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Case Report

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Improving inpatient mental health medication safety through the process of obtaining HIMSS Stage 7: a case report

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ABSTRACT

Although electronic health record systems have been implemented in many health settings globally, how organizations can best implement these systems to improve medication safety in mental health contexts is not well documented in the literature. The purpose of this case report is to describe how a mental health hospital in Toronto, Canada, leveraged the process of obtaining Healthcare Information Management Systems Society (HIMSS) Stage 7 on the Electronic Medical Record Adoption Model to improve clinical care specific to medication safety in its inpatient settings. Examples of how the organization met several of these HIMSS criteria are described as they relate to utilizing data from the system to support clinician practice and/or decision-making for medication safety.

Key words: electronic health records, mental health, medical informatics, health information technology, behavioral health

INTRODUCTION

To date, there have been efforts to describe how electronic health records (EHRs) can be best adopted to support the improvement of care quality in a variety of clinical care settings such as ambulatory care[1] and for specific clinical conditions or contexts such as diabetes[2] and vascular access.[3] Despite these promising examples, there are limited illustrations of how EHRs can be best adopted to support improvements in care quality in mental health and addictions contexts specifically.[4] The limited literature that is present on this topic within the specialty setting suggests that the EHR may be used to support the reduction of restraint usage, increase compliance with mental health clinical guidelines, reduce the number of infection-related outbreak days, and achieve cost savings related to better decision-making, particularly in the context of obtaining Healthcare Information Management Systems Society (HIMSS) Stage 7 on the 8 stage (0–7) Electronic Medical Record Adoption Model (EMRAM).[5] Additional examples of how and in what ways mental health organizations can leverage the process of obtaining HIMSS Stage 7 to improve clinician practice and/or decision-making is needed. Therefore, the purpose of this case report is to describe how a mental health organization in Toronto, Canada, used the process of achieving HIMSS Stage 7 to make improvements to clinical care specific to the focused area of medication safety, primarily through strategies enacted to enhance the use of system generated data [reports which aggregate meaningful EHR data for a particular purpose for example, Computerized Provider Order Entry (CPOE) rates].

Although there are many criteria used to evaluate an organization for HIMSS Stage 7 (inpatient version) that address medication safety, those discussed in this case report include: (1) using technology to scan patient identification and medication prior to the administration 95% of the time or higher; (2) ensuring that the ordering

provider is entering the order themselves at least 90% of the time; and (3) using data from the EHR to identify a medication safety issue or challenge; implementing strategies to address this issue or challenge; and monitoring the potential effectiveness of these strategies.

BACKGROUND

This case report describes work completed in the mental health inpatient setting at the Centre for Addiction and Mental Health (CAMH) in Toronto, Canada.[6] This organization has 3 main sites, and over 30 satellite sites that operate 90 distinct services. Services include a mental health emergency department, outpatient clinics, inpatient units, day treatment, and partial hospital programs. Each year, CAMH services over 34 000 unique patients, with the full spectrum of psychiatric disorders, across the lifespan (from children to the elderly).

In 2010, CAMH embarked on an EHR transformation endeavor in an effort to mitigate the risks and challenges associated with the previous hybrid system. This work was also done to standardize the way clinical information was collected and organized within the clinical record, and to improve process efficiencies. Identified risks and challenges to be addressed included duplicate documentation, the potential for adverse drug events, difficulty in accessing patient clinical information, and the inability for clinicians to effectively collaborate through the various systems present. Between 2010 and 2012, CAMH prepared for and purchased an EHR system. Engagement with CAMH clinicians (inclusive of physicians, nurses, social workers etc.), and other relevant stakeholders to define system requirements, and identify current state processes was extensive during the preparatory and implementation phases. Once the specific system was selected, the decision to implement the EHR using a "big bang" approach was made.[7,8] Between 2012 and 2014, the EHR was designed, built, customized for CAMH, and thoroughly tested. Numerous clinicians were engaged throughout this process to inform the design, determine future workflows, and test the system.

During the 2 months prior to the "go-live" date of the EHR, an organization-wide training effort was executed with training conducted for over 3000 staff who would be required to access and use the system as a part of their roles. In May 2014, the EHR was successfully launched at CAMH, and the day-to-day maintenance of the EHR was transitioned to the respective operations teams. In 2015, the organization began EHR optimization efforts, and in 2017 the organization achieved HIMSS Stage 7.[9] The EHR optimization efforts provided opportunities for modifications to the system to be made so that data generated could aid in clinical decision-making and/or clinical care, and to support the achievement of HIMSS Stage 7.

