Jefferson
Thomas Jefferson University

Jefferson College of Population Health

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November 11, 2021

Anthony Stanowski, DHA FACHE
President & CEO, CAHME
PO Box 911
Spring House, PA 19477

Dear CAHME/George and Regi Herzlinger Innovation Education Award Members,

I am pleased to submit the attached documents from the Healthcare Quality and Safety program in Thomas Jefferson University's College of Population Health for the CAHME/George and Regi Herzlinger Innovation Education Award. As the Program Director for the Healthcare Quality and Safety program, I attest to our eligibility, including 1) certification in Healthcare Quality and Safety by CAHME; and 2) a HQS curriculum that integrates concepts of innovation in healthcare management education and practice.

Our University has shown a commitment to innovation since its inception, and our College of Population Health recognizes the significant impact that CAHME Accredited programs can have in providing the foundation in the principles of innovation for future leaders to be the change needed in healthcare. They have supported our journey without reservations. Included with this submission are our five-page proposal for the award; letters of support from three alumni, two students, and the university leader of our innovation pillar; a team-based business plan featuring innovation, which in our College is demonstrated through a student Capstone; and a proposed budget for the use of the award if we were to receive it.

We agree to 1) make a short video by February 1, 2022 about our success which would be featured at the Awards Ceremony, featured on the CAHME website, and highlighted on the Jefferson College of Population Health's website and social media; 2) have at least one representative present at the 2022 ACHE Annual Congress on Sunday March 27, 2022, to receive the award; and 3) commit to spending the award grant in ways as described in the application, including updating CAHME on the use by December 31, 2022.

Thank you for making this award available.

Sincerely,

Mary Reich Cooper M.D. J.D.
Program Director, Healthcare Quality and Safety

Jefferson's Healthcare Quality and Safety (HQS) program is pleased to apply for the CAHME/George and Regi Herzlinger Innovation Education Award to acknowledge the role HQS programs play in creating leaders of change in healthcare. The CAHME-certified HQS program at Thomas Jefferson University (TJU) has embraced innovation throughout its short history. TJU was founded as Jefferson Medical College by innovators in the education of physicians in 1824, while JCPH was the fruition of a dream of Dr. David Nash, a luminary in healthcare quality and safety and founder of the nation's first College of Population Health (JCPH) in 2008. To make that dream a reality, Dr. Nash focused on healthcare quality and safety, leadership, global health, innovation and its spin-off, change management. Today HQS is joined by programs in Health Economics and Outcomes Research, Public Health, Population Health, Operational Excellence, and the newest innovation in digital health, Data Science.

The innovation at JCPH mirrors the Innovation Pillar at TJU, developed in 2014. In addition to the traditional missions of academics (teaching and research) and patient care, Jefferson elevated innovation and philanthropy to pillars of its future. Jefferson has licensed more than 100 patents and started over 25 new ventures, hosted numerous hacks and tanks, and created students and faculty who want to change the world through innovation. An entire team of specialists in innovation staff the university's forays into innovation partnerships, development, and technology transfer. The innovation pillar supports the work that JCPH undertakes in innovation in healthcare delivery.

In 1962, Everett Rogers described innovation as "an idea, practice, or object that is perceived as new by an individual, unit, or system" (Diffusion of Innovations, 1962), recognizing that it is not necessarily the identification of something new but perception and adoption that makes it innovative. Starting with a focus on the Affordable Care Act, a national

innovation that has changed healthcare for vulnerable populations, JCPH's HQS program introduced students to the domains articulated in STEEEP (IOM, 2001): Safe, Timely, Effective, Efficient, Equitable and Patient-centered Care, perceived as innovative when they were published, but adopted by the World Health Organization and others since that time.

