium and valproic acid/divalproex monitoring were not significant.

Conclusions: Targeted clinical decision support for prescribers, in the form of EHR alerts, can be effective for improving compliance with recommended lab monitoring for psychiatric medications, particularly metabolic monitoring for second-generation antipsychotics, in the ambulatory setting.

Laboratory (lab) monitoring is an important component of the assessment of efficacy, safety, and adherence for many psychiatric medications. Major guidelines from the National Institute for Health and Care Excellence (NICE), American Diabetes Association (ADA), American Psychiatric Association (APA), American Association of Clinical Endocrinologists (AACE), and North American Association for the Study of Obesity (NAASO) provide recommendations for lab monitoring and frequency for common psychiatric medications, such as antipsychotics, lithium, and valproic acid/divalproex.[1-3]

Despite the availability of these guidelines, data on monitoring after initiation of these medications illustrates that compliance with the recommendations in clinical practice is low.[4-10] A 2011 meta-analysis by Mitchell et. al. evaluated metabolic monitoring for patients prescribed antipsychotics. The meta-analysis included nine studies conducted after the publication of major guidelines, and found that only 56.1% and 37.2% of patients had glucose monitoring and lipid monitoring, respectively.[7] While it had not been formally evaluated, a similarly low rate of compliance to the recommendations had been observed by clinicians at Froedtert & the Medical College of Wisconsin (F&MCW) Center for Consultative Academic Psychiatric Services (CCAPS) clinic, an outpatient behavioral health clinic staffed by post-graduate year 2 (PGY2) psychiatric medical residents and supervising faculty psychiatrists.

Psychiatric medication monitoring support using electronic health record (EHR) alerts has been used as an effective method for improving compliance to psychiatric medication monitoring guidelines since at least 2004, in both the acute and ambulatory care settings.[11-15] Based on this information, clinic leadership in the F&MCW CCAPS clinic requested to be included in creation of clinical decision support, in the form of EHR alerts, for select psychiatric medications that require lab monitoring. This study was completed to determine the impact of these EHR alerts.

Methods

Intervention

A collaborative multidisciplinary team, involving clinical and informatics pharmacists and physicians, created best practice advisories (BPAs) designed to fire for antipsychotic, lithium, and valproic acid/divalproex prescriptions ordered by psychiatry medical residents in the CCACPS clinic. A BPA is a customized, practice-specific alert within the EHR that is programmed to appear for a patient, medication, lab, or other order according to pre-determined triggers, using inclusionary or exclusionary logic.

Inclusionary and exclusionary logic was based on guidelines from NICE, ADA, APA, AACE, and NAASO, with minor modifications to best fit institutional lab practices and clinician preferences.[1-3] Recommended lab monitoring parameters were: for antipsychotics, annual glycohemoglobin and lipid panel; for lithium, semiannual basic or comprehensive metabolic panel, thyroid stimulating hormone, plasma lithium level, and serum calcium; for valproic acid/divalproex, annual liver function tests, complete blood count, and total (with or without free) valproate level.

Upon opening the chart of a patient with incomplete recommended lab monitoring for an included medication, a BPA would fire and display as an alert window within the EHR. From this alert, the prescribing resident could order missing labs or decline to order them. If declining, the resident could select an acknowledgement reason ("labs not appropriate;" "labs already ordered [but not yet completed];" "patient refuses labs;" or "labs completed elsewhere"). The alert could also be deferred temporarily to allow for chart review prior to decision-making. Signing a prescription for an included medication with incomplete recommended lab monitoring would also fire a BPA and display as an alert with similar options. The BPAs were not a hard stop to prescribing or closing the patient's chart (i.e., they could be bypassed).

Study Design

This was a retrospective, pre-post quasi-experimental study. This study was reviewed by the Froedtert Health Pharmacy Research Committee and Medical College of Wisconsin Human Research Protection Program and determined to be a quality improvement project that did not require further review by the Institutional Review Board.

The pre-intervention time period was July 1, 2017 through December 31, 2017, and the post-intervention time period was July 1, 2018 through December 31, 2018. The intervention went live in the EHR on May 1, 2018 after a one-time, in-person education session for all affected psychiatry medical residents and supervising faculty physicians in April 2018.

All prescriptions for antipsychotic, lithium, or valproic acid/divalproex medications ordered by a psychiatry medical resident in the CCAPS clinic were included(medications entered as "historical" or otherwise not sent to a pharmacy were excluded). Medication class, prescription dates, and class-specific recommended lab parameters were collected for included prescriptions. Prescriptions could be considered 100% compliant with recommendations if all recommended labs were complete (with results) or considered partially compliant (recorded as a percentage) if only some of the recommended labs were complete. Labs could be completed up to 28 days after a prescription order and still be considered compliant. This 28-day window was selected to provide adequate time for patients to visit the lab after their office visit or refill request, thus avoiding interruptions to these important pharmacotherapy regimens that could occur if care teams were required to hold prescriptions until after completion of labs.

