Case Study
Enhancing Use of Drug Libraries Across a Large Healthcare System

Phyllis J. Miller

Catholic Health Initiatives (CHI) was formed in 1996 following the consolidation of four Catholic health systems. Headquartered in Englewood, CO, the system operates in 18 states and includes 103 hospitals. These include four academic health centers, 30 critical-access facilities, and numerous other healthcare agencies that provide both inpatient and outpatient services.

Description of Issue
In mid-2011, CHI began focusing its infusion safety initiatives to realize improvements across the health system and move toward a single standard for infusion. It recognized the utility of using software as a safety mechanism for patients, as well as an opportunity to control increasing costs. CHI's main objective was to improve drug library compliance in all facilities and broaden best practices system wide.

The initiative was originally focused on financial return, in order to maximize financial savings through group-purchasing contracts and other initiatives; however, the scope expanded rapidly. Mary Kane, MS, RN, vice president and regional chief nursing informatics officer, serves as executive leader for CHI's infusion safety initiatives. Kane began working with the program in 2011 and expanded the initiative to include the examination of clinical quality and safety data. As the data were analyzed, the health system saw opportunities for improving its infusion safety protocols across its hospitals. An initial compliance rate of 60.4% (for nurses using the drug library and the accompanying safety software [MedNet]) was determined based on the number of programs (i.e., number of times the device is turned on and used on a patient and the library is accessed with each use [each program]).

Knowing future data analysis would be hampered unless a higher compliance rate for use of the software could be achieved, the quality board at CHI set the target for drug library compliance at 85% and tied the initiatives to the performance standards of the chief nursing officer for each of its entities. Thus, performance evaluations, incentive compensation, and other benefits could be affected if the 85% threshold was not reached.

As compliance with the drug library improved, additional initiatives were implemented with an emphasis on the highest risk and most frequently used drugs, as well as an examination of the upper and lower alert limits for infusions. In addition to CHI's data, data from the Institute for Safe Medication Practices (ISMP) was incorporated to determine the desired state. Furthermore, a gap analysis was undertaken to determine further areas for improvement.

About the Author

Phyllis J. Miller, MS, RN, FHCE, is an independent nursing consultant and assists the AAMI Foundation with its patient safety initiatives. Email: millerphyllis@verizon.net

Knowing future data analysis would be hampered unless a higher compliance rate for use of the software could be achieved, the quality board at CHI set the target for drug library compliance at 85% and tied the initiatives to the performance standards of the chief nursing officer for each of its entities.

The Never-ending Process of Quality Improvement

A drug library initiative takes the full engagement of executive leadership, nursing informatics, nursing leadership and pharmacy leadership to realize success.

"The quality process never ends. It is a cadence—a continuous quality improvement process. You are never finished. There is always a tomorrow that we can tackle," said Mary Kane, MS, RN, vice president and regional chief nursing informatics officer VP at Catholic Health Initiatives (CHI) in Englewood, CO.

"As you begin your initiative, you must perform a gap analysis that includes both the clinical and technological gaps so that you can identify what changes you need to make as well as the rationale for change," she added.

A three-pronged support structure, including governance setup, stakeholder support, and a continuous improvement process, is necessary to the success of such initiatives, according to Alison Mason, national director of quality informatics for CHI.

"Clinical Informatics really is the glue that holds the entire program together. It allows for quality and technology to intersect in a meaningful way, ensuring data drive improved safety and compliance," said Mason.

Challenges

Buy-in from Stakeholders

As the hospitals progressed through the initiative, it became clear that success would be contingent on two factors: 1) close coordination between the national offices and their regional and local partners as the national protocols were implemented and 2) effective collaboration among nursing informatics, nursing leadership, and pharmacy executives, in order to grasp the full scope of the changes that were needed.

The challenges faced by CHI were not atypical of those present with many new initiatives. One challenge was that caregivers were reluctant to change their practices. Initially, they questioned the convenience and utility of the initiative, despite evidence supporting it as best practice.