Woven throughout education about these domains in the HQS program are the concepts from Roger's approach to the diffusion of innovation: the use of champions, a structured communication channel, attributes such as simplicity and replicability, and most important, the work of those extolling the innovation (1962). Even Machiavelli recognized that people don't want to change and would resist, and that the advocates for change would need to defend their change with "the passion of partisans" (The Prince, 1513). In healthcare, that change can take up to 17 years (Balas, 2001) but the JCPH HQS program has put a model in place to shorten that timeline: translating innovation into practice. The skills taught by Jefferson are practical yet academic, giving participants the ability to design strategy and then implement it, with the passion of partisans.

The mission of JCPH is to prepare leaders with global vision to develop, implement and evaluate health policies and systems that improve the health of populations and thereby enhance the quality of life. It was founded on the principles of educating health professionals from many disciplines, supporting CAHME's mission of interdisciplinary education to advance the quality of healthcare management globally. For example, JCPH was an early adopter of on-line education from its inception in 2008, facilitating its recruitment process with national and global students. More recently, JCPH partnered with other organizations focused on healthcare management education, to create a certification and accreditation process for HQS.

The HQS students come from all over the world, with healthcare backgrounds and an interest in improving healthcare. The students are not always certain they can create change, because they have seen for years how the healthcare system fails patients and staff, through medical errors, infections, wait times, lack of equitable care, and a lack of respect toward patients. Part of the success of the HQS program is to teach the students that they can be successful in creating change. The program translates evidence to practical applications for advancing healthcare management, and their success is measured in the achievements of their capstones, which improve a process in their organization.

The students' Capstones are evidence of the rigor of the program from an academic perspective, demonstrating scholarship and applied research as the students translate innovation into practice. Capstones are the culmination of their Master's degree, where they need to show how they have convinced others to change, through stakeholder analyses; how they have measured their change, with leading, lagging, and balancing measures; how their project comports with the best evidence out there, through Cochrane models and academic references; and how their project is sustainable, though a business case and financial return on investment. All projects are done in the student's own organization, so that their experiential learning from developing and implementing the project is translated to benefit for their organization. Students have gone on to doctoral degrees with a HQS track, including decreasing maternal morbidity and mortality on obstetric patients with cardiovascular disease, enhancing the process for facial reconstructive surgery, and creating a measure set for outcomes in radiation oncology. Alumni return to give talks through our PopTalks webinar series.

Innovation best practices in teaching include a stacked model beginning with microcredentials though Academies or Boot Camps, which enhance life-long learning in

innovation. JCPH creates and hosts Colloquia, Academies, and Boot Camps quite frequently, including 20 years of Population Health Colloquia; Population Health Academy since 2014; OPX Boot Camp held twice since January 2021; High Reliability Healthcare Academy begun this past fall; and Women's Leadership Boot Camp planned for Spring 2022. Through the innovative Quality Improvement and Patient Safety Leadership (QIPS) program, we focus on getting students' initial immersion through three on-line courses that provide a foundation in quality and safety; a monthly in-person/virtual session that drills down on innovation topics such as change management, project management, leadership, teamwork, negotiation, presentation skills, creating a business case, and other topics; and a short project that is started and completed during the ten months of the QIPS curriculum. QIPS has been an effective way to create engagement in students, and it results in approximately a 30 to 40% conversion to graduate degrees in HQS. Students who know almost nothing about quality and safety and innovation at the beginning report knowledge and competency by the end.

The education in innovation experienced by the students tracks them through their development and competencies, as they learn to create change and then spread it through various courses, such as tools and methods, leadership, business case, change management, health care delivery, and applied principles of quality and safety. Another innovation in JCPH's education is the choice to rely on adjunct faculty who are still practicing healthcare quality and safety for most of the coursework. The faculty experience the difficulties faced by the students in their own work, and it makes them more compassionate instructors who can distill solutions with the students. Because the curriculum is standardized, any faculty member can teach any course, allowing for a bench with racial, ethnic, and geographic diversity. All students have the opportunity to take an elective when getting their graduate degrees, and electives have been

created in response to student needs. Electives range from Healthcare Quality in Post-acute Care to courses such as Baldrige and Data Science. All courses are interprofessional, and faculty, too, represent various health care professions including Public Health, Medicine, Nursing, Social Work, and Healthcare Administration , to name a few.

