Case Study: Electronic Medical Records Decrease Adverse Drug Events in Long-Term Care Environment

2006 Long-Term Care Health Information Technology Summit

I. Background

The Valley View Center for Nursing Care and Rehabilitation provides long-term and short-term care for patients who need 24-hour nursing due to chronic illness, injury or advancing age. Located in Goshen, New York, the 520-bed facility consists of four buildings and 15 units. The center provides physical, occupational, and speech therapies, as well as respite and hospice care. The Valley View Center offers the area’s largest team of on-site physicians, nurses, therapists, registered dieticians, social service professionals, and long-term care activity specialists.

When an annual medication incident study in 2003 revealed an unacceptably high number of adverse drug events, the facility immediately launched a quality improvement program. The Valley View Center created an interdisciplinary task force to study the problem and to develop and execute a solution. A follow-up study analyzing medication order administration identified a labor-intensive process with a high potential for human error. The quality improvement team recommended an electronic medical records (EMR) system with computerized physician order entry (CPOE) and electronic prescribing capability. The proposed solution aimed to reduce the number of adverse drug events and to improve quality of care by allowing staff members to spend more time with residents and less on paperwork.

Implementation of an EMR system with CPOE and electronic prescribing exceeded the center’s expectations in decreasing both the incidence of adverse drug events and the administrative time spent processing physician order renewals. The quality improvement team also identified opportunities for automating additional clinical procedures that will further improve quality of care and operational efficiency.

II. Problem

In a long-term care environment, paper-based physician orders and medication administration not only consumes time better spent with residents, but it also carries the risk of human error, which can prove life-threatening and even fatal.

The 2003 medication incident study at the Valley View Center sparked an initiative to identify and resolve the causes of the adverse drug events. The findings of the quality improvement team coincided with the conclusions of a study published in the February 24, 2005, issue of The American Journal of Medicine, titled “The Incidence of Adverse Drug Events in Two Large Academic Long-term Care Facilities.”
The study identified 815 adverse drug events during an eight- to nine-month period at two facilities with a total of 1,229 beds. Four of these 815 events were fatal, while 33 were life threatening. Of the balance, 188 were serious, and 590 were less serious. Most of the adverse drug events resulted from errors in drug prescribing and monitoring. Errors in drug dispensing and administration led to far fewer adverse events. The types of errors identified included wrong dose, drug interactions and failure to monitor residents for side effects.

The American Journal of Medicine study concluded the following:

- 42% of the total adverse drug events were preventable.
- 61% of the serious, life-threatening and fatal adverse drug events were preventable.
- Use of information technology improves accuracy in ordering and monitoring medications.

The task force at the Valley View Center recognized the potential for human error in its manual processes. Team members believed that automating physician order entry and prescribing would decrease both the number of errors and, consequently, the incidence of adverse drug events.

III. Objective

On average, the Valley View Center manages approximately 32 standing physician orders per resident; medications account for almost one-third of these orders. Because of the serious consequences of adverse drug events, especially in the nursing-home setting, the nursing team submitted the results of its annual medication incident study in December 2003 and discovered an average of almost three adverse drug events per month. The facility staff considered this number unacceptable and launched a quality improvement initiative in January 2004 to reduce adverse drug events.

As part of this initiative, the center conducted a study to analyze the workflow of processing medication orders. The study found that nursing and medical staff spent nearly 800 hours per month on general order review and renewal processing. Manual paperwork slowed the processing of medication and treatment orders, a problem compounded by intermittent handwritten modifications. For example, nurse verification and physician approval for order renewals consumed 180 hours per week. Processing telephone orders took 150 hours each week.
Armed with this information, the center speculated that automating the physician order process for medications and treatments would decrease adverse drug events. Facility administration based this conclusion from the study reported in *The American Journal of Medicine* cited above, which attributed the majority of adverse drug events to errors in prescribing and monitoring. In addition, automation would permit the staff to spend less time on paperwork and more time with residents, improving overall quality of care.