Criterion 1

This section describes the approach used to address the first HIMSS Stage 7 criterion, which was to utilize scanning technology to verify patient identification and medication prior to the administration 95% of the time or higher across inpatient units, excluding the emergency department. Medication errors that occur during the administration process are one of the most common type of medication error.[10] Although some medication errors may be minor, there is a potential for treatment complications and serious adverse events to occur as a result of these errors. One possible way to mitigate errors during the administration process is to adopt barcode scanning as part of closed-loop medication administration.[11,12] During closed-loop medication administration, both a form of patient identification (usually a wristband) and the medication package are scanned before the patient receives the medication. If the patient identification and medication correspond correctly to the medication order identified in the EHR, the medication may be safely administered. A recent review of the literature identified that when scanning rates are high using this technology, a decrease in medication incidents during the administration process may occur.[12]

An examination of scanning rates at CAMH shortly after the implementation of the EHR revealed that scanning was being completed at an average rate of 62%, which contributed to a potential risk of medication administration related errors. Through an evaluation of people, processes and technology,[13] numerous improvements to the medication administration process facilitated by barcode technology were made, including ensuring that there were adequate technology present on clinical units to conduct scanning. This evaluation and subsequent improvements were done to remove barriers to clinicians being able to successfully use the technology. Additionally, 3 main strategies were enacted to improve scanning rates. These included: (1) distributing weekly communications to clinical managers and directors which provided unit-specific and organizational scanning rates (a section of the weekly communication is shown in Figure 1); (2) training 3 nurse champions per unit to be able to support their colleagues in using the technology effectively; and (3) identifying categories of medications frequently not scanned (high-alert,[14] high-volume, and patient's own supply), and addressing these challenges. Mismatch alerts generated from the EHR were collected for 1 year (6 months prior to the interventions and 6 months after the interventions). The target scanning rate for the organization was set at >95%.

After the 3 strategies were introduced to address poor medication administration scanning rates, the target scanning rate of >95% was achieved and sustained. The greatest increase in scanning rates occurred after distributing weekly communications to clinical managers and directors with unit-specific and organizational scanning rates. Weighted scanning rates and the timeline of strategies is shown in Figure 2. Upon reviewing mismatch alerts generated during the barcode scanning process before and after the 3 strategies were introduced, a 97.5% increase in potential patient identification errors (from 483 to 954) was identified. This result suggests that many potential medication errors that may have occurred when scanning rates were lower were now being prevented as the act of the scanning process was catching and preventing these errors from occurring before medication administration.

Criterion 2

This section describes the approach used to address the second HIMSS Stage 7 criterion, which was to ensure that the ordering providers were entering orders themselves at least 90% of the time. Previous research has indicated that patient safety can be improved when orders are entered through the CPOE function embedded in the EHR.[15] Accordingly, an EHR can only support improved order safety if generated in this way, and not through telephone or verbal orders. In an effort to ensure that health professionals at CAMH were able to enter all orders through CPOE, 278 electronic orders and 103 electronic order sets were developed in the EHR. These orders and order sets were developed in consultation with various clinicians and through a significant review of numerous paper-based orders previously generated by clinicians at CAMH. Therefore,

Performance Summary*

Date of Performance Summary: January 29 - February 4, 2017

Indicator	Target	CAMH	Unit A
1) Suicide Risk Assessment	90%	98.4	100.0
2a) % of Clients with Physical Restraints	3.4%	1.76	7.69
2b) Median Time (hrs) in Restraints - Mechanical	2.1	1.98	3.75
2c) Median Time (hrs) in Restraints - Seclusion	5.8	8.15	15.86
4) ULOA events for Involuntary Patients	16.0	2.0	0.0
5) Client/Patient ID and Medication Scanning	95%	95.24	88.80

Performance Summary

Change over previous week

Indicator	Desired Direction	CAMH	Unit A
1) Suicide Risk Assessment	↑	8.44	0
2a) % of Clients with Physical Restraints	↓	0.034	-28.67
2b) Median Time (hrs) in Restraints - Mechanical	↓	-1.52	-2.82
2c) Median Time (hrs) in Restraints - Seclusion	↓	-5.58	12.89
4) ULOA events for Involuntary Patients	↓	2	0
5) Client/Patient ID and Medication Scanning	↑	-0.9	-1.1

Figure 1. Scanning rate report. *This report was developed on a weekly basis for each inpatient unit by an analyst using data generated from the EHR system to create the report. Other indicators were also monitored in addition to medication safety. Dummy data has been populated in this figure.