Outcomes

The primary study outcome was the difference in the rate of fully compliant antipsychotic, lithium, and valproic acid/divalproex medication monitoring pre- and post-intervention. Secondary outcomes were: the difference in mean percentage of compliance with antipsychotic, lithium, and valproic acid/divalproex medication monitoring pre- and post-intervention; the difference in the rate of fully compliant antipsychotic medication monitoring pre- and post-intervention; the difference in the rate of fully compliant lithium medication monitoring pre- and post-intervention; and the difference in the rate of fully compliant valproic acid/divalproex medication monitoring pre- and post-intervention.

Data Analysis

Compliance was recorded as the number and percentage of lab monitoring requirements that were fulfilled for each prescription. Compliance was summarized using the mean, standard deviation, median, and range, and as the frequency and percentage of prescriptions with 100% compliance. The proportion of prescriptions with 100% compliance was compared between the pre- and post-intervention periods using Fisher's exact test. Compliance (continuous) was compared between the pre- and post-intervention periods using the exact Wilcoxon rank-sum test. Comparisons were made for all prescriptions and within the following medication subgroups: antipsychotics, lithium, and valproic acid/divalproex. All statistical analyses were performed using R version 3.6.0 (R Foundation for Statistical Computing, r-project.org). All tests were two-sided and $p < 0.05$ was considered statistically significant.

Results

The rate of fully compliant antipsychotic, lithium, and valproic acid/divalproex medication monitoring improved from 45.0% in the pre-intervention period to 67.0% in the post-intervention period ($p < 0.001$). The mean percentage compliance with antipsychotic, lithium, and valproic acid/divalproex medication monitoring also improved, from 58.1% to 76.2% (SD 42.4 and 37.4 respectively; $p < 0.001$). Statistically significant improvements were seen in 100% compliance rates and continuous percent compliance for antipsychotic monitoring. No statistically significant differences were observed for lithium or valproic acid/divalproex monitoring. Mean percent compliance for valproic acid/divalproex improved from 72.2% to 86.3%, but this difference was not statistically significant. See Table 1.

The majority of included prescriptions in the pre- and post-intervention periods were for second-generation antipsychotics (86.4% and 81.6%, respectively).

Discussion

The findings of our study demonstrate that targeted clinical decision support, in

TABLE 1. Compliance with Recommended Laboratory Monitoring, Pre- and Post-intervention

	Pre-intervention Prescriptions	*Post-intervention Prescriptions*	*p-value*
Antipsychotics	**n = 168**	**n = 154**	
Fully Compliant	74 (44.0%)	104 (67.5%)	< 0.001
Mean Compliance (SD)	56.5% (42.9)	75.6% (38.0)	< 0.001
Lithium	**n = 11**	**n = 8**	
Fully Compliant	5 (45.5%)	2 (25%)	0.633
Mean Compliance (SD)	65.9% (39.2)	62.5% (35.4)	0.645
Valproic Acid/Divalproex	**n = 12**	**n = 17**	
Fully Compliant	7 (58.3%)	14 (82.4%)	0.218
Mean Compliance (SD)	72.2% (37.2)	86.3% (31.3)	0.239
Overall	**n = 191**	**n = 179**	
Fully Compliant	86 (45.0%)	120 (67.0%)	< 0.001
Mean Compliance (SD)	58.1% (42.4)	76.1% (37.4)	< 0.001

SD = Standard Deviation

the form of EHR alerts for prescribers, can be effective for improving compliance with recommended lab monitoring for psychiatric medications at our institution. These findings are in alignment with and extend the generalizability of similar studies that involved the creation of recommendations on lab monitoring for psychiatric medications and associated electronic reminder tools.[11-15] In our study, the rate of 100% compliant lab monitoring at the time of prescribing antipsychotics, lithium, and valproic acid/divalproex improved from just 45% before the intervention to 67% after the intervention, a relative increase of nearly 50%. This change was driven by improvement in metabolic monitoring for antipsychotic prescriptions, most of which were second-generation antipsychotics (86.4% and 81.6% of prescriptions in the pre- and post-intervention periods, respectively), whereas changes to lithium and valproic acid/divalproex monitoring were insignificant.

Our study had some important limitations. First, because the CCAPS clinic is staffed specifically by PGY2 psychiatry medical residents, the group of prescribers differs in our pre-intervention and post-intervention periods, due to the annual advancement of resident physicians in their program. However, the supervising faculty psychiatrists were consistent in the pre- and post-intervention periods. Second, there were relatively few prescriptions sent for lithium and valproic acid/divalproex, limiting our power to detect a difference in monitoring for those medications. Finally, we were unable to collect data on resident physicians' individual electronic responses to the EHR alerts for the purposes of this study.

Conclusions

Clinical decision support for prescribers, created and implemented by a multidisciplinary team, can improve compliance with evidence-based guidelines for monitoring psychiatric medications, particularly metabolic monitoring for second-generation antipsychotics, in the ambulatory setting.

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