2014 Gage Awards

Reference #	7492400
Status	Complete
Name of hospital or health system	UC Davis Medical Center
Name of project	Enhancing the Quality and Safety of Insulin Therapy
CEO name	Ann Madden Rice
CEO approval	Check here to confirm that your CEO approves of this project being submitted for a 2014 Gage Award
Submitter name (first and last)	Khanh-Nhat Tran-Viet
Submitter title	Administrative Fellow
Submitter email	khanh-nhat.tran-viet@ucdmc.ucdavis.edu
Submitter phone	916-734-5043
Project contact person's name (First and Last)	Patricia Parker
Project contact title	Assistant Chief/Clinical Coordinator/Pharmacy Practice Residency Director
Project contact email	patricia.parker@ucdmc.ucdavis.edu
Project contact phone	916-816-5333
Within which of the two categories does your application best align?	Quality

1. Provide a brief description of the project. (This section should resemble an abstract for a poster presentation or an abstract for a peer reviewed journal. Include an objective, data sources, study design, findings, and conclusions.)	Hyperglycemia is a ubiquitous problem in hospitalized patients that is associated with an increase in clinical complications, length of stay (LOS), mortality, and cost. Continuous infusion insulin therapy (CIIT) is a high-risk intervention due to the consequent probability and impact of further dysglycemia—hypoglycemia and glycemic variability. Glycemic control in the hospital setting is fraught with controversy following a large, multi-center randomized controlled trial that challenged the safety and efficacy of tight glycemic control (TGC). No definitive logistical process exists for safely and effectively delivering CIIT; therefore, institutions deliver CIIT with nominal guidance. The unifying objective was to improve dysglycemia through development and implementation of novel CIIT protocols throughout the hospital. Methods: Multidisciplinary task forces systematically developed, piloted, implemented, and validated CIIT protocols for the spectrum of hospitalized patients including those with critical illness and diabetic ketoacidosis/hyperosmolar hyperglycemia state (DKA/HHS). The principal intervention for each initiative was a comprehensive change in protocolized management of dysglycemia. Each protocol was investigated through pre-post study design with robust clinical endpoints to establish safety and efficacy, including dysglycemia, clinical complications, and LOS. Data was collected from the electronic medical record and included demographics, insulin use, and blood glucose levels (BG). Descriptive statistics and regression analysis were conducted to describe the impact. Findings: Critically Ill Patients A total of 555 patients were identified for the pre- (n=454) and post-intervention (n=101) that received CIIT for hyperglycemia. Liberated glycemic control (LGC) dramatically reduced the prevalence of hypoglycemia and severe hypoglycemia, 53% vs 11% ($p<0.0001$) and 9% vs 0% ($p=0.0004$) respectively. The LGC cohort experienced a statistically significant reduction in ICU LOS (15.7 ± 22.5 7.3 ± 9.9 days, $p<0.05$), hospital LOS (20.8 ± 24.9 vs 13.2 ± 12.4 days, $p<0.05$), and duration of mechanical ventilation (10.2 ± 16.9 vs 2.4 ± 7.9 days, $p<0.05$). Rescue Dextrose (D50W) A subgroup of 129 patients experienced 470 hypoglycemic events and received D50W within this cohort. A mean dose-adjusted BG response of 4 – 5 mg/dL/g of D50W was consistently observed in a heterogeneous, critically ill population. Acutely Ill Patients There were 84 patients identified for matched cohorts of pre- (n=42) and post-intervention (n=42) phases. The rate of hypoglycemia was dramatically reduced from 35% to 14% ($p<0.0001$).

	DKA/HHS A total of 209 patients were identified for the pre- (n=100) and post-intervention (n=109) that received CIIT for DKA/HHS. The conservative-correction protocol overwhelmingly reduced the rate of hypoglycemia (34% vs 0.9%, p=0.0003), glycemic variability, and hospital LOS (6.6 vs 5.6 days, p=0.29). Conclusions: Innovative processes to safely and effectively deliver CIIT were successfully designed, piloted, implemented and validated. The effects of the intervention in scope and impact—for a large high-risk population on key clinical outcomes—appear to be substantial.
Do you have an optional relevant attachment to add?	Yes
1A. Attachment, if applicable (Applicable examples include a peer reviewed journal article, other content published in the literature, or a presentation at a national meeting)	GAGEapplicationattachments.pdf (7386k)