The grant will be used to develop and host an Innovation Boot Camp through the HQS program. The Innovation Boot Camp will be held in Fall 2022. We focus on this type of education, in addition to our transcriptable credits, because they are great sources of microcredentials, which working professionals need right now. Microcredentials show expertise in a narrow field and require less time to achieve. We have also found that they are a great method for increasing enrollment when people get hooked on a topic. The Innovation Boot Camp will be held over 3 days, 4 hours a day, with experts in the field. HQS will select the speakers, create a cogent integrated and interprofessional agenda, and market the Boot Camp to attract 20-30 participants; the small size is very attractive as it allows conversations rather than merely didactic instruction. We will use a work study student to keep the costs down for planning and marketing the course. The grant will be used to offset the cost of the speakers and provide scholarships for up to 20 people at $200 per person. The fee for the Boot Camp mimics our other Boot Camps at $2500 per person. A budget for the Boot Camp is included in the supplemental materials.

The HQS program at JCPH is proud of its accomplishments in the short 13 years of existence, demonstrating that innovation can create sustainable change. Our school, our faculty, our students and their projects are our evidence.

Budget for Innovation Award														
Design and host a Microcredentials Innovation Bootcamp														
	HQS and JCPH have hosted multiple bootcamps and academies in the past													
	Working professionals want the knowledge but don't want to take a long time to get it													
	Working professionals want a credential to signify their expertise													
Support for work-study student for logistics of bootcamp														
	With Dr. Cooper, create agenda and syllabus													
	Identify speakers and oversee production, develop marketing materials													
	Host bootcamp													
	Frequency		Hours		sum		cost per hour						sum	
	26		1.5		39		15						585	
Host bootcamp with experts in the field														
	3	days	4		12		1500						18000	
Support for Dr. Cooper as the convener														
	3		4		12		200		2400		100%		2400	
Support for Dr. Cooper planning														
	26		0.5		13		200		2600		100%		2600	
Scholarships														
	10			200					2000		100%			
	15			200					3000		100%		3000	
	20			200					4000		100%			
Infrastructure , Staff plus supporting materials, e.g., zoom or go to webinar, materials, copyrights, billing etc.														
	Planning													
	26		0.5		13		50		650		100%		650	
	Hosting													
	3		4		12		50		600		100%		600	
													27835	
Overhead											20%		5567	
												TOTAL	33402	
Offset Revenue												Award	-$10,000.00	
												Fees	-$30,000.00	

Support Materials: Letters of Recommendation

Kettering HEALTH

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November 7, 2021

Anthony Stanowski, DHA FACHE
President & CEO, CAHME
PO Box 911
Spring House, PA 19477

Dear CAHME/George and Regi Herzlinger Innovation Education Award Committee Members,

I am a recent graduate of the Healthcare Quality and Safety (HQS) program at Jefferson's College of Population Health (JCPH) , and I am happy to support Thomas Jefferson University's HQS program for the CAHME/George and Regi Herzlinger Innovation Education Award. It contributed to my growing role at Kettering Health in western Ohio, a role I took on in the middle of my Capstone process. The support of the College and my Capstone advisors allowed me to function outside my comfort zone and tackle a project with neurosurgeons and vascular surgeons even though I don't work in the operating rooms. In fact, my project was so successful that we are now spreading it to other surgical disciplines and other hospitals in our system.

I did not go to medical school in the United States. I am an international graduate and I chose a Master's degree in Healthcare Quality and Safety to further my education and enhance my career possibilities. I started the program while I was working in Wisconsin and moved halfway through, to Ohio. The focus at JCPH on translating innovation into practice, and the competencies I learned, made me so comfortable and so accomplished that I had no concerns about starting a project all over again at a new organization. Although we focused on the basics, the real opportunities to grow came from learning about innovation and how to apply leadership and change management concepts to diffuse innovation.