Engaging leadership at local hospitals in the decision-making process was another challenge—and a common one for organizations with the size and complexity of CHI. Without local involvement, decisions made at the national level face increased resistance at the local level. To avoid this, CHI created pharmacy and nursing dyad partners representing each market. This group consisted of both administrative and frontline staff selected by hospitals at the local level. This approach helped ensure that equal numbers of individuals from both pharmacy and nursing were present at the table and that both groups were represented within the governance structure of the organization and able to participate in the decision-making process for implementing national drug library standards. Group members compared system data with scrubbed data that the vendor (Hospira/Pfizer) had obtained from other hospitals around the nation. All medications in each hospital's drug library were analyzed for limit analysis, as well as concentration amounts and naming conventions at the department level. After that information was aggregated, the group—with the assistance of clinical informatics—compared and contrasted

One challenge was that caregivers were reluctant to change their practices. Initially, they questioned the convenience and utility of the initiative, despite evidence supporting it as best practice.

results with ISMP guidelines to gain an understanding of the recommended best practice. The group then reviewed proposed solutions for use in its organization and had the opportunity to put forth its own recommendations for improvement.

A change management working group consisting of pharmacy and nursing staff was formed; the group drove data analysis, decision making, and project implementation. With this strong involvement at the local level, pressure was applied on local hospitals to engage at the front end of the process. When resistance was met at later stages of implementation, local leaders were able to point to the opportunities for input at earlier stages of the process, thereby decreasing the impact of the resistance.

Despite a desire to establish uniform practices across the organization, CHI determined that it was not going to remove the change management practice for the drug library from the local entities. As a result, if a local hospital determined that it preferred a standard other than the national standard because of workflow patterns, drug availability, or other issues, they were allowed to take that alternate approach but were asked to notify the national structure of their local decision. Change management practices dictate that all changes be tracked, so that the origin and reason for deviation are known and best practice patterns can be identified. This also allows for the discovery of a data point(s) that support a deviation, which then may drive a change throughout the entire health system.

Inherent with this decision was a realization that the changes needed would take a longer time to implement. As leadership reviewed the data and saw opportunities for changing practices, it was challenged by the ongoing tension of giving local entities the time needed to change practices while making the changes rapidly enough to have a positive impact on patient outcomes. Although consideration was given initially to implementing the initiative on a regional level, that idea was discarded

when an analysis of the data showed an opportunity for improvement on a national level. The regional and national staff came to realize that the improvements would take more time to fully implement and that it would not be a process of immediate change with lasting results but one of ongoing, incremental improvement.

Processes

Early on, the change management group encountered questions of credibility, as it did not have a history of data collection. To bolster its case, the group reached out to its vendor, which was able to provide data from other high-performing organizations to be used in discussions with staff. Based on its experience with other hospitals, the vendor also was able to make predictions for how much gain in drug library compliance CHI might realize with certain interventions.

One of the first challenges to be addressed was variability in how drug libraries listed the same items (i.e., naming conventions). For example, CHI determined that there were 78 different ways of referring to the infusion fluid of 1 L of 5% dextrose water with 20 mEq potassium chloride. To bring uniformity to drug library listings, initiative leaders talked with local hospitals to determine the reasons behind their naming conventions, then compared the information with vendor data to determine the most common names. CHI then began the process of standardizing its terminology by agreeing on the use of drug nomenclature based on generic drug names and "tall man" letters (mixed case) to address look-alike drug names.[1,2]

The upper- and lower-limit settings for infusion pump alerts also were a challenge. CHI initially found that the most frequent alert categories were for concentration and amount of drug infused. To benchmark its practices, the organization asked its vendor to benchmark alert limits for the top 20 most infused drugs, as well as for the top 20% of drugs with the greatest risk, as identified by ISMP. CHI then collaborated with pharmacy staff to set appropriate upper and lower limits based on the benchmarked data.

