

Sharon Jeffers
Phebe Searcey
Kathy Boyle

Carol Herring
Kathleen Lester
Hillarie Goetz-Smith
Polly Nelson

Centralized Video Monitoring For Patient Safety: A Denver Health Lean Journey

EXECUTIVE SUMMARY

- ▶ The demand for certified nursing assistant (CNA) staff used as 1:1 sitters for safety enhancement and fall prevention can be costly.
- ▶ Through Lean thinking and tools and brainstorming, leaders at Denver Health conceptualized the centralized video monitoring (CVM) program for patient safety.
- ▶ The CVM program reallocated the underutilized talents of CNA sitters as video monitoring technicians (VMT) to meet the challenge of delivering high-quality, cost-effective patient care.
- ▶ Implementing the CVM program required tight connections and collaboration with a multidisciplinary team of individuals.
- ▶ Actual program performance exceeded the initial projected benefits.
- ▶ The CVM program supports the high level of vigilance required by nursing staff to ensure patient safety and quality.

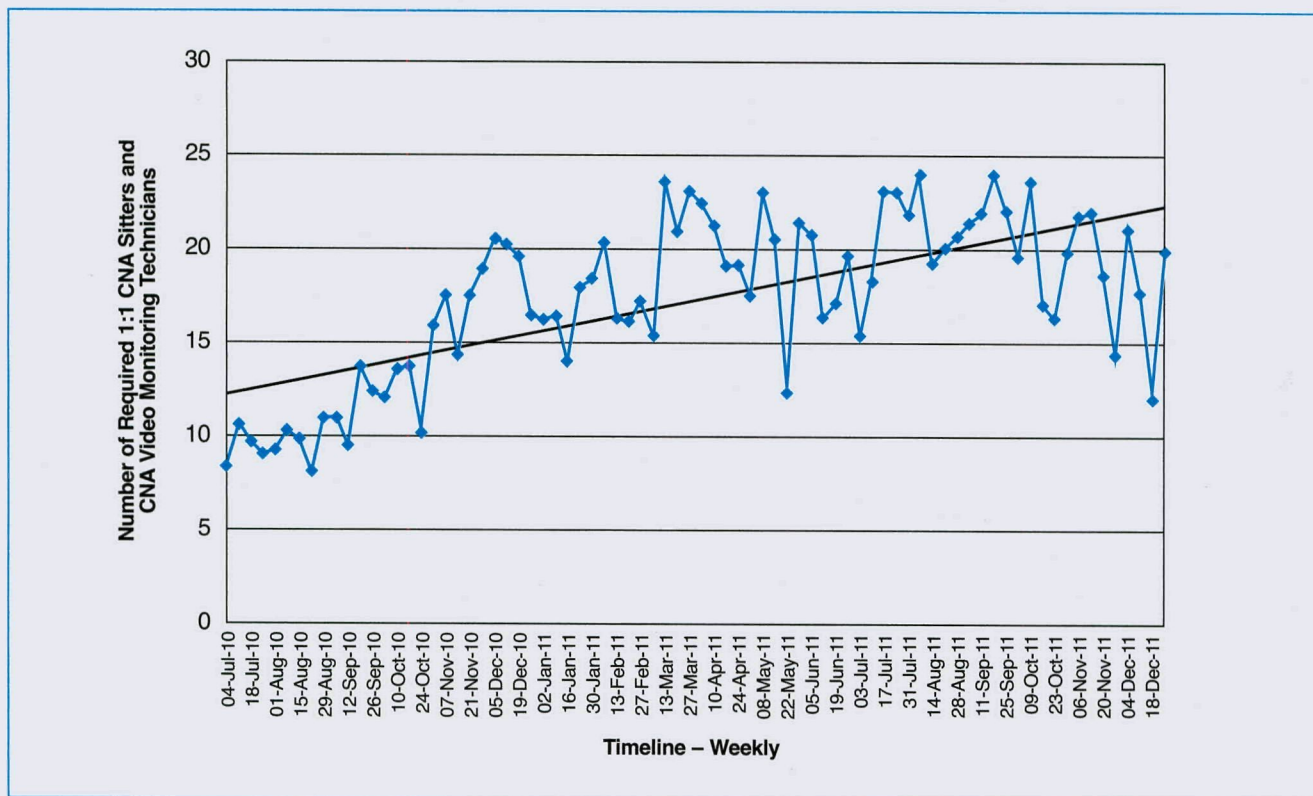
THE CORE OF SUCCESSFUL HEALTH care delivery systems is the ability to deliver care in a safe, injury-free environment for patients and staff using current protocols and proven science (Evans & Lindsay, 2011). The Joint Commission (TJC) identified injury from falls as one of the safety concerns when a patient is hospitalized (Inouye, Brown, & Tinetti, 2009). Within the hospital setting “accidental falls are the commonest reported patient safety incident in hospitals” (Oliver, 2008, p. 1774) and approximately 2% to 12% of patients experience at least one fall during their hospital stay (Coussement et al., 2008). In terms of the financial burden, by 2020, the nationwide cost of falls is projected to be more than \$43.8 billion (Quigley, Neily, Watson, Wright, & Strobel, 2007). To address the challenging impact of falls on patients and organizations, TJC added the requirement of a fall-reduction program with effectiveness evaluated as the 9th National Patient Safety Goal in 2005, and elevated it to a TJC Standard in 2010 (Jorgensen, 2011). Furthermore, the Centers for Medicare & Medicaid Services created guidelines related to

