USE OF BUSINESS PROCESS MANAGEMENT TECHNOLOGY
AND LEAN TO IMPROVE CARE

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BACKGROUND

Healthcare organizations are faced with increasing complexity of care, diminishing resources, and increased regulatory oversight. Providers are attempting to improve quality and efficiency while trying to decrease costs in an effort to maximize “value.” Many institutions are implementing new process improvement methodologies such as LEAN [2] and SIX SIGMA. In addition, with increased government incentives from the Health Information Technology for Economic and Clinical Health (HITECH) Act, technology is now considered a cornerstone for healthcare improvement. This creates additional challenges for the healthcare providers as they are the final arbitrator between new quality initiative programs and the rapid implementation of healthcare information technology (HIT).

RESEARCH PROBLEM

Denver Health (DH) has adopted an approach utilizing LEAN management tools with the innovative use of healthcare information technology (HIT) and Business Process Management (BPM) software to automate the process of care. Focusing on LEAN techniques for project implementation and BPM software to encode the process of care into an electronic health record, Denver Health sought to maximize the value of healthcare across many processes of care. BPM has been used successfully in many industries, but very rarely has been applied to healthcare. [3] The coupling of a new approach to quality improvement with a new type of HIT software created a “natural experiment” to see if healthcare could be improved with this intervention. Specifically, one process of care was addressed – the early identification of patients with deteriorating clinical conditions.

METHODOLOGY

The quality improvement methodology was focused on using LEAN management tools. LEAN is a systematic approach of continuous improvement used for the identification and elimination of waste to optimize the use of available resources. LEAN is based on the Toyota Production System of LEAN principles and LEAN tools. The program relies heavily on “standard work” where each team member is aware of and accountable for specific actions throughout the five phases of project implementation (planning; analysis and design; build and test; go live; and optimization (see Figure 1). Each phase has specific “milestones”, “check lists” and “sign-offs” to ensure standard work is followed.
The Rapid Response (RR) workflow was developed to support the reduction in patient morbidity and mortality through more efficient and early identification of clinical deterioration. In-hospital cardiac arrests account for approximately 500,000 cardiac arrests annually in the US, and there is a 60%-70% mortality rate regarding these cardiac arrests. A 30% delay in treatment has been shown with these cardiac arrests [4]. Research shows that a patient’s baseline condition begins to deteriorate 6.5 hours before an unexpected critical event or cardiac arrest [5].

The workflow surveys the EHR data and notifies nursing when clinical triggers are met.

It is important to catch these patients in the early stages of decompensation when vital signs begin to fall out of the normal range, and to treat them before a life threatening event or cardiac arrest occurs. The workflow continuously monitors all vital signs entered into the system, sending an alert to the nurse for vital signs out of range (see Figure 2). The workflow monitors for values entered exceeding the predefined range: respiratory rate less than 8 or greater than 28, systolic blood pressure less than 90, diastolic blood pressure greater than 110, temperature greater than 39.0 Celsius, heart rate less than 50 or greater than 120, and oxygen saturation less than 90%. The nurse then documents if an RR escalation was initiated.
RESULTS

Since the implementation of the RR workflow, there has been a 40% increase in the number of RR calls initiated, indicating that a more automated process can lead to increased identification of these patients. After implementation, the average number of rapid response calls per month was 91 (see Graph 1). Pre Live vital signs were monitored for 6 months. In total, there were 6244 episodes (more than 34 per day in Acute Care). Most of these alerts were for decreased systolic blood pressure (3207 episodes) or increased heart rate (1346). These findings continued after the implementation of the RR workflow (see Graph 2). When comparing the data from prior to implementation to post implementation, the rate for Non-ICU COR Zeros per 1000 Census Days continued trending down after the RR workflow implementation (see Graph 3). Coupling LEAN techniques with the implementation of advanced HIT has the potential to provide significant improvements in the quality of care. Although the results are preliminary, coupling LEAN techniques with the implementation of advanced HIT has the potential to provide significant improvements in the quality of care.
Graph 1

Adult Rapid Response Calls

Graph 2

Rapid Response Workflow Alert by Trigger Reason - 2011
CONCLUSIONS

Multiple lessons were learned during this project; 1), LEAN works in healthcare to improve quality while not increasing costs, 2) frontline staff can best identify and eliminate waste, and 3) LEAN facilitates culture change by empowering employees to implement change and own the process. DH has been able to address some of the new challenges in healthcare to create improved value (increased benefits related to cost) in the process of care delivery. With the use of LEAN quality improvement techniques and BPM software, care process improvements are implemented in a more standardized and timely manner with full integration into the electronic health record, and are well integrated into the workflow of the busy healthcare providers.

REFERENCES

Dr. Andrew Steele is an Internist and Director of Medical Informatics at Denver Health, a large integrated public safety net organization. He oversees the clinical system selection, design, and implementation activities. He received his B.A from Stanford University, his M.D. from Yale University, and his M.P.H. from the Harvard School of Public Health. He also received a Masters in Medical Informatics degree from the Royal College of Surgeons of Edinburgh in the UK. He has been working in the medical informatics field for the last twelve years with an emphasis on cost-effective utilization of computer technology in the clinical arena.

Deborah Scherger, RN, MS is the Health Informatics Supervisor of the Workflow/Rules Engine team at Denver Health eHealth Services. Previously she worked at the Rocky Mountain Poison and Drug Center, a division of Denver Health, in a variety of roles including clinician managing poison emergency calls, project manager, medical call center manager, and technology manager. In 2002, she received her Masters of Science in Nursing Informatics from the University of Colorado Health Sciences Center. She participated in the first Denver Health Lean Black Belt training in 2005 and is a Denver Health Lean “Master Black Belt”.

Melissa Anderson recently graduated from the University of Colorado at Denver School of Nursing with a Masters of Science in Health Care Informatics. She completed a six month internship at Denver Health eHealth Services in December 2011. Previously she worked at Presbyterian/St. Luke’s Medical Center in Denver, CO in the Float Pool and Bone Marrow Transplant units and at the Virginia Commonwealth University Health System in Richmond, Virginia in the Pediatric Intensive Care and Clinical Transplant units.