

**Appendix 1** to Moloo H, Brooke R, Sundaresan S, et al. Enabling front line–driven perioperative quality improvement through organizational infrastructure built around the Comprehensive Unit Based Safety Program. *Can J Surg* 2016.

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## **Introduction**

“A system produces the results it is designed to produce” is a quote that has been attributed to Don Berwick. Infrastructure as well as process are important in creating a sustainable quality improvement program. Through participation in the National Surgical Quality Improvement Program (NSQIP) (1,2), The Ottawa Hospital determined that the surgical site infection (SSI) rate across the Department of Surgery required improvement.

There was an initial attempt to improve this with a ‘top down’ approach with minimal front line engagement and for 3 years there was no significant change. The CUSP process has been well described in specific units (3-9). It includes elements such as examining and learning from defects based on front line provider input. Tools for improvement are implemented by front line providers, including measures to improve teamwork and communication. CUSP differs from the Model for Improvement in its focus on locally-identified solutions and frontline engagement. CUSP differs from LEAN in its equal attention to technical and adaptive changes, or improvement of both clinical and interpersonal processes.

We planned to adopt CUSP across our entire Department of Surgery and, to our knowledge, there is a paucity of surgical literature describing an effective infrastructure to support multiple teams within a department. We anticipated there would be multiple challenges.

Mechanisms would be needed to address:

1. Proposed interventions that would overlap between CUSP teams
2. Proposed interventions that would require departmental implementation across all surgical divisions
3. A forum for CUSP teams to share their successes/challenges and new ideas
4. Ideas which would not be feasible to implement from a logistical or financial perspective
5. Ensure that the vision on these multiple teams aligned with the hospital vision

This paper aims to explain 1) a flexible multi-level infrastructure which has enabled effective, efficient change at our hospital 2) the challenges and lessons learned in implementing multiple CUSP teams across multiple hospital campuses engaging a large number of front line providers and 3) an important change we made to the traditional CUSP composition (addition of a Quality Improvement Coordinator to each team) which we feel improves team efficiency and expedites change.

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## **METHODS:**

Setting: Three-site, 1149 bed, tertiary academic care center with a trauma center. The three sites include two inpatient tertiary campuses and one outpatient campus.

### *1. Description of infrastructure Evolution:*

To provide vision and act as a steering group for implementations, a CUSP Executive Committee was formed. This team has been involved with planning the education of the frontline, organizing interdisciplinary grand rounds, and staging/approving the implementation of additional Divisional CUSP teams to ensure a coordinated, organized approach.

Initially, three Divisional CUSP teams were piloted and the CUSP five-step methodology was followed. The first step involved training the staff in the principles of patient safety and was achieved by watching the ‘Science of Safety’ video.<sup>(4)</sup> The second step was to engage staff to identify defects through a two question Patient Safety Culture survey (1.How will the next patient be harmed? 2. What can be done to prevent this harm?).<sup>(4)</sup> General Surgery, Vascular Surgery and Orthopedic Spine at one campus were chosen to begin CUSP implementation in order to identify logistical issues and determine the type of supports required.

The third CUSP step is the creation of safety rounds.<sup>(4)</sup> In our project, the CUSP kickoff began with a combined surgery, anesthesia and nursing Grand Rounds that included presentations from the Johns Hopkins Colorectal CUSP team and Dr. Clifford Ko, NSQIP Director. Each of our 3 inaugural CUSP teams met with this group to obtain feedback on their quality improvement plans. Subsequently we have had three other multidisciplinary rounds on Patient Positioning, Culture Survey Debrief, and In Situ Simulation for Team Communication.

The fourth step is to continue to learn from defects. This allows teams to choose certain problems and investigate contributing factors. Initial CUSP team meetings identified several commonalities which could be more effectively addressed at a corporate level.

From these commonalities three Corporate CUSP teams were created: Wound management, Patient Warming and Perioperative Antibiotics. Additionally, when the scale of implementation increased, we found it necessary to meet regularly with senior management to facilitate logistical aspects of executing the changes suggested by the CUSP teams – therefore the Perioperative CUSP Implementation group was created.

The Ottawa Hospital Model deviated from the typical CUSP framework with the addition of quality improvement coordinators to support both divisional and corporate CUSP teams. They also are involved in all the levels of our infrastructure.

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## 2. Infrastructure Description

### a. Overview

There are five domains in the infrastructure: The CUSP Executive Committee, The CUSP Advisory Committee, The Corporate CUSP teams, Divisional CUSP teams, and the Perioperative CUSP Implementation Group.