patient safety and reduced financial reimbursement for injuries resulting from falls occurring during a patient’s hospital stay (Department of Health and Human Services, 2010).

When evaluating quality and organizational performance, health care organizations look toward the Agency for Healthcare Research and Quality and other organizations such as TJC for published standards of care such as National Patient Safety Goals, competencies, and standards of practice. At Denver Health (DH), in 2009, fall rates continued to remain above national benchmarks despite the implementation of a comprehensive fall-prevention program. The use of yellow arm bands, signage, risk-score associated interventions, and a validated risk-to-fall assessment tool did not result in a desired decrease in fall rates. In response, DH implemented an hourly rounding fall-prevention program based on an evidence-based program developed and studied by the Studer Group (Meade, Bursell, & Ketelsen, 2006). However, the demand for certified nursing assistant (CNA) staff as 1:1 sitters for safety enhancement and fall prevention and the cost of sitters

NOTE: Please see the following page for authors’ biographical information and acknowledgments.

Figure 1.
Denver Health Analysis of Demand for Sitters (July 2010 - December 2011)



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SHARON JEFFERS, MBA, PMP, is Program Manager and Lean Black Belt, eHealth Services/Information Technology, Denver Health and Hospital Authority, Denver, CO.

PHEBE SEARCEY, MSN, RN, is Clinical Nurse Educator, Nursing Support Services, Denver Health and Hospital Authority, Denver, CO.

KATHY BOYLE, PhD, RN, is Chief Nursing Officer and Lean Black Belt, Denver Health Administration, Denver Health and Hospital Authority, Denver, CO.

CAROL HERRING, MA, RN, is Quality Initiatives Coordinator, Nursing Management, Denver Health and Hospital Authority, Denver, CO.

KATHLEEN LESTER, BS, BSN, RN-BC, is Clinical Nurse Educator, Denver Health and Hospital Authority, Denver, CO.

HILLARIE GOETZ-SMITH, BSN, RN, is Clinical Nurse Educator, Denver Health and Hospital Authority, Denver, CO.

POLLY NELSON, RN, is Nurse Program Manager - Float Pool and Lean Black Belt, Nursing Support Services, Denver Health and Hospital Authority, Denver, CO.

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continued to trend upwards as shown in Figure 1. In response, other innovative ways to monitor patients' safety and use resources more efficiently were explored. DH's use of Lean thinking and tools (Radnor, Holweg, & Waring, 2012) and brainstorming sessions were used to conceptualize the centralized video monitoring (CVM) program for patient safety. The purpose of this article is to describe CVM as an innovative approach to address the organizational demand to ensure patient safety at reduced operational expenses. Implementation of the CVM program reallocates the underutilized talents of 1:1 CNA sitters as video monitoring technicians (VMT) to meet the challenge of delivering high-quality, cost-effective patient care.

Background

Founded more than 150 years ago, Denver Health, a 525-bed acute care facility, serves the people of Denver, the state of Colorado, and the Rocky Mountain region. The integrated health care system includes a level I trauma center, Denver's 911 Emergency Management System, a paramedic division, eight family health centers, 15 school-based health centers, the Rocky Mountain Poison and Drug Center, NurseLine, correctional care, Denver CARES (a 100-bed detox facility), Denver Public Health, and the Rocky Mountain Center for Medical Response to Terrorism, Mass Casualties, and Epidemics. Denver Health, an aspiring Magnet® facility, is the largest provider of care in the state for the uninsured and Medicaid populations as well as a major provider for the Child Health Plan. Approximately 42% of DH patients are uninsured, and uncompensated care for uninsured patients exceeded \$450 million in 2011 and more than \$4 billion since 1991.