I am a proud alumnus from the Jefferson College of Population Health with a Master's degree in Healthcare Quality and Safety. I support their award submission, and I think they deserve to win.

Sincerely,

Chizoba Ugwummadu MD, MS-HQSM, FACP

Jefferson

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November 9, 2021

Anthony Stanowski, DHA FACHE
President & CEO, CAHME
PO Box 911
Spring House, PA 19477

Dear CAHME/George and Regi Herzlinger Innovation Education Award Committee Members,

As the Executive Vice President and Chief Innovation Officer of Thomas Jefferson University (TJU), I am pleased to write this letter in support of our Healthcare Quality & Safety (HQS) program in Jefferson's College of Population Health for the CAHME/George and Regi Herzlinger Innovation Education Award. Dr. David Nash, the emeritus Dean and founder of the College of Population Health is well-known for his innovation and commitment to changing healthcare through HQS, and the Healthcare Quality and Safety program embodies that passion.

At TJU, we have made innovation a mission. In addition to the traditional missions of academics (teaching and research) and patient care, Jefferson elevated innovation and philanthropy to pillars of its future. Innovation re-imagines the future and restates our relationship with our community and the aspirations of many to create a better society.

We made trans-disciplinary teaching, research and team care, the focus of our strategic planning. We've made creativity the key skill we believe will prepare our graduates for professions of the future. As the Innovation Pillar, it is our job to foster ideas and convert them into products and services. The Innovation Pillar is where we test new business models and nurture entrepreneurialism among employees, students and the Jefferson community. We want to make a profound change by adopting new forms of value creation. We are an academic medical system working to keep people OUT of the hospital! That's the focus of innovation at Jefferson.

I have had more than 20 years of experience in creating partnerships driven by emerging technology and new business model creation, and I have a team of like-minded people focused

on innovation and technology transfer. We have hosted week-end hackathons, created the Jefferson Accelerator Zone (JAZ), and leveraged the talents and the interests of our faculty and our students to solve problems facing healthcare now, and in our future. Our HQS program has populated many of our quality and safety positions with its Quality Improvement and Patient Safety Leadership programs, and JCPH has been a leader in a relentless focus on Population Health.

The HQS program translates innovation into practice, changing systems and fostering different perspectives. I am pleased to support their application for the CAHME/George and Regi Herzlinger Innovation Education Award.

Sincerely,

Rose Ritts, Ph.D.
Executive VP & Chief Innovation Officer
Jefferson Health & Thomas Jefferson University

SENTARA®

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Joel T. Bundy, M.D., FACP, CPE
Vice President, Chief Quality & Safety Officer

Nov 8, 2021

Anthony Stanowski, DHA FACHE
President & CEO, CAHME
PO Box 911
Spring House, PA 19477

Dear CAHME/George and Regi Herzlinger Innovation Education Award Committee Members,

As a current student in Jefferson's College of Population Health, I am pleased to write this letter in support of Thomas Jefferson University's Healthcare Quality & Safety (HQS) program for the CAHME/George and Regi Herzlinger Innovation Education Award. I will graduate in the next few months, and I am presenting my Capstone on the High Reliability Journey at my organization this week. As the Chief Quality and Safety Officer for that organization, which was an early adopter and innovator for high reliability in healthcare, I understand innovation and what it takes to foster innovation. Jefferson's Healthcare Quality and Safety program embodies that innovation.

I was already quite knowledgeable about quality and safety when I arrived for my Master's degree. In fact, my father asked me why I was getting another degree when I had already been a physician for a number of years. Why? Because I was eager to learn and to put an academic grounding in my knowledge. What I didn't expect is how much more than that I would take in. I learned about leadership and tools for spreading innovation. I learned about return on investment and change management, and I even polished my knowledge about statistics. Jefferson's program is designed to challenge the mid-careerist and to give them the tools to solve the problems within healthcare.

Every day I find myself using things I learned at Jefferson. During the pandemic, they were flexible and innovative in how they coped with the changes that each of us in the clinical arena had to endure. I am grateful to Jefferson for supporting my candidacy for a Master's degree, and I support their award submission for the Innovation award.