The CUSP Executive Committee essentially is a steering committee to ensure that efforts throughout the hospital are coordinated. The Divisional CUSP teams are the ‘engine’ of change in our organization and where ideas for improvement are generated. The Advisory Committee is a forum where the CUSP team leads meet monthly to share progress and ideas. The Corporate CUSP teams were created based on similar goals identified at the Advisory Committee meetings and address goals that transcend divisions so that common issues are identified at a departmental level. The perioperative CUSP implementation group was found to be required for ideas that required new equipment, standards, and other operational improvements. This group ensures that ideas are logistically possible.

### b. Infrastructure Details:

- CUSP Executive Committee: NSQIP Surgeon Champion, Chair
  - Mandate: To provide vision and coordination of CUSP initiatives. Additionally, to facilitate support from senior hospital executives to expedite changes and ensure the department and hospital visions remain aligned.
  - ii) Membership: Department of Surgery Chair, NSQIP Surgeon Champion, NSQIP General Surgery Surgeon Champion, Senior Vice President of Medical Affairs, Quality, and Performance, Senior Vice President of Clinical Programs/Perioperative Services, Quality Improvement Coordinators.
  
- CUSP Advisory Committee: NSQIP Surgeon Champion, Chair
  - Mandate: To provide sharing of ideas, initiatives and progress updates on a monthly basis among the different CUSP teams. Identification of common themes that are best dealt with by a corporate CUSP team. Through periodic presentations at Advisory Committee meetings, divisional teams are held accountable on their progress.
  - Membership: Leadership from each CUSP team (follows dyad model with a surgeon and nurse champion), executive sponsors for each CUSP team, NSQIP Surgeon Champion, Quality Improvement Coordinators, Chief Quality and Performance Officer.

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- Corporate CUSP teams
  - Mandate: Using CUSP methodology, provide solutions to problems that affect the entire Department of Surgery. These include the Perioperative Antibiotic Working Group, the Perioperative Patient Warming Working Group, the Wound Management Working Group and the Blood Glucose Working Group.
  - Membership: Multidisciplinary team with executive sponsor.
  
- Divisional CUSP teams: Surgeon Lead and Nursing Lead, Co-Chairs
  - Mandate: Improve quality of care by utilizing input of frontline providers through CUSP methodology (i.e. 2 question survey).
  - Membership: Multidisciplinary team including frontline providers with an executive sponsor. Importantly, our membership deviates from the traditional CUSP team infrastructure with a dedicated Quality Improvement Coordinator on each team.
  
- Perioperative Implementation Group: Perioperative Services Director, Chair
  - Mandate: Support implementation of CUSP initiatives
  - Membership: Surgeon Champion, Perioperative management, Quality Improvement Coordinators

## **Timeline**

August 2012: Medical Affairs funds surgeons to attend NSQIP Annual Conference. CUSP workshop attended by frontline surgeons, members of hospital administration and Chief of Surgery.

October 2012: CUSP approved by corporate perioperative administration

November 2012 – January 2013: CUSP educational sessions with surgical inpatient ward nurses and OR personnel. CUSP Executive Committee (Table 1) formed to provide vision for implementation.

January 2013 – March 2013: Initial CUSP teams selected in Colorectal, Vascular, and Spine Surgery at one inpatient campus.

March 2013: CUSP inaugural meeting (“kickoff”): Interdisciplinary CUSP Rounds featuring presentations from The Johns Hopkins Hospital Colorectal CUSP Team and the NSQIP Director.

March 2013: First meeting of the CUSP Advisory Committee.

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May 2013: Initial hospital-wide (Corporate) CUSP teams formed in Antibiotic Prophylaxis, Patient Warming, and Wound Management

September 2013: CUSP initiatives commence

November 2013: Local CUSP Training Day offered to all perioperative staff (i.e. residents, Senior executives, housekeeping, nurses, physiotherapy, surgeons, anesthesiologists) - 200 participants.

January 2014: Additional CUSP teams added after approval by CUSP Executive Committee.

February 2014: Introduction of teamwork and communication concepts at Interdisciplinary Surgery Rounds (First time that 'teamwork' as a concept discussed at interdisciplinary grand rounds)

June 2014 – August 2014: Increased focus on auditing of interventions and process measures.

## **Results**

The project has resulted in a high level of support from frontline providers who are participating: 177 individuals are involved with CUSP teams. There are 15 CUSP teams (Table 1) which include members representing surgery, anesthesiology, residents, nursing, management, infection control, housekeeping, sterile processing, transportation (porters), pharmacy, occupational therapy, physiotherapy, social work, ward clerks, clinical experts, and facilities/engineering.