In a society characterized by flat revenues and increasing costs, health care organizations must make the most of their investments in people, process, and technology by threading quality and organizational performance throughout their organizations. Denver Health is not immune to the changing and uncertain economy, and executive leadership states quality initiatives are an integral part of health care operations and provide processes and tactics that address the challenges facing health care organizations. In 2005, DH embarked on a Lean transformation journey, a paradigm-shifting organizational behavior change initiative to create a new model for health care delivery and build a mature organizational culture committed to reducing waste while perfecting the patient experience and becoming a model for the nation. Denver

Health's leadership driven initiative, "Getting It Right and Perfecting the Patient Experience," utilizes Lean principles in all aspects of the organization. Lean is an integrated system of principles, practices, tools, and techniques focused on reducing waste, synchronizing workflows, and managing variability in production flows (Radnor et al., 2012). Lean gives organizations a systematic approach and tools to drive out waste from overproduction, motion, rework, waiting, transportation, intellect, inventory, and processing (Yousri, Khan, Chakrabarti, Fernandes, & Wahab, 2011). The result is standard work that adds additional value to processes and workflows that serve the customer's needs. Lean's strength to organizations is built from the common set of standard solutions and a focus on the customer and the entire value chain (De Koning, Verver, Van Den Heuvel, Does, & Bisgaard, 2006).

The Lean transformation journey started with the first Black Belt training program designed to build core competency in the use of Lean tools and principles. In the spring of 2005, multiple value stream analyses aligned efforts with core value stream business objectives and resulted in the first rapid improvement events (RIE) in June 2005. In April 2006, DH established a Lean Systems Improvement (LSI) department to commit dedicated resources to focus on Lean initiatives. In August 2006, DH recognized the first confirmed financial returns. Momentum and commitments from all levels of the organization continued to push this effort forward. In the spring of 2007, DH conducted the first internal Black Belt training program and had engaged more than 20% of the organization's employees in some type of Lean quality initiative. Cumulative figures published from the LSI department in June 2012 confirmed Lean had taken hold as evidenced by 400 RIEs with more

than 2,000 employee participants from over 220 departments aligned with 16 corporate value streams. Lean "brings action and intuition to the table, quickly attacking low hanging fruit with Kaizen events" (Smith, 2003, p. 1). The Lean process fits health care by leveraging an intuitive tool set of Lean principles and a two-pronged approach to organization change through facilitated RIE events and trained DH Lean Black Belts. Lean provides meaningful employee engagement, initial rapid results, and the power to change culture across the organization. Through June 30, 2012, organizational Lean financial impact has reached \$171 million. Lean transformations occur daily in the DH system. The CVM program is an example of Lean at work, identifying and eliminating waste within an increasing sitter population, through the utilization of CVM to deliver continuous patient safety while decreasing personnel expenditures.

Literature Review

Denver Health's CVM program research produced limited published content on the use of video surveillance monitoring in a patient care setting to support patient safety initiatives. A Boston-based hospital pilot-tested video monitoring to "collect reliable data for use in quality improvement" ("Video Monitoring," 2005, p. 8). This type of monitoring focused on staff performance and facility security. In 2009, Ochsner Medical Center in New Orleans, LA, implemented a small-scale 24-hour camera surveillance program on a 34-bed internal medicine unit with success, "reducing their sitter cost from \$960 for four patients to \$240 for four patients" (Goodlett, Robinson, Carson, & Landry, 2009, p. 21). Rochefort, Ward, Ritchie, Girard, and Tamblyn (2011) supported arguments that sitter usage and increasing sitter costs cannot be associated directly with specific patient health condi-

tions. However, sitters have been used historically as a tool to increase patient safety in those patients with at-risk characteristics. "To our knowledge, no prior study has documented the factors that are associated with higher sitter use costs" (Rochefort et al., 2011, p. 2). Rochefort and colleagues (2011) also reported annual sitter costs in U.S. hospitals can reach as high as \$3 million. Most hospitals have adopted technology such as bed alarms, chair alarms, restraints, and unlicensed assistive personnel as part of a comprehensive patient safety program (Wiggins, Welp, & Rutledge, 2012).