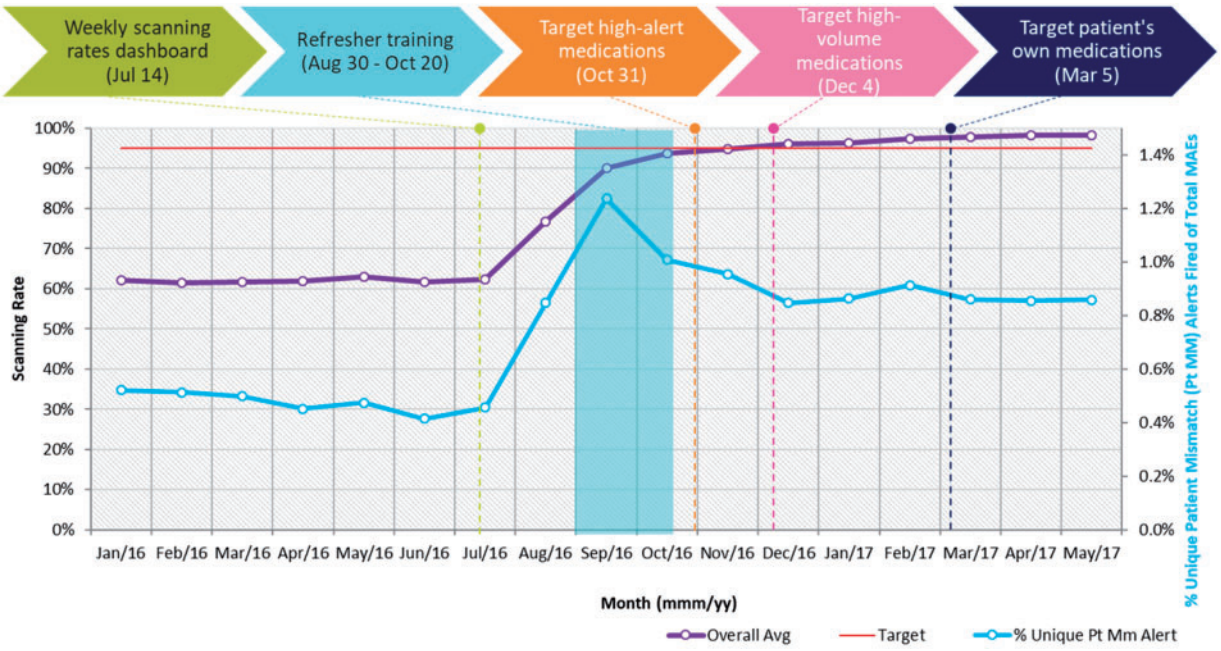

Figure 2. Weighted scanning rates*. *Note:* After the 5 strategies (weekly scanning rates dashboard, refresher training, target high-alert medications, target high-volume medications, and target patient's own medications), there was a sustained increase in medication scanning rates. *The shaded blue section of the figure indicates the time period when refresher training took place.

orders and order sets developed at CAMH were specific to the mental health context, increasing the likelihood of the uptake of CPOE. In addition to ensuring that all required orders and order sets were built in the EHR, practice expectations were modified to ensure that only emergency situations, whereby the prescriber may not have EHR access, warranted the use of verbal or telephone orders. It was

Reporting Period
April 01 - April 30, 2018

CAMH CPOE Rate (%) *Average across all inpatient units*
96.44%

Your CPOE Rates					
Personnel Name	Total # of Orders	CPOE Rate (%)	Non-CPOE		
			Telephone Orders (#)	Verbal Orders (#)	Co-Sign Required (#)
Medical Head, MD, CCFP	0	96.5%	0	0	0
Chief, MD, FRCPC	14	78.6%	0	2	1

Individual Personnel CPOE Rates					
Personnel Name	Total # of Orders	CPOE Rate (%)	Non-CPOE		
			Telephone Orders (#)	Verbal Orders (#)	Co-Sign Required (#)
FirstName LastName, MD, CCFP	0	96.5%	0	0	0
FirstName LastName, MD, CCFP	0	96.5%	0	0	0
FirstName LastName, MD, CCFP	845	98.7%	0	3	8
FirstName LastName, MD, CCFP	208	98.6%	0	0	3
FirstName LastName, MD, CCFP	353	99.7%	0	0	1

Figure 3. CPOE rates report. Dummy data has been populated in this figure.

the expectation that all orders would be entered through the CPOE function of the EHR. A script was provided to clinicians receiving orders to support them in communicating with prescribers regarding the importance of ordering through CPOE. Prescribers were provided with remote access to the EHR so that they could enter orders when off-site.