As alert parameter limits were adjusted, the number of actionable alerts requiring a nurse response also was affected. The decrease in non–clinically actionable alerts resulted in increased satisfaction from the nursing staff, as well as encouraged their buy-in.

National informatics leadership was an integral underlying aspect of this work. To assess performance, a dedicated director-level staff member analyzed all data in aggregate form, as well as from each individual hospital.

Overcoming Barriers

The nursing-pharmacy partnership was one of the most effective tools CHI used in overcoming barriers and challenges to implementation. Having both national and local personnel involved in the frontlines of the initiative and in implementation increased support at the local level and enhanced the overall results.

Continually using a data-driven approach has helped generate staff acceptance. The gap analysis, which compared local hospital performance with the initiative's goals—both technologically and clinically—also has been integral in providing a roadmap for improvement. The national staff has continued to improve its understanding of the various issues facing local hospitals based on each institution's specific implementation needs. Although the complete harmonized drug library has not been fully implemented, local hospitals have begun to reference the evidence and practice-based recommended standards to address override issues related to high alert medications, and those recommendations have been well received.

The data-driven approach also has changed the interactions of executive leadership at both the national and local levels. A review of the data has brought an awareness of the importance of infusion therapy delivery to all levels of the organization. The national quality board and local hospital CEOs and CNOs now look at these data in depth. Monthly reports, which track the number of overrides to the pumps, number of alerts, and percent of compliance in accessing the drug library, are pushed out

> As alert parameter limits were adjusted, the number of actionable alerts requiring a nurse response also was affected. The decrease in non–clinically actionable alerts resulted in increased satisfaction from the nursing staff, as well as encouraged their buy-in.

to the local level. Results are compared at the local, regional, and national levels and have become part of the routine dialogue surrounding patient and infusion safety. Leaders have developed more refined skills in analyzing safety issues. They are able to make more informed decisions about operational issues and engage in conversations about best practices. In addition, frontline clinical staff are aware of their impact on safety and practice and have been able to engage with leadership on these issues. Their concerns are now heard in new ways.

Results

Adverse drug events (ADEs) result in increased mortality and healthcare costs through additional necessary treatment, increased length of stay, and additional associated costs. The Institute of Medicine (IOM) reported that the average ADE costs $8,750.[3] Based on data from 36 healthcare facilities, Barker et al.[4] reported that 7% of ADEs caused harm to patients. Using this standard of 7% from the study of Barker et al., CHI determined that the average cost for an ADE at its hospitals was $2,200.

In addition to the tangible costs, ADEs can have other, more abstract detrimental effects, including patients losing trust in caregivers and the health system. Any improvement in infusion safety will help to reduce those undesired effects.