In 2009, the Nursing Executive Center published a case study from Poudre Valley Hospital in Fort Collins, CO, discussing their video surveillance deployment within a single neurosciences unit. Poudre Valley's use of cameras for all patients assessed as high risk for falls resulted in "a fall reduction from 23.5 falls per year to 2 in the first year after implementation" (Nursing Executive Center, 2009, p. 130). Denver Health was faced with similar challenges with staff providing patient and family-centered care with safety as a primary focus. In an effort to keep patients safe, there are times when staff is required to intervene and redirect patients. For example, patients with a traumatic brain injury may try to pull out intravenous catheters or have a propensity to fall. These patient behaviors require staff interventions to keep patients safe. A sitter's responsibility is to keep the patient in line of sight at all times and to intervene when necessary (Harding, 2010). The CVM team visited Poudre Valley to learn from their successes and look for a Lean method to apply their findings on a larger, centralized scale.

Health care organizations experience tremendous pressure to change to keep pace with advances in technology, medical

practice, and the better-informed patient population. Advanced technologies and increased costs due to operational inefficiencies impact all areas of health care organizations (De Koning et al., 2006). The CVM program team focused on using technology and Lean with the premise the whole is greater than the sum of its parts and implemented a CVM program that is patient centered, timely, efficient, technologically advanced, and expanded the hospital's current investment in the fall-prevention program. Lean initiatives "become a formidable tool for attacking the problems that enlarge the difference between annual revenues and the bottom line" (Smith, 2003, p. 1). Organizational behavior initiatives, such as Lean, combined with leading edge, centralized video technology, provided a formidable solution in DH's acute care setting.

Intervention and Programming

Implementing the CVM program required tight connections and collaboration with a multidisciplinary team of individuals representing nursing administration, acute care nursing management and staff, nursing support services management and staff, biomedical services, information technology, legal, regulatory, quality and patient safety, and vendor partners. Denver Health assigned a project manager to coordinate work efforts across the departmental areas and to help streamline the implementation steps. Information technology resources facilitated the selection of a video technology solution that supported the minimum requirements for continuous monitoring without recording with video image, quality, and patient visualization in both high and low light settings. Construction of a monitoring room or "command center" provided video monitoring staff with a centralized, secure space to perform the monitoring job functions. Communication between care provi-

ders required the expansion of the nurse call system to the centralized monitoring room to provide proactive, immediate audio contact with unit nursing staff and patients. Finally, camera installation on all acute care units required closure of patient rooms with minimal impact to patient census.

Following many planning meetings and site visits the previous year, CVM program implementation began in September 2010. Before implementation, clinical nurse educators created working documents such as flow sheets for documentation, admit and discharge logs, and a resource manual for staff. The resource manual provided VMTs with key operational guidelines on the CVM and nurse call systems, workflow and downtime algorithms, and contact information for support staff. Training and education of the staff occurred through "at the elbow" hands-on use of software and equipment, discussion of standard workflows, and job simulation. Competency evaluation tools were used to validate the VMT knowledge and understanding of the system and processes being implemented. Ancillary staff were educated regarding the surveillance program and reassured their own performance was not being evaluated. An administrative procedure was drafted and approved by the legal department. Consent for video monitoring was part of the general consent form and did not require a separate consent. After repeated discussions between the nursing and legal departments, the legal department stood firm on the decision patients could refuse video monitoring, and when this occurred, they would be provided with 1:1 CNA sitters due to the newness of this type of program in a clinical setting.

After the preliminary steps were in place, the implementation team executed a small, focused pilot on one of the acute care

units. During the first week of the program implementation, the pilot was limited to day shift monitoring to provide better support for the pilot staff and to facilitate program feedback and lessons learned. The CVM room was staffed at all times with two CNAs, also referred to as VMTs. Patients enrolled in the pilot were consented and an in-room sitter remained in place for the first week. During the pilot, the average census of patients monitored was 8-10. Status meetings were held daily including staff from the pilot unit, CVM room, information technology, and the nurse call system representative. The meetings were used to evaluate program effectiveness and provide process and procedure feedback. After the first week, the pilot was expanded to 24/7 coverage with an increase in the number of patients on video monitoring. The CVM program pilot expanded quickly to additional floors with full implementation across all acute care units by December 2010.