IV. Method/Solution Used

To develop a cohesive strategy, the Valley View Center formed an interdisciplinary team that included nurses, physicians, administrators and information technologists. Given the facility’s cultural considerations and size, and allowing for unknown obstacles, the Valley View Center allotted 16 months for the overall quality improvement project:

- four months for needs assessment,
- four months for solution selection,
- two months for internal support gathering,
- three months for pre-implementation planning, and
- three months for implementation.

Two main obstacles arose as the facility began assessing the feature and implementation requirements for an automation solution: cost and culture. Cost was a significant issue, given the physical size of the facility, the technology infrastructure required to support mobility and remote access, and the number of personnel who needed training. The second issue depended on gaining staff acceptance and support of automation in an environment that relied on manual paper processes. These manual procedures formed part of the facility’s culture and would require time and effort to change.

**Initial Analysis**

To understand how to automate the physician order process, the center needed a well-documented understanding of manual procedures. The quality improvement team analyzed the current system from the perspective of all related roles, entities, workflows and dependencies.

Initial analysis revealed many automation opportunities, including:

- Remote and local access to clinical information (*e.g.*, current medications, physician orders, diagnoses, allergies, height, weight, and vitals)
- Drug interaction checking
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- Drug and formulary reference availability
- Data collection verification (for accuracy and completeness)
- Order review and verification
- Physician approvals
- Pharmacy communication
- Routing and accessibility of order information throughout the facility
- Safety and census reporting

Based upon the business process analysis, identification of priority automation opportunities, and continued dialogue with order management personnel, the team concluded that the proposed solution should include the following features:

- Electronic Medical Records (EMR) system with Computerized Physician Order Entry (CPOE) and Electronic Prescribing (eRx) capability
- Clinical information repository to track diagnoses, allergies, height, weight, and vitals
- Medication order management with formulary presentation (including Medicare Part-D formularies)
- Automatic drug utilization review (DUR) for drug interactions (e.g., drug-to-drug, drug-to-allergy, and drug-to-condition)
- Automatic routing capability for prescription approval and fulfillment
- Renewal order processing (e.g., scheduling and approval)
- Clinical and administrative reporting capability (e.g., quality indicator reporting)
- Web browser support to allow remote access from outside the facility
- Wireless operation to promote mobile access at the point of care
- Intuitive user interface
- Integration with the facility’s financial system, pharmacy, RxHub (e.g., PBM consortium) and other key vendors

Vendor Selection
Preliminary review of the long-term care IT marketplace revealed that most solutions focused on back-office functions. Even though these systems captured much of the information the facility needed to track, they did not support the mobility required in the clinical environment. Most automation packages lacked important usability features, including point-of-care collection of clinical data and automatic cross-referencing of data with protocols for quality control. Therefore, the facility narrowed the field to vendors with a clinician-focused solution and a proven implementation strategy. The Valley View Center ultimately selected the SigmaCare™ long-term care application from eHealth Solutions, Inc.
The SigmaCare application addressed the cost issue by offering affordable per-day per-bed pricing on a monthly basis. The Valley View Center did not have to invest in an on-site data center or IT staff because the application operates securely over the Internet using an Application Service Provider (ASP) model. In addition, the fixed monthly fees simplify annual budgeting by including all software licensing, system upgrades, training, documentation, consulting, and support.

eHealth Solutions managed the culture issue with an implementation plan that acknowledged the fear invoked by change. At the Valley View Center, that change took shape in a computerized system that would replace most of the manual processes the clinical staff had grown accustomed to during their careers. Compounding this fear, most staff members were older and had limited computer skills. The vendor allayed these fears by performing a facility-wide workflow assessment to understand the needs, policies and procedures from the perspective of every discipline (e.g., nursing, physicians, admissions, administration, etc.).

The implementation team then demonstrated the SigmaCare product for every department and discipline. During this process, the vendor listened to feedback, learning firsthand about staff expectations and concerns about deployment. The Valley View Center bolstered these efforts by launching its own internal marketing campaign to secure staff support early in the process.

**Implementation**

The vendor assigned a project manager to oversee the entire implementation process at the Valley View Center. The project manager supervised the installation of an enterprise-grade 802.11x wireless network infrastructure (WiFi) throughout the facility, as well as redundant broadband Internet access (i.e., primary and failover broadband connections). The vendor installed desktop computers, laptops, printers, and backup battery chargers throughout the facility, in addition to providing ruggedized PDA handheld devices.