The CUSP two-question survey returned 305 responses ( 30 % response rate). Based on the results of these surveys, CUSP teams selected interventions. To date, 47 interventions have been tested and evaluated using Plan-Do-Study-Act (PDSA) cycles to audit whether they are effective and should be continued (Table 2).

*Description of Interventions- The following interventions illustrate the breadth of change seen over the past year*

### 1) Peri-operative Patient Warming

Heated operating room tables were introduced and the ambient room temperature was increased to 21.5° C +/- 1° C.

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Pre warming was introduced for all patients with a case time over two hours which includes warming blankets placed on patients in the Preadmission Unit and kept on patients as they wait outside the operating room.

#### 2) Antibiotic Prophylaxis (Figures 1 and 2)

Best practice guidelines for antibiotic re-dosing were promoted. Manual timers were introduced to improve antibiotic re-dosing in surgical cases over four hours.

This has now evolved into a timer that has been integrated into the anesthesia electronic medical record system.

#### 3) Wound Management

In the operating room, new antimicrobial dressings were introduced. For both OR patients and inpatients on the General and Vascular Surgery floors, a new protocol for wound management was initiated. The SSI rate (which was the main impetus to initiate this project) initially showed significant improvement but has now returned to baseline (Figure 3). In specific areas, such as the bariatric surgery program we have seen a sustained decrease in SSI, but the overall rate remains unchanged across the department.

#### 4) Environmental Sterility

Improvements were made by installing automatic scrub dispensers, prominent display of posters demonstrating appropriate attire, creating a protocol for enhanced cleaning of the anesthesia workstation, review of OR housekeeping protocols, delaying the opening of irrigation solution, using a sterile towel to cover open irrigation solution, double gloving by scrub nurses, and re-gloving and regowning prior to closing in colorectal cases.

#### 5) Blood Glucose Management

The Canadian Diabetes Risk Questionnaire (CANRISK) questionnaire is used to screen patients pre-operatively for pre-diabetes or type 2 diabetes and HA1c testing is performed for diabetics and high-risk non-diabetics. During the surgical procedures there is glucose monitoring and nurses alert the anesthesiologist if glucose levels become elevated. At a corporate level, there has been creation of the peri-operative blood glucose working group.

#### 6) Surgical Instruments

Efforts have been made to reduce the number of instruments required for a specific OR case and to improve the cleaning of instruments in the OR after their use. Surgical staff also view the video titled “Day in the life of surgical instrument” that was created by one of the Divisional CUSP teams to better understand the necessity of cleaning surgical instruments immediately after use.

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#### 7) Fall Risk

Patients at risk for fall have an alert sign at the bedside and nurses use a Bedside Shift Report to communicate about the patient’s fall risk. There has been improvement in the use of a post-operative fall risk assessment.

#### 8) Communication

The use of Nursing/Resident log sheets has been improved to capture non urgent matters. A consistent Nursing/Resident designated meeting time has been arranged – this has been done on the General Surgery floors. The Surgical Safety Checklist has been revised and its optimal use has been audited. The number of pages residents receive is audited and efforts such as defined surgeon-nurse ward meeting times have been introduced to decrease the number of resident pages.

#### 9) Supply Chain Improvements (Lean process)

Audits were performed for consolidation in the warehouse. There have been improvements on reporting of discrepancies in orders as well as a review of core carts to reduce the number of supplies and improve sterility. A standard process for introducing new supplies into inventory has been initiated.

#### 10) NSQIP data quality

New wound classification guidelines have been developed and applied in order that there is more accurate data that frontline providers input from the operating room.

### **Discussion:**

The Ottawa Hospital Model has created an environment where CUSP projects are enabled by providing a flexible framework; in doing this a large number of front line providers have become engaged in quality improvement. This ensures that lessons learned are shared and overarching themes are not dealt with repeatedly by individual teams but rather are introduced with a broader approach (through CUSP Executive

Committee and Corporate CUSP Working Groups). Lessons learned and implementation barriers faced by teams are shared through monthly CUSP Advisory Committee meetings. At the core of all the change initiatives are the divisional CUSP teams that have engaged frontline providers informed by timely NSQIP performance data that is shared widely.

The following factors have been critical to the successful implementation of our infrastructure which has led to improved compliance with best practices. Although the SSI rate has not decreased significantly, with our front line engagement and sustainable infrastructure, we are optimistic that the SSI rate will improve significantly. We now have teams in place that continue to gain more experience with quality improvement and have ongoing interventions

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and new ideas in the process of being implemented on a consistent basis. This is a radical change from what occurred prior to the implementation of CUSP.