The current CVM program monitors 8-18 patients from seven acute care units, with an average daily program census of 12 patients. Two VMTs continue to staff in the CVM room 24/7 post pilot. The inpatient nursing float pool management team provides the orientation and staffing and maintains competencies for all CNAs in the centralized monitoring room. The VMTs are scheduled for 12-hour shifts with relief breaks provided by the acute care unit CNAs on a rotating basis. The VMTs work together as a team to monitor for patient activity, communicate with patient and unit staff, and troubleshoot and provide interventions as necessary. Documentation occurs in real-time on a video monitoring technician work log (see Figure 2), and resulting documentation is transferred to the patient's electronic medical record at 2-hour increments.

A VMT's shift begins with a formal hand-off of information

from the previous shift. The VMTs in the monitoring room give report on each patient to incoming staff and round on each nursing unit to collect patient census reports and establish communication with unit staff. Each shift, the unit charge nurse responsible for CVM patients calls report to the VMTs to confirm the correct patients are on camera and are being monitored for the correct identified risks. Two patient identifiers and the specific criteria that categorized the patient as at risk occur upon patient admission, upon return from patient transport from off-unit locations, or at a change in level of care or risk criteria. The VMTs are responsible for follow up with the charge nurse and bedside RN for clarification, verification, and updates as needed. Key video monitoring processes including admission to program, escalation procedures, and downtime operations are formalized as

Lean standard work to ensure the same workflow is followed independent of the individual staff performing the same job function.

The CVM program was met with skepticism initially by nursing unit managers and staff. However, shortly after implementation, the value of the program became apparent and is now widely accepted. "Initially I was very skeptical and not at all a fan, but they (the cameras) have proved much more helpful than I anticipated. When (video monitoring) CNAs speak to the patients, we hear it and can go in before anything actually happens. Much like a bed alarm, it gives us an extra 60 second warning before a fall," stated a nurse manager. A CNA and VMT noted, "This has been a great way to enhance patient safety while maintaining privacy."

Figure 2.
CVM Video Monitoring Technician Work Log

Patient Label		Date: _____
		Room No: _____
		<input type="checkbox"/> Meets Sitter Criteria
		<input type="checkbox"/> Patient with Sitter
<input type="checkbox"/>	RN	_____ Fall
	CNA	_____ Forgetful
Report Time:		_____ Flight
	Dx	_____ Pulling lines
		_____ Seizures SMT initials

**Outcomes and Implications
For Future Practice**

The benefits of this program expanded beyond the original expectations. The program was originally implemented to increase patient safety, decrease falls, and prevent elopement. The benefits included increased patient satisfaction, decreased interruptions in therapy, added staff safety, and improved time to recognize seizures through limited

seizure monitoring. The VMTs keep a log of "Great Saves" to record informal feedback for reporting of improved outcomes as a result of VMT interventions (see Figure 3). The first 3 months of VMT interventions contributed to the prevention of 57 falls, seven oxygen therapy disruptions, and 10 IV catheter pulls. Additionally, the CVM program facilitated a faster transition of two patients from an in-room sitter to CVM, and subsequent placement to a

skilled nursing facility. Another of the benefits is the ability for the staff to have a "second pair of eyes," increasing both staff and patient safety.

Additional unintended benefits occurred related to staff safety. An informal survey of staff indicated the CVM program helped provide security to staff when working with more challenging patients. For example, a patient on a mental health hold was assigned a sitter and was additionally assigned to the video monitoring team. The VMTs noticed the patient fidgeting with his sock and notified the 1:1 sitter of the behavior. Upon further investigation, the patient was found to have a small weapon hidden in his sock. The patient became aggressive with the weapon with the intention to cause harm to staff. The VMTs notified the unit of the need for staff assistance and help arrived for the sitter without harm

**Figure 3.
Centralized Video Monitoring 'Great Saves'**

"Patient started to roll out of bed, monitor alert called, staff responded quickly. The patient did not fall."
"Patient having a grand-mal seizure, RN walked into room, pressed tracker (staff assist) – no response. We called the front desk to get extra staff to help. Sitter appointed to patient for remainder of shift with camera assist."
"Patient very agitated and restless not redirectable. Patient on edge of bed starting to stand. Monitor alert called, within 5 seconds staff in room to catch patient and help untangle patient from oxygen. Patient did not fall."