The project team documented the facility’s policies and workflow, which the quality improvement team reviewed and approved. The automation process affected many manual policies and procedures, which then required revision. The vendor project team used this information to customize and configure the SigmaCare application before training and back-order entry.

Training began in early February 2005 and ended in April 2005, with 209 Valley View Center employees taking part in the process. Vendor personnel created a classroom setting at the center that included laptop computers, PDA handheld devices, and training documentation. Before training started, the quality improvement team offered
guidance on organizing and scheduling training sessions and student groups based on job function and discipline.

Initial training sessions included facility administration and department managers (known as “super users”). These individuals engaged in a structured three-day curriculum, which emphasized hands-on learning and competency testing for both the web browser and handheld devices. In addition, physicians and nurse practitioners participated in separate training sessions. The quality improvement team selected nurses in subsequent sessions based on the facility’s deployment schedule. Implementation started in the most complex sub-acute units since these residents had the most physician orders.

While classroom training was taking place, the vendor’s project team supervised the back-order entry process according to the deployment schedule. Previously trained nurses input the standing physician orders, along with diagnosis history for residents on the unit. Physicians then reviewed and approved the orders. Once all orders on a given nursing unit were approved, the quality improvement team designated that nursing unit as “live” on the SigmaCare application.

The vendor provided ongoing support on-site throughout the implementation process by assigning trainers on all shifts. The trainers reported issues and feedback from each shift during a daily status meeting. The project manager then met with the quality improvement team to report issues that required remediation. To address priority issues, the vendor project team changed the configuration of the SigmaCare application or worked with the Valley View Center to create new policies and procedures as needed.

V. Results Achieved

The Valley View Center has a well-defined process for identifying, reporting, recording, and reviewing medication incidents (e.g., adverse drug events, prescription fulfillment errors, etc.). Initial analysis of the facility’s business processes provided the standard for collecting baseline information. Using this foundation, the Valley View Center set performance benchmarks.

The table below summarizes the baselines, goals, and outcomes for the quality improvement initiative:
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Benchmarks, Goals, and Outcomes

<table>
<thead>
<tr>
<th>Area</th>
<th>Baseline</th>
<th>Goal</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adverse Drug Events</td>
<td>2.81 per month</td>
<td>.70 per month (75% reduction)</td>
<td>.44 per month (84% reduction)</td>
</tr>
<tr>
<td>Time Spent on Order Processing</td>
<td>1,076.25 hours per week</td>
<td>538 hours per week (50% reduction)</td>
<td>370 hours per week (66% reduction)</td>
</tr>
</tbody>
</table>

Using the SigmaCare application, the Valley View Center decreased the average monthly number of adverse drug events from 2.81 to .44, an 84% reduction. During the 16 months before full implementation, the center had 45 adverse drug events. In the nine months since SigmaCare deployment, the facility has had only four adverse drug events.

Additionally, the computerized physician order entry and electronic prescribing application significantly decreased the amount of time clinical personnel spent on manual administration and paper processing. More than 200 employees reduced their total workload by nine percent. Consequently, the staff could devote more time to care planning and direct resident care. The Valley View Center believes that the efficiency gained with automation enhanced the quality of care at the facility and played a significant role in reducing adverse drug events.

As the table below indicates, the Valley View Center saved 706.25 hours per week (36,725 hours per year, or 18 full-time clinical personnel) in administrative time. Automated procedures performed by staff members now take only one-third of the time consumed by paper-based systems (370 versus 1,076.25 hours per week.).