Sincerely,

Joel Bundy, MD, FACP, FAAPL, CPE
Chief Quality and Safety Officer
Sentara Healthcare

Jefferson Health
HOME OF SIDNEY KIMMEL MEDICAL COLLEGE

Jefferson Washingtod Township Hospital

555 Egg Harbor Road

Sewell, NJ 08080

November 8, 2021

Anthony Stanowski, DHA FACHE
President & CEO, CAHME
PO Box 911
Spring House, PA 19477

Dear CAHME/George and Regi Herzlinger Innovation Education Award Committee Members,

As a graduate of the Masters in Healthcare Quality and Safety program at Jefferson College of Population Health, and the recent winner of the inaugural Jefferson Nash Award for Healthcare Quality, I am pleased to offer this letter of support for Thomas Jefferson University's Healthcare Quality & Safety (HQS) program. They deserve to win the CAHME/George and Regi Herzlinger Innovation Education Award because they were instrumental in my win of the Quality Award. My Capstone project became my submission, and the HQS faculty taught me how to translate innovation into practice.

The innovative approach to teaching that they foster started with my introduction to HQS through their Quality Improvement and Patient Safety Leadership program. I was chosen for the second cohort and was exposed to a different way of thinking about HQS. Instead of being only data focused, they taught me how to combine project management and communication strategies with the business case for quality and multiple tools to foster innovation. I was happily surprised how concepts learned in course after course coincided with my "day job," and I was able to practice newly learned quality tools in real time. My project started with coding to improve mortality scores and expanded to consider palliative care consults and hospice referrals. There wasn't a standardized answer to improve mortality; instead, I was taught to think of multiple solutions and innovations that could help me get to the goal…and then set a newer and bigger goal.

Jefferson's HQS program contributed to my own advancement, when I was Chief of Medicine for Jefferson New Jersey. I am a passionate advocate for HQS and for innovation and the spread of innovation through stakeholder analyses, project plans, and the utilization of champions and models for change.

I enthusiastically support this application and I am proud to have earned my degree from Jefferson's HQS program.

Sincerely,

Todd P. Levin, DO, MS-HQS, FIDSA, FACOI

Chief of Medicne

Physician- Infectious Diseases

Medical Director- LGBTQ+ Health Services

Jefferson Health New Jersey

November 9, 2021

Anthony Stanowski, DHA FACHE
President & CEO, CAHME
PO Box 911
Spring House, PA 19477

Dear CAHME/George and Regi Herzlinger Innovation Education Award Committee Members,

As a non-traditional student in Thomas Jefferson University's Healthcare Quality & Safety (HQS) program I am pleased to write this letter in support of their application for the CAHME/George and Regi Herzlinger Innovation Education Award. I have gone back to get my Master's degree after working as a respiratory therapist, and to be honest, when I got my RT degree, I was not the student who got the highest grades; I had other obligations at the time. I still do. I am challenged by the courses' content and just so interested in making a difference, that I have an A average this time around.

I have always wanted to help people; it is why I went into healthcare. The Master's degree gave me the opportunity to learn skills I can apply in my day-to-day activity to improve care and to make care better for patients. I am learning innovative ways to fix systems and processes and sometimes people. Even with the time needed to treat patients with Covid, I kept focused on this degree, because I feel I will be able to help people so much more.

I just started my Capstone project, and to push myself, I am collaborating with the staff in the bronchoscopy and endoscopy suite to look at better scope cleaning processes. It is not my area of expertise, but what has become my specific area of expertise is creating change. I am confident that I will be successful.

There are now others in my respiratory therapy program who are getting their degrees because they have seen what I have learned in the past two years. I am grateful for the opportunities this has opened for me, and I am happy to support the Healthcare Quality and Safety program and the Jefferson College of Population Health.