**Figure 4.
Denver Health Acute Care CNA Usage Results**

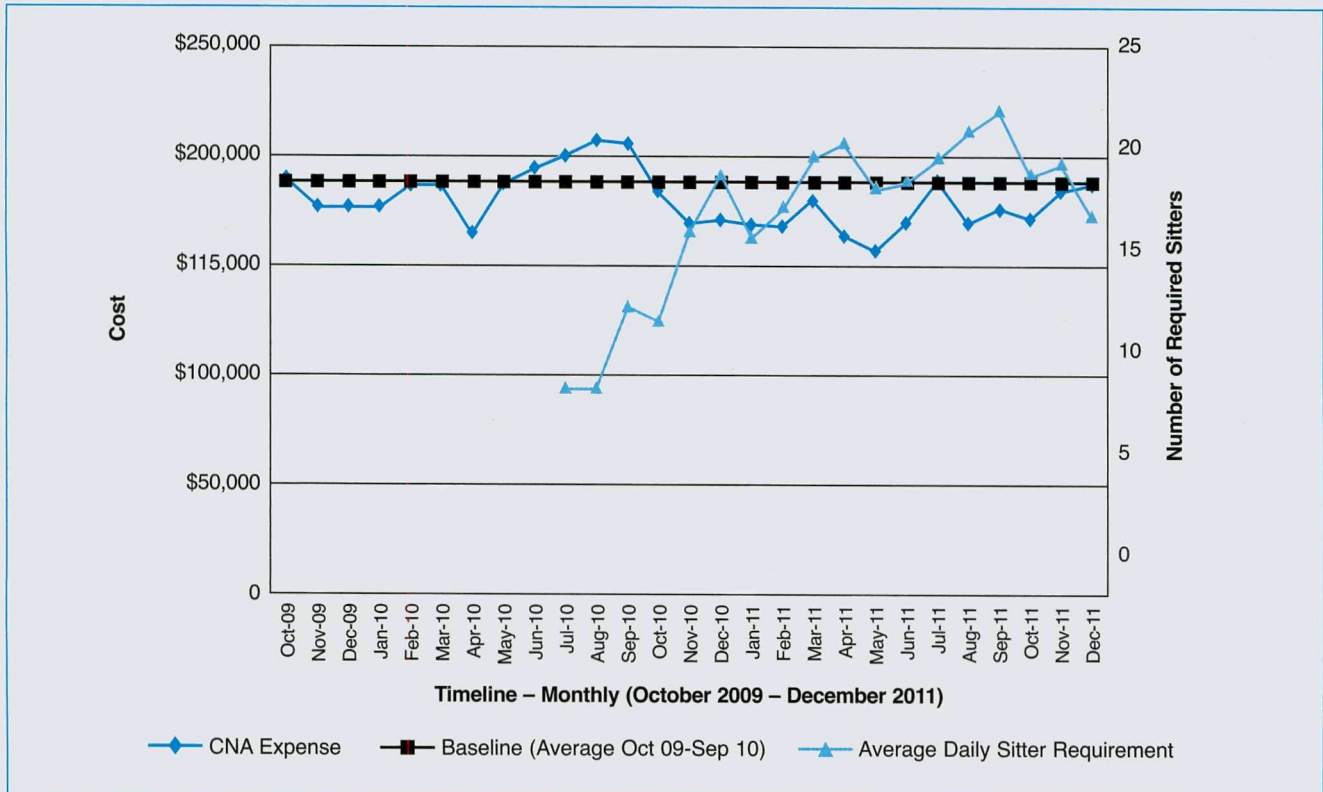
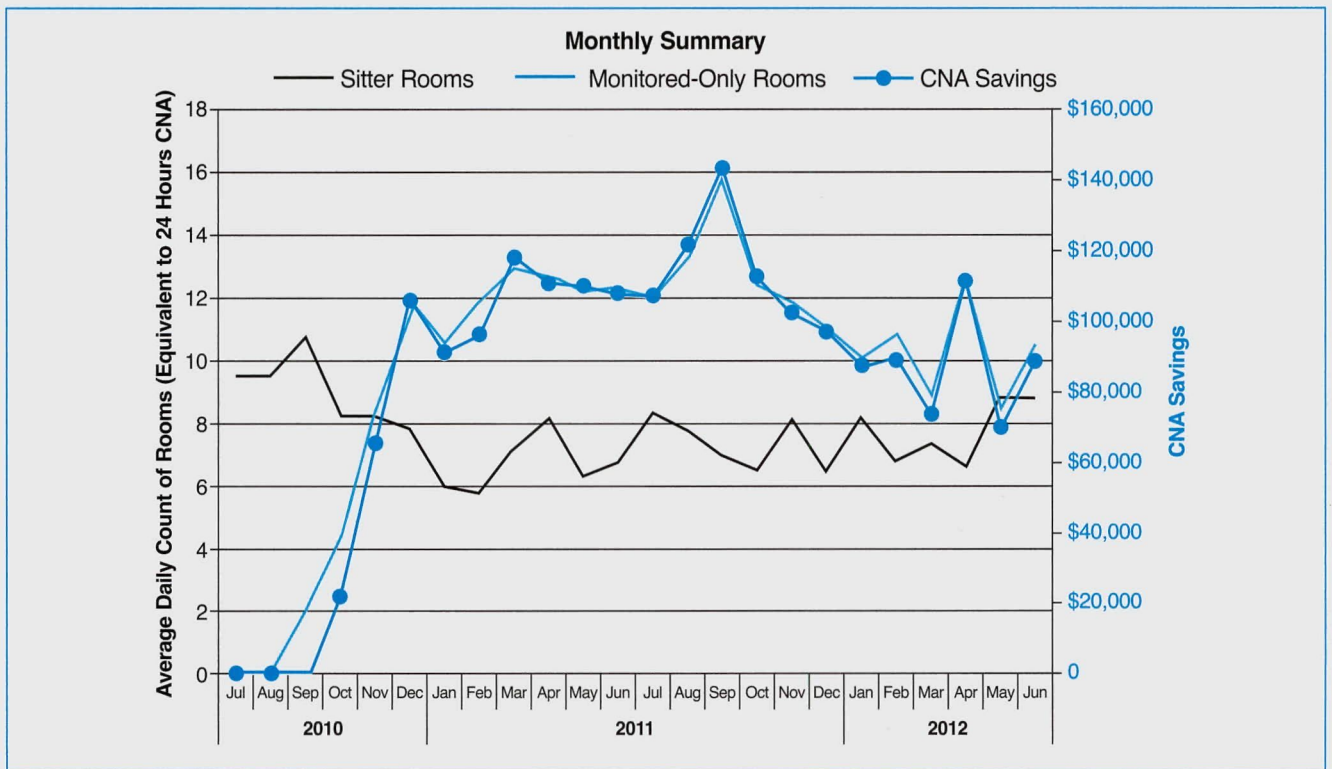