<table>
<thead>
<tr>
<th>Business Process</th>
<th>Hours Per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completing accurate lab orders (e.g., ICD9 issues)</td>
<td>22.50</td>
</tr>
<tr>
<td>Completing lab requisitions based upon orders</td>
<td>18.75</td>
</tr>
<tr>
<td>Transcribing interim updates on the MAR/TAR</td>
<td>40.00</td>
</tr>
<tr>
<td>Scheduling renewals</td>
<td>7.50</td>
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</tbody>
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Administrative Time Savings
Administrative Time Savings

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hours Per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Producing current orders for renewals (i.e., nurse verification)</td>
<td>135.00</td>
</tr>
<tr>
<td>Approving current orders for renewals (i.e., physician approval)</td>
<td>45.00</td>
</tr>
<tr>
<td>Routing and completion of telephone order documentation</td>
<td>150.00</td>
</tr>
<tr>
<td>Delivering medication orders (i.e., transmission to pharmacy)</td>
<td>40.00</td>
</tr>
<tr>
<td>Completing consultation forms</td>
<td>56.25</td>
</tr>
<tr>
<td>Communicating ADT changes throughout facility</td>
<td>11.25</td>
</tr>
<tr>
<td>Distributing orders to all ancillary departments (e.g., Rehabilitation, Dietary)</td>
<td>20.00</td>
</tr>
<tr>
<td>Completing orders for new admissions during off-shift hours</td>
<td>247.50</td>
</tr>
<tr>
<td>Producing resident safety reports</td>
<td>5.00</td>
</tr>
<tr>
<td>Distributing and educating staff on formulary updates</td>
<td>7.50</td>
</tr>
<tr>
<td>Reporting end-of-shift activity</td>
<td>262.50</td>
</tr>
<tr>
<td>Producing census reports</td>
<td>7.50</td>
</tr>
<tr>
<td><strong>Totals:</strong></td>
<td><strong>1,076.25</strong></td>
</tr>
</tbody>
</table>

In addition to reducing adverse drug events and refocusing clinical personnel on direct resident care, automation reduced order errors by 225%. In the 16 months before full implementation, the Valley View Center had 32 order errors. In the nine-month period since implementation, the facility has had only eight order errors.

The Valley View Center exceeded its expectations and will use this momentum to seek further improvements.

VI. Lessons Learned

The initiative at the Valley View Center supports the theory that automating the physician order process for medications and treatments reduces errors and improves
overall quality by freeing more time for direct resident care. Sheer volume makes quality
control difficult when using manual processes and often leads to errors.

The Valley View Center manages more than 16,500 standing physician orders for more
than 500 residents. On average, each resident has 32 orders, with medications
representing almost one-third. There are more than 100,000 possible prescription drug
interventions. Compounding the challenge, more than 200 clinicians take part in the
order management process. Automation streamlines the inherent complexity in
prescribing medications in the long-term care environment, thus reducing the chance for
human error, as validated by the 84% decrease in adverse drug events.

Based on the initial success of implementing CPOE and electronic prescribing, the
Valley View Center seeks to gain additional efficiencies and patient safety
improvements by automating more clinical processes.

Even though the bulk of adverse drug events result from errors in prescribing and
monitoring, according to the American Journal of Medicine study cited above,
decreasing errors in drug dispensing and administration will likely raise patient safety
rates further. To this end, the Valley View Center plans to adopt electronic medication
and treatment administration records (eMAR/eTAR), which will provide additional quality
control at the point of medication administration.

The proposed system by the vendor, eHealth Solutions, uses barcode technology to
match the right resident to the right medication at the right time. The system also
improves compliance with standards of care by providing online protocols, such as
recording vital signs before or after administering medications. Additionally, the
application alerts staff if vitals register outside normal parameters. The technology also
tracks when residents receive their medication or treatment and helps ensure timely
administration. For instance, if a resident misses a dose, the system reminds the staff to
follow up and administer the medication.

In addition to eMAR/eTAR, the Valley View Center plans to automate other clinical
procedures related to accident and incident tracking, MDS assessment scheduling and
management, and care planning. The facility estimates that staff members currently
spend more than 950 hours per week on these manual procedures, including time spent
exchanging resident pre-admission and discharge information with local hospitals. If
automation of these procedures only yields a 50% time savings, the center would still
gain the equivalent of 12 additional full-time clinical personnel to redeploy on direct
resident care.
The quality improvement initiative at the Valley View Center demonstrates how automating physician orders can significantly reduce errors and increase efficiency, freeing staff members to spend more time with residents. Applying such clinician-focused technology to other processes in the long-term care environment holds great promise for additional advances in patient safety. With long-term care facilities facing the challenges of tighter budgets and staffing shortages, mobile technology at the point of care can maximize limited resources without sacrificing quality of care.