1) Senior leadership involvement and approval: There has been a high level of support for this initiative from the Chief of Surgery and senior Vice-Presidents. Within a relatively short space of time, much has been accomplished through the coordinated efforts of surgeons, anesthesiologists, nurses and administrators. A strong partnership between physicians, nurses, and administrators has resulted in marked change that has occurred at a rapid pace.

2) Mentorship and collaboration: There has been consultation with a more experienced center and cooperation with various hospitals initiating CUSP projects. The Johns Hopkins group has been an effective mentor for our CUSP initiatives. Additionally ACS NSQIP arranges monthly teleconferences involving hospitals that have started CUSP teams.

3) Frontline engagement: There was a significant investment of resources in the education of residents, nurses, and administration with respect to what CUSP entailed and the support that would be required. Implementation of this initiative, without educating frontline personnel would have likely led to a suboptimal outcome.

The changes implemented have all resulted from the 2-question survey permitting the frontline to have ‘ownership’ of this process. Because of this widespread engagement there has been momentum and change – starting with small projects for ‘quick wins’ was important for the frontline to see that progress was being made.

4) Surgeon ownership: The CUSP quality improvement initiative was initiated by surgeons. Education of surgeons on the fundamentals of Quality Improvement was a key component of this initiative. Surgeons are actively involved in all dimensions of this project. Frontline surgeon involvement has been crucial. Involving good surgeon leaders at the inception of the project was fundamental for early success..

5) Quality Improvement Coordinators: The principles of Lean Methodology, PDSA cycles and other improvement tools and methodologies are often foreign to many members of the health care team. Our Quality Improvement Coordinators have been essential to ensure these important aspects of quality improvement and project management occur alongside the CUSP steps; they maintain team member accountability to agreed-upon actions that are specifically designated to individuals. Review of these “action items” is usually the first agenda item at a CUSP meeting. Two Quality Improvement coordinators have been dedicated to the surgical CUSP initiative. A Quality Improvement Coordinator works with each CUSP team and ensures that the CUSP teams follow quality improvement principles.

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This investment by the hospital has been essential for success and reflects the support of the hospital administration – this support was given at the inception of the project.

The inclusion of Quality Improvement Coordinators may seem like a minor deviation from the typical CUSP team, but we feel that this has been a major reason for our success. We recommend that all CUSP teams include a Quality Improvement representative when feasible.

Conclusion:

The infrastructure that has been created has been valuable for aligning the Department of Surgery quality improvement initiatives with the strategic direction of The Ottawa Hospital. Senior executive engagement has created a synergistic relationship between administration and frontline healthcare providers. Development of multiple CUSP teams has not been a barrier to progress. In fact, multiple teams have facilitated initiatives otherwise thought not possible. In some cases, CUSP teams have provided realistic insight into ideas that may not be functionally sustainable solutions. We include Quality Improvement.

Coordinators on all our CUSP teams and recommends that other institutions include them within their CUSP team membership if feasible. A solid infrastructure has been key to our success. This has allowed us to create many CUSP teams within a short time frame and enabled multiple front line driven quality improvement changes that have resulted in improved patient care with greater staff engagement.

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Table S1. List of different CUSP teams (Corporate teams shaded)	
Service/Area	Campus
Operating Room (OR)	Civic
Per-operative Areas	Riverside
Vascular Surgery	Civic
Orthopedic Surgery	Civic
General Surgery (OR)	Civic/General
General Surgery B2 (Floor)	Civic
General Surgery 7E (Floor)	General
General Surgery (Bariatrics)	Civic/General
General Surgery (HPB)	Civic/General
General Surgery (B2/7E Communications)	Civic/General
Neurosurgery	Civic
Gynecology	All campuses
Otolaryngology – Head and Neck Surgery	General
Urology	Civic/General
Pre and Intra Operative Patient Warning Working Group	All Campuses
Wound Management Working Group	All Campuses