At the beginning of this initiative (mid-2011), drug library compliance was 60.4%. As shown in Figure 1, compliance has improved
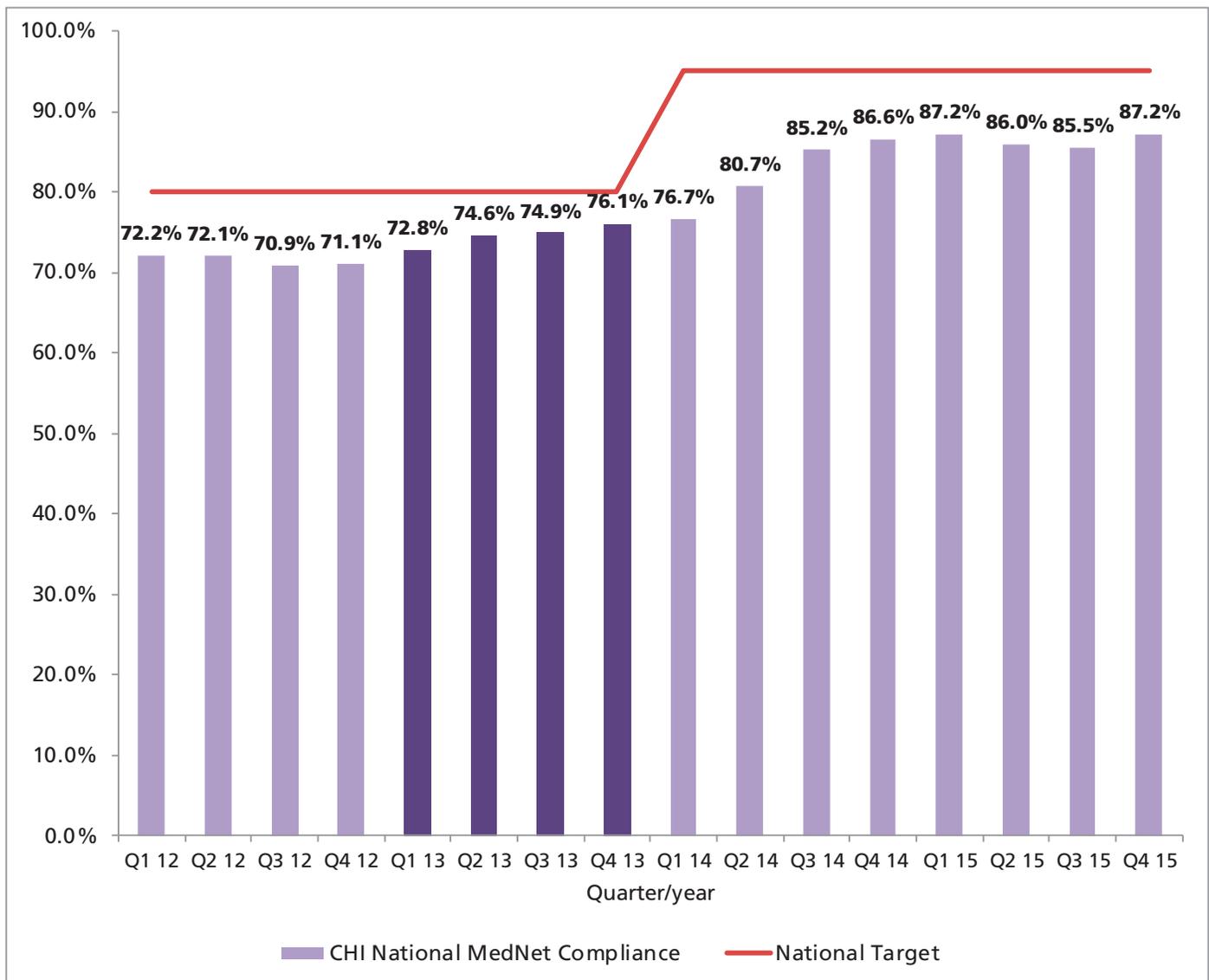

Figure 1. Catholic Health Initiatives (CHI) nursing compliance and targets for the use of the drug library

Category	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Total
Total hard limit edits	4,440	4,939	5,825	5,819	5,649	5,925	6,136	6,557	45,290
7% of hard limit edits	311	346	408	407	395	415	430	459	3,170
ROI = 7% of hard limit edits × $2,200	$683,760	760,606	$897,050	$896,126	$869,946	$912,450	$944,944	$1,009,778	$6,974,660

Table 1. Edits made to hard limits as compliance with drug library increased. Abbreviations used: Q, quarter; ROI, return on investment.

markedly, with CHI reporting a compliance rate of 87.2% at the end of 2015.

As CHI refined its drug library and identified appropriate parameters for infusion with high and low limits, along with alerts, improvements in the management of infusion safety began to emerge. As compliance with the use of smart infusion pumps increased, CHI was able to revise its hard limits. The health system realized nearly $7 million in cost avoidance during a two-year period (i.e., years 2 and 3 of its initiative) by using the smart pump and drug library functionality (Table 1).

During the same tracking period, CHI also evaluated clinician behavior in the use of smart pumps and found that greater efficiencies were realized (Figure 2). As alert limits were improved, a decrease in medication overrides also occurred. In addition, the effectiveness of clinicians' drug library programming behavior improved.