Once this work had been completed, reports were generated and shared with physicians in leadership roles (eg division chiefs) with regards to their divisions CPOE rates and percent change since the previous month; individual CPOE rates (broken down by total number of orders and frequency); total number of telephone orders; total number of verbal orders; and total number of co-sign required orders. A section of the sample report is shown in Figure 3. These reports were developed to allow individual physicians the opportunity to view their own rates, and make improvements when required. Due to using a paper-based order system prior to using the EHR, a baseline CPOE rate could not be established. However, after these various strategies were put in place, CPOE rates rose above 95% and have been maintained since this time. It is unclear as to how these reports may have contributed to the achievement of the desired CPOE rate. It may have been that physicians became more reflective of their ordering practices having had the opportunity to review their rates on a regular basis. It may also have had to do with the subjective norm, and/or a combination of multiple factors.

Criterion 3

This section describes the approach used to address the third criterion, which was to use data from the EHR to identify a medication safety issue or challenge; implement strategies to address this issue or challenge; and monitor the potential effectiveness of these strategies. At CAMH, an opportunity was identified to improve the monitoring of a high-risk medication called clozapine. Clozapine is prescribed for treatment-refractory patients with schizophrenia. The population of patients with schizophrenia who may qualify for this medication as a result of being treatment-refractory may be as high as 25–30%.[16,17] Clozapine is one of the only known antipsychotic medications with proven efficacy for this population, however, this medication can have significant side effects.[18] One of the most well-known risks of the medication is agranulocytosis (a dangerous condition of the blood involving a lowered white blood cell count). Due to the seriousness of agranulocytosis, it is commonplace for regular hematological monitoring to be in place for patients who take clozapine. Lesser known but more common side effects of taking clozapine include both constipation and myocarditis, both of which are associated with a risk of morbidity and mortality.[18]

The implementation of the EHR at CAMH provided an opportunity to standardize and enforce the adherence to a clozapine-induced monitoring protocol for these side effects by developing a clozapine order set that was eventually made mandatory for ordering the medication. Use of the order set ensured that follow-up tests and other monitoring procedures outlined in the monitoring protocol were followed since these were included in the order set and thus ordered at the same time as the medication. For example, mandatory clozapine-induced myocarditis monitoring was included in the order set through specific orders such as regular bloodwork.

After introducing the mandatory clozapine-induced myocarditis monitoring within the order set, 100% ($n = 237$) of clozapine-eligible patients received the monitoring protocol. Initially, not all patients were being monitored as some physicians were not ordering clozapine using the order set. Through discussions, improved awareness, educational efforts related to the use of the order sets, and the forced function of the monitoring "tick-box", physicians who had not been ordering through the order set, modified their practice to

do so. Once this behavior change had been made, protocol compliance rates reached 100%. Since all patients were being monitored for clozapine-induced myocarditis, several of the clinical teams used this data to take several patients off of clozapine to ensure their safety.

CONCLUSION

This article reports on the before and after results of implementing a number of select strategies to improve medication safety in inpatient mental health settings in Toronto, Canada as part of the achievement of HIMSS Stage 7. The relationship between the strategies implemented and their potentially associated outcomes cannot be viewed as causal as there may be other factors that contributed to the post-strategy implementation results identified in this report. In the future, studies that isolate and investigate specific strategies as "interventions" may identify potential causality. That said, the organization was able to obtain a number of improvements to medication safety following the implementation of the specified strategies.

Key factors that contributed to the success of achieving HIMSS Stage 7 were addressing challenges in a timely manner that were associated with people, processes and technologies that acted as barriers to clinician use of the EHR to support medication safety. This included extensive consultation with clinicians throughout the organization. In addition, clinicians were engaged in the process of identifying system-generated data that would be meaningful to obtain on a regular basis through reports, and resources were dedicated to ensuring that regular reports were developed and shared with this information present. Finally, the goal of obtaining HIMSS Stage 7 allowed for the organization to dedicate resources toward improving clinician's experience and use of the EHR system, which allowed for the benefits described in this paper to be realized.

CONTRIBUTION

All authors made substantive contributions to the described project and manuscript development. All authors have approved the submitted manuscript.

Conflict of interest statement. None declared.

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