Figure 5.
Denver Health Centralized Video Monitoring Utilization (July 2010 - June 2012)



occurring to the staff or patient. The program has also assisted in timely identification of patient needs, such as the patient who needs assistance with meals, or a patient struggling to replace an oxygen cannula.

The CVM program had an immediate and significant impact to Denver Health's operations and mission of providing "Level One Care for All." Prior to implementing this program, conservative estimates of 1:1 sitter use were as high as 30 sitter patients per day (average of 11 - 1:1 sitter rooms/day). Of those, more than 50% of the sitters were a combination of regular DH CNA staff at \$14.51/hour and contracted agency CNA staff at \$23/hour. The CVM program goals included two primary "target state" metrics: (a) decrease 1:1 sitter observation by a minimum of 50% per day or six patients with 1:1 sitters per day, and (b) decrease hospital fall rates to

under National Database of Nursing Quality Indicators (NDNQI) benchmarks. The projected program return on investment, excluding the initial technology investments, was estimated at \$381,323.

Actual program performance has exceeded the initial projected benefits. Figure 4 shows actual CNA expenses in most periods were lower than baseline expenses even during periods of increased CNA usage. Within the first quarter of operation, the \$392,000 cumulative VMT deferred staff savings exceeded the original technology investment of \$305,000, passing the program breakeven point. As of June 2012, with just over a year and a half of operation, the CVM program has affected more than \$2.02 million in deferred cost savings (see Figure 5). The deferred savings are represented by the costs associated with "Monitored Only Rooms"

where a 1:1 sitter was replaced with CVM minus the cost of two VMT CNAs required to staff the CVM monitoring room. An average cost of \$14.51 per hour per CNA or \$696.46 per day was used in these deferred savings calculations. Future discussion will determine the feasibility of building monitoring costs into patient charges. Within the first 3 months of operation, 57 falls were prevented with a potential minimum savings of \$24,225. Following the first quarter of CVM implementation, acute care units experienced their highest percentage of NDNQI fall compliance since the program implementation, with 75% of the nursing units meeting or exceeding the benchmark mean for the second quarter 2011 (see Figure 6). This is the best performance in 2 years, and the overall trend for acute care falls per 1,000 patient days continues to decrease post implementation (see Figure 7).