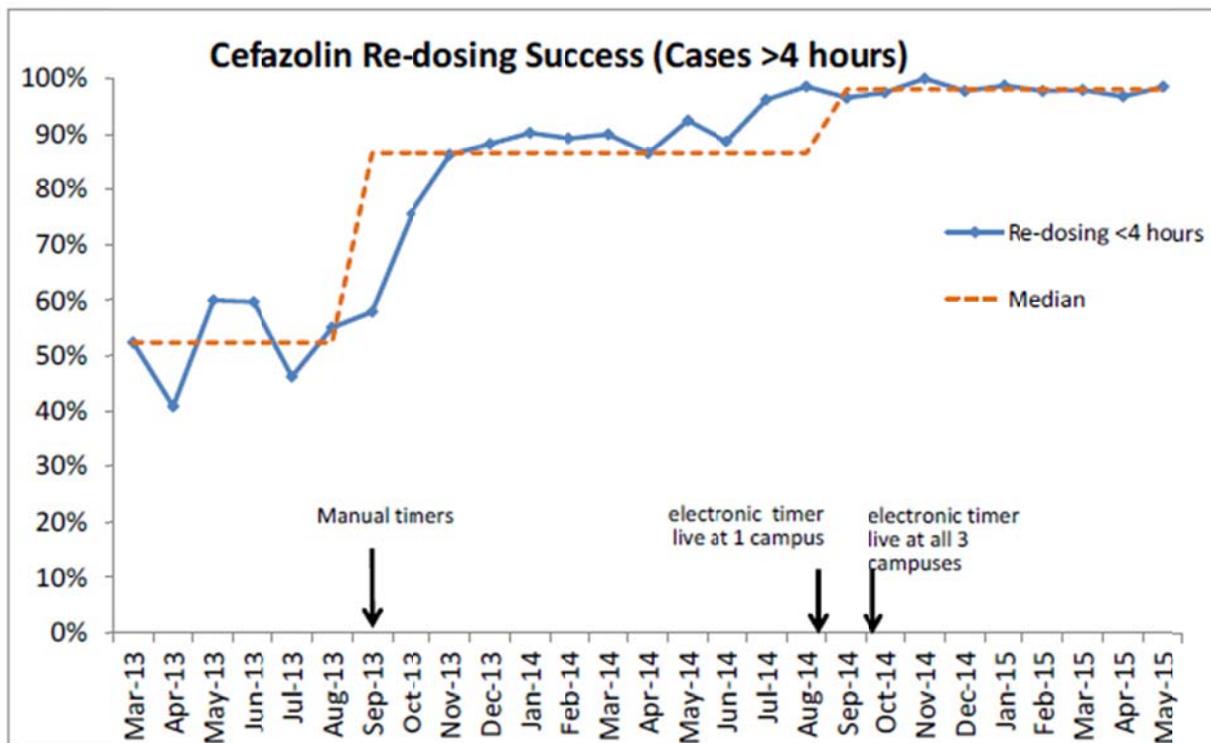
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Figure S1



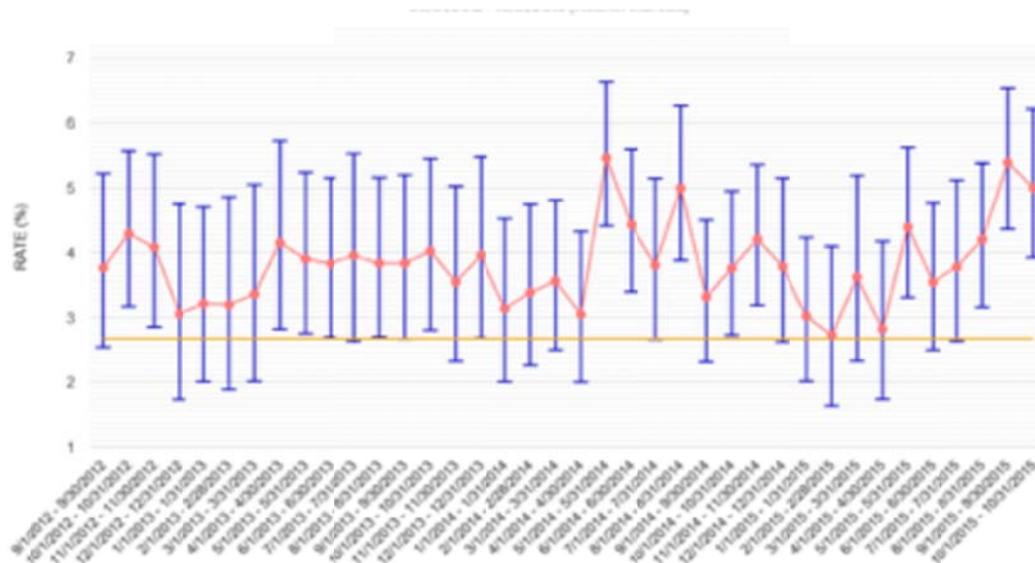
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Figure S2: Department Surgical Site Infection Rate



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