The health system also found that the number of alerts decreased dramatically (Table 2). This decrease underscores the evolution in the setting of alert limit parameters, leading to a decrease in alert fatigue for clinicians. Clinicians reported satisfaction with this outcome, as nurses and support staff were not resetting device limits and/or turning off alerts as frequently.

Next Steps

As CHI continues to monitor results on an ongoing basis, further refinements will be made to its infusion initiatives. In March 2016, the health system added a national governance structure that will review all pharmacy concerns, including infusion safety strategies. It is expected that this will further drive these initiatives forward and include an eventual signoff by health system leadership on the entire revised drug library.

CHI also will seek to enhance the use of its

Facility	Alert Rate: August 1, 2015	Alert Rate: December 1, 2015	Alert Rate Difference	Change in Alert Rate %
Hospital A	17.0	5.2	−11.8	−69.5
Hospiral B	8.1	3.7	−4.4	−53.9
Hospital C	4.3	2.1	−2.2	−51.4
Hospital D	10.3	5.8	−4.5	−43.7
Hospital E	6.8	3.9	−2.8	−41.9
Hospital F	2.5	1.5	−1.0	−38.3
Hospital G	9.0	5.6	−3.3	−37.4
Hospital H	11.4	8.0	−3.4	−29.9
Hospital I	13.7	9.8	−3.9	−28.3
Hospital J	6.1	4.7	−1.4	−22.7
Hospital K	13.2	10.4	−2.8	−21.2

Table 2. Alert rates after limits were adjusted

drug library as a therapeutic modality, programming infusion pumps in a manner that could potentially decrease length of stay. Three areas under consideration are the improvement of infection rates, decreasing the risk for additional asthmatic attacks, and more rapidly achieving therapeutic INR levels (a measure of the time it takes for blood to clot) for patients receiving heparin therapy. By tracking the relevant data, CHI will seek to determine whether certain prescribing patterns result in improved therapeutic efficacy, better patient outcomes, and increased cost savings.

The health system also will work to fully integrate the infusion device strategy with its electronic health record (EHR) systems. Through enhancements, such as the content optimization of the EHR and documentation of computerized provider order entry, CHI will seek to further decrease the potential for human error and improve infusion safety.

Lessons Learned

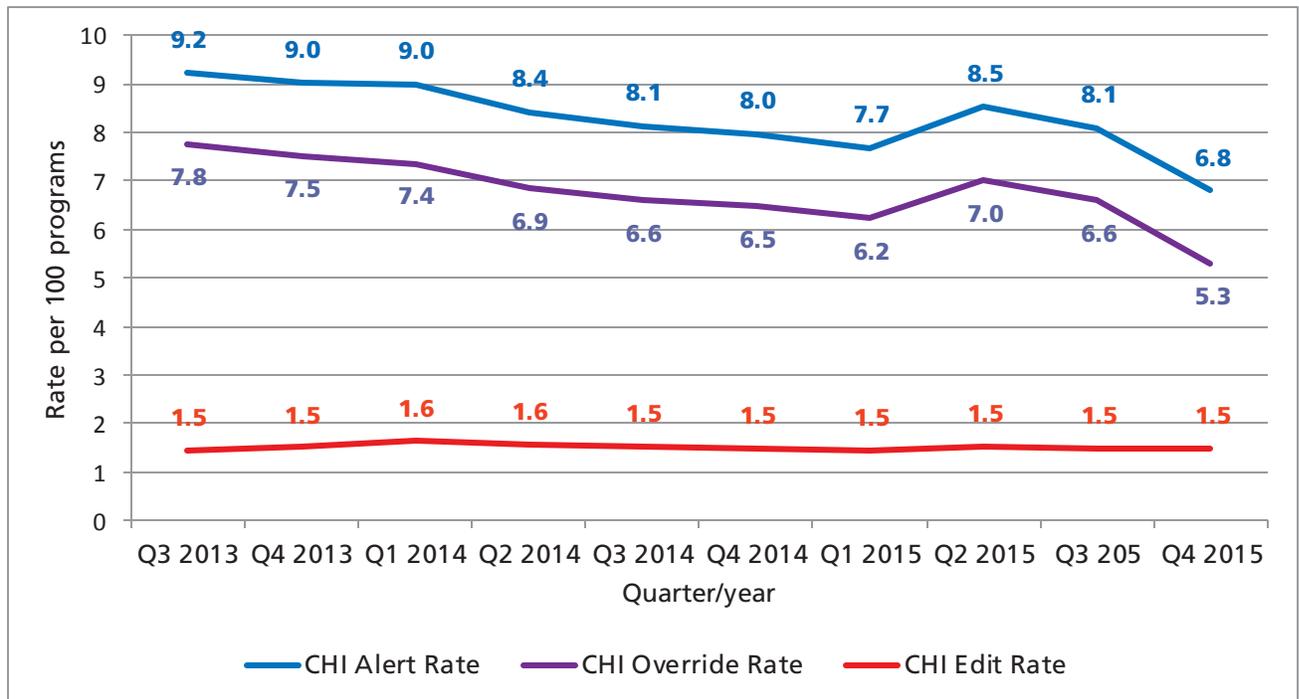These infusion safety initiatives will only become more important to hospitals as