2. Describe the methods use in this project. Include where, why, and how the project was accomplished.	The University of California, Davis Medical Center (UCDMC) is a 619-bed, academic medical center that provides patient care services for 33 of the 58 counties in California. Hyperglycemia is a common complication of acute illness; continuous infusion insulin therapy (CIIT) is often associated with significant adverse events. Multidisciplinary task forces—pharmacists, nurses, physicians, administrative leaders, and information technology analysts (IT)—were assembled with the unifying objective of improving dysglycemia throughout the hospital. The shared goals were to develop, pilot, implement, and validate novel CIIT protocols that safely and effectively •Integrated evidence-based glycemic control •Supported nurse-driven bedside management •Provided wide safety thresholds and risk-mitigation strategies •Fused intuitive parallel design features •Consolidated dysglycemia management across the continuum of care An innovative approach to multidisciplinary teamwork modeled: •Continuous collaborationof multiple departments and disciplines •Multi-faceted educational outreach via web-based training modules, peer-to-peer coaching, and just-in-time adaptive intervention •Real-time decision support via the electronic medical record and cross-disciplinaryconsultation and oversight Critically Ill Patients An investigator-initiated, pre-post study was conducted on all patients that received CIIT for the respective periods. The pre-intervention cohort (August 2008 – August 2009) received tight glycemic control (TGC) to target blood glucose (BG) of 70 – 120 mg/dL. The post-intervention cohort (04/2011 - 07/2011) received liberated glycemic control (LGC) to target BG of 111 – 150 mg/dL through a novel protocol. The primary objective was prevalence of hypoglycemia. Secondary objectives included time in therapeutic range, ICU and hospital LOS, duration of MV, and 30-day mortality. Data collection included demographics, insulin use, and BG values. Descriptive statistics, student's t-test, and Chi-square tests were used for data analysis. Rescue Dextrose (D50W): A retrospective, cohort study was conducted to determine the optimal D50W dose for correction of hypoglycemia in critically ill patients. All patients that received CIIT and D50W for the study period (August 2008 to August 2009) were included. Descriptive tests and regression analysis were used for the statistics. Acutely Ill Patients: A matched-cohort, pre-post study was conducted for patients that received CIIT for acutely ill patients with hyperglycemia. The pre-intervention cohort received TGC to target BG of 70 – 120 mg/dL. The principal intervention was expansionof the LGC protocol (target BG: 111 – 150 mg/dL) to non-ICU patients. The primary objective was prevalence of hypoglycemia. DKA/HHS: An investigator-initiated, retrospective pre-post

	study was conducted on all patients admitted for DKA/HHS. The pre-intervention cohort (October 2010 – October 2012) received CIIT to achieve rapid reversal of hyperglycemia and gap closure. The post-intervention cohort (March 2013 – November 2013) received CIIT via a novel, conservative-correction protocol. The primary objective was prevalence of hypoglycemia. Secondary objectives included time to gap closure, glycemic variability, and ICU and hospital LOS. Descriptive tests and regression analysis were used for the statistics.