Figure 6.
Denver Health Acute Care Performance Against National Benchmarks – Acute Care Falls

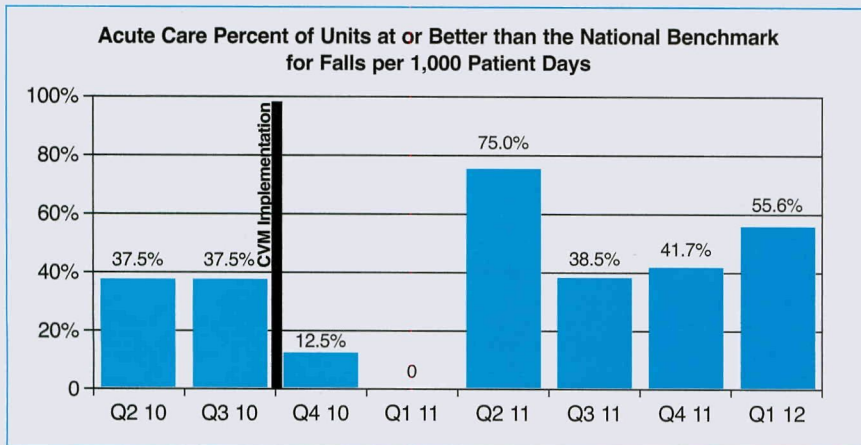
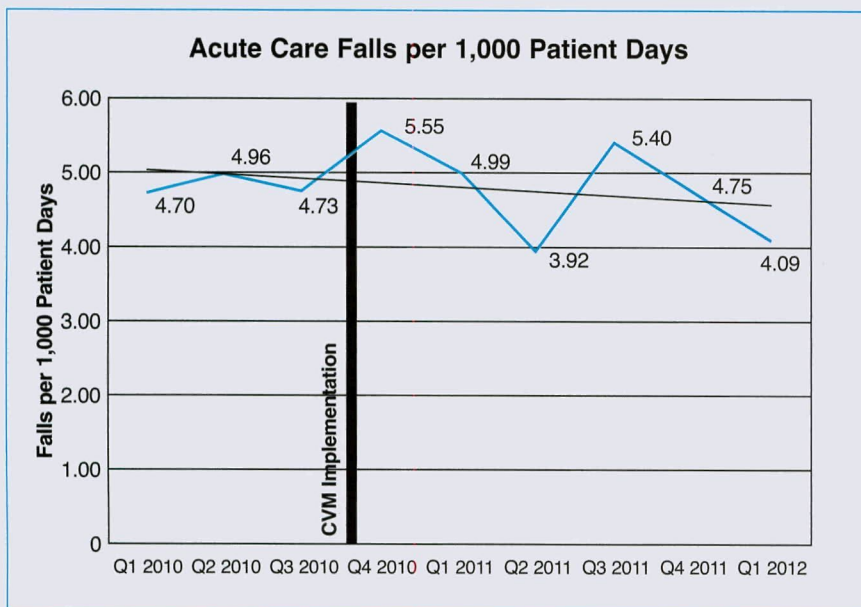


Figure 7.
Denver Health Acute Care Fall Trend (Q1 2012 - Q1 2012)



A secondary goal of the program was to reduce the number of patient elopements. The camera's view of the patient's bed and surrounding area is static, so at the onset of the program, it was discovered the patient who is at risk for elopement could move outside of the camera's range and not be attempting to elope. Consequently patients who are at risk for elopement but do not meet other quali-

fying criteria are no longer placed on video monitoring.

Nursing leaders continue to look for opportunities and learn from the CVM program as a fall cannot always be prevented even when a patient is on video monitoring. Some patients are impulsive, move quickly, and do not adhere to direction provided by the VMT staff. In these situations, VMTs immediately notify unit

staff who respond quickly to prevent patient fall or injury. Additionally, patients with communication challenges including language barriers and hearing loss could not be instructed and redirected utilizing the integrated nurse call system. These patients are monitored by an in-room sitter. The CVM program team continues to seek ways to expand CVM to this population.

The Denver Health Lean improvement story is rooted in the mission of serving all of the people of Denver, including disadvantaged and vulnerable populations. Additional resources are always needed to meet the demands for health care delivery. The fundamental improvement question for DH has always been, "How can more people be served with our limited resources?" The CVM program supports the high level of vigilance required by nursing staff to ensure patient safety and quality (Matsuo et al., 2008). The DH story is one of continuous growth and maturation while identifying and eliminating waste in the delivery of health care. The investment in the CVM Lean initiative has paid off for Denver Health and health care organizations are looking closely at operationalizing the successes at Denver Health. \$

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