Figure 2. Increased effectiveness of drug library in improving nursing performance at Catholic Health Initiatives (CHI)

reimbursement policies shift toward pay-for-performance models. Patient access to data from hospitals to "comparison shop" also will drive the importance of identifying and implementing best practices for infusion safety.

An important realization of any clinical improvement initiative is that implementation is only the start of the process. Arriving at the "go-live" point in the process is really only the beginning; it serves as the launching point for how a hospital will use the data to inform quality improvement efforts going forward.

The importance of a gap analysis and its role in shaping the implementation at the local level cannot be underemphasized. It must include both a technological component and a clinical component. An assessment of the existing technology and its ability to operate the new safety software and changes is necessary. In addition, the budget cycle for acquiring necessary technology also must be considered.

The importance of having a three-pronged support structure (governance, stakeholder support, and a continuous quality improvement process) was critical to CHI's initiative. The governance structure must be feasible

for the organization managing the process and should include a dedicated project manager. Stakeholder support is greatly enhanced by involvement at the implementation level. Finally, a continuous quality improvement process must be in place in order to ensure a culture of safety.

The importance of data use cannot be overemphasized. As more personnel become accustomed to reviewing data in the quality reports, their proficiency increases, allowing them to compare the data with those of other leading facilities. Inevitably, the initiative gains momentum from the increase in knowledge and analytical skills, as well as the spirit of friendly competition.

A final practice for this improvement initiative has been the development of best practices for the go-live implementation. CHI deploys educators to the local hospitals 10 to 14 days before the go-live date for training of staff. Go-live support also is provided on-site by the same educators for a period of one week, then reinforced with remote support as needed.

Finally, the importance of effective collaboration among executive leadership, clinical

informatics, nursing, and pharmacy, along with the partnership with the infusion device vendor, must be highlighted. This collaboration is perhaps the strongest driving force for improving infusion safety. ■

References

1. **Smetzer JL, Vaida AJ, Cohen MR, et al.** Findings from the ISMP Medication Safety Self-Assessment for hospitals. *Jt Comm J Qual Saf.* 2003;29(11):586–97.

2. **Institute For Safe Medication Practices.** FDA and ISMP Lists Of Look-Alike Drug Names with Recommended Tall Man Letters. Available at: www.ismp.org/tools/tallmanletters.pdf. Accessed May 11, 2016.

3. **Aspden P, Wolcott J, Bootman JL, Cronentwett LR (Eds.).** *Preventing Medication Errors: Quality Chasm Series.* Washington, DC: National Academies Press; 2007.

4. **Barker KN, Flynn EA, Pepper GA, et al.** Medication errors observed in 36 health care facilities. *Arch Intern Med.* 2002;162(16):1897–903.