3. Describe the results of the project. What data was used to support improvement results?	Hyperglycemia Management for Critically Ill Patients In the baseline assessment phase (August 2008 – August 2009), 454 ICU patients received CIIT for tight glycemic control (TGC). Hypoglycemia (BG < 70 mg/dL) was experienced by 53% of patients in this cohort with 9% of patients categorized as severe hypoglycemia (BG < 40 mg/dL). An average of 3 hypoglycemic episodes was experienced per patient. A new liberated glycemic control (LGC) protocol was then developed. In the validation phase (April 2011 – July 2011), use of the LGC protocol dramatically reduced the rates of hypoglycemia and severe hypoglycemia—11% vs 53% ($p<0.0001$) and 0% vs 9% ($p=0.0004$)—compared to the TGC protocol [Figure 1]. The LGC group also experienced a statistically significant reduction in ICU LOS, hospital LOS, and duration of mechanical ventilation [Figure 2]. Hyperglycemia Management for Acutely Ill Patients A matched case-control study was conducted to compare non-ICU patients managed with the TGC protocol (target BG 70-120 mg/dL) versus those managed with the LGC protocol (target BG 111-150 mg/dL). In the validation phase, use of the LGC protocol reduced the occurrence of hypoglycemia 14% vs 35% ($p<0.0001$) compared to the TGC protocol [Figure 3]. The incidence rate ration (IRR) was 0.28 (98% CI, 0.12-0.58), which represents the chance of having a positive outcome as a patient on the LGC protocol, when compared to a patient on the TGC protocol. Rescue Dextrose A retrospective cohort study was conducted on 129 critically ill patients who received rescue dextrose for BG < 70 mg/dL while on an insulin infusion. There were 470 hypoglycemic events requiring D50W correction within this cohort. The mean change in BG was 4.7 mg/dL ± 3.3 mg/dL per gram of dextrose. Subgroup analysis showed a mean change of 5.1, 4.6, 4.6 and 3 mg/dL for 7.5, 10, 12.5, and 25 g, respectively. Univariate logistic regression analysis showed the dose-adjusted change in BG decreased with increasing dextrose dose ($p < 0.001$). Following a hypoglycemic event, a BG change of 4-5 mg/dL per gram of D50W can be predicted based on our results. These findings directed a change in D50W dosing for hypoglycemia. DKA/HHS A retrospective cohort study was conducted on all patients admitted with a diagnosis of DKA/HHS (September 2011 – November 2013). In the baseline assessment phase, 100 patients received CIIT for DKA/HHS. Hypoglycemia was experienced by 34% of patients in this group with an average of 1.7 hypoglycemic episodes per patient. A conservative-correction protocol was then developed, piloted, and implemented. In the subsequent validation phase, the conservative-correction protocol (n=109) overwhelmingly decreased the rate of hypoglycemia from 34% to 0.9% ($p=0.0003$) [Figure 4]. Glycemic variability, as measured by glucose standard deviation, was also substantially reduced (40.36 units, $p<0.0001$).

Do you have an optional relevant attachment to add?	Yes
3A. Attachment, if applicable (Only graphically displayed data such as charts will be accepted. Data should include baseline and improvement data)	GAGEawardapplication-tablesfigures.docx (457k)
4. Describe what happened as a result of the project. Was the improvement related to the intervention? Can the project be duplicated by other organizations?	Impact on Patient Care •Dramatically reduced prevalence of hyperglycemia and rate of dysglycemia throughout the hospital •Improved clinical outcomes for a broad population of patients receiving a high-risk medication •Discovered and incorporated escalating strategy for rescue dextrose that decreased glycemic variability •Disseminated novel strategies for continuous insulin infusion therapy (CIIT) to institutional, regional, national, and international multidisciplinary audiences in the form of poster and podium presentations. (Further publication of these findings is anticipated.) Impact on Quality Improvement Process •Dissolved silos between departments and disciplines •Formed important partnerships that sustained further collaboration to improve patient care •Developed innovative multi-tiered educational methods that culminated in demonstrably advanced competencyby the bedside nurse •Leveraged technology to support policies and protocols with electronic order sets, customized calculators, and bedside decision support •Elevated expectations for initiative implementation such that outcomes-based research validates and drives further quality improvement •Standardized delivery of CIIT, e.g. concentration, volume
5. Describe how patients, families, and if appropriate, community was included in the work.	Patient and Family Involvement Patients and families were informed and educated of the goals continuous insulin infusion therapy (CIIT). Nurses counseled and educated patients at every point of intervention. Clinicians provided patients with diabetes with brief interventions to promote awareness of the importance of glycemic control and concordance with therapy. The benefits of glycemic control were explained to patients in clinical and practical terms. Patients and families were routinely encouraged to engage and participate in their care. Pharmacists, discharge planners, and physicians cooperated to solve medication accessibility challenges. Professional Community Involvement The findings of these initiatives and studies were disseminated in abstract, oral, and poster form at numerous regional, national, international conferences (see accompanying attachments). Regulatory agencies referred and directed other institutions to the protocols for CIIT developed at our institution.
Do you have an optional relevant attachment to add?	Yes

5A. Attachment, if applicable (Applicable attachments include documents created for patients, families, or community members or by them as a result of the project)	
Last Update	2013-12-16 16:58:51
Start Time	2013-12-16 03:50:26
Finish Time	2013-12-16 04:02:20
IP	67.172.191.6
Browser	Chrome
OS	Windows
Referrer	http://www.naph.org/Main-Menu-Category/About-NAPH/Gage-Safety-Net-Awards/2014-Gage-Awards.aspx