Sincerely,

Blessing Nwandiko

Blessing Nwandiko RRT

Student at JCPH HQS program

MAYO CLINIC
HEALTH SYSTEM

November 7, 2021

Anthony Stanowski, DHA FACHE
President & CEO, CAHME
PO Box 911
Spring House, PA 19477

Dear CAHME/George and Regi Herzlinger Innovation Education Award Committee Members,

I am pleased to write this letter in support of Thomas Jefferson University's Healthcare Quality & Safety (HQS) program for the CAHME/George and Regi Herzlinger Innovation Education Award.

Innovation led to the founding of Jefferson's College of Population Health and the HQS program by Dr. David Nash only thirteen years ago and the program is now recognized nationally for its education. The certification process for HQS programs at CAHME was supported by Jefferson's HQS program, where Dr. Billy Oglesby played a large role. I graduated two years ago and I work at one of the most innovative health systems in the country. However, my education at Jefferson College of Population Health's HQS program made me even more innovative and better prepared to lead change in our organization. I emerged a more well-rounded physician who considers the STEEP domains of safety, timeliness, equity, effectiveness, efficiency and patient-centered care central to everything I do.

Jefferson's HQS program contributed to my own advancement, when I was promoted to community division Chair. I have advocated for the program to others who are leading large health systems. I am confident that the continued development of Jefferson's HQS program, reflecting the rapid changes in quality and safety, will continue to produce passionate and successful leaders who greatly benefit the quality and safety industry and healthcare management at large.

I am proud to have earned my degree from Jefferson's HQS program and enthusiastically support this application.

Sincerely,

Thomas Howell MD
Community Division Chair, OB/GYN
Assistant Medical Director for Patient Experience

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Support Materials: Student Based Business Plan

Improving Compliance with Preoperative Nasal Povidone-Iodine to Prevent Surgical Site Infection: A Pilot Quality Improvement Project in Vascular and Neurosurgery Units in a Community Teaching Hospital

Chizoba Ugwummadu

Master of Science in Healthcare Quality and Safety (MS-HQSM)

Jefferson College of Population Health

Thomas Jefferson University

Summer 2021

Capstone Chair: Mary Reich Cooper, M.D., J.D.

Second Reader: Alison Hong, M.D.

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Acknowledgement

I want to first and foremost express my deepest gratitude to my family who gave me the full support and took the pain of me spending most of my spare time to pursue the execution and completion of this capstone project. That is on top of our relocation to a new state and environment. My ultimate gratitude to God almighty for providing me the health in the middle of a pandemic to carry out this project.

My deep appreciation to Dr. Mary Cooper, my capstone chair for her guidance during this capstone project. Dr. Cooper's confidence in my ability to conduct the project was profoundly encouraging and grew my confidence as well. I also want to extend my sincere appreciation to Dr. Ashlee Ames, the co-director of Hospital Medicine program and Dr. Jeffrey Weinstein, the Chief Safety Officer at Kettering Health. Dr. Ames and Dr. Weinstein wholeheartedly accepted to assist me with my capstone project several months before I officially started work at Kettering Health. Dr. Weinstein literally participated in the project as part of the taskforce providing visible leadership to the end of the pilot project.

This project was executed on a daily basis by a 13-member taskforce, and I owe my deepest gratitude to the team including but not limited to Eric Schmidt, the project manager; Luella Walker, preoperative nurse manager and Kay Ridgway, a nurse champion; and the surgeon champions, Dr. Alyssa Bonta (vascular surgery) and Dr. Mark Hoeprich (Neurosurgery).. I also want to thank Dr. Richard Gregg, the chief informatics officer, and the IT team for their support in facilitating the development and test running the electronic cognitive aids deployed during the project. I will not conclude this section without extending my gratitude to the meeting organizers of the departments involved in this project for their assistance in ensuring that there were opportunities to present and educate the target audience and raise awareness.

Improving Compliance with Preoperative Nasal Povidone-Iodine to Prevent SSI

Abstract

The nasal mucosa is the main site of Staphylococcus aureus colonization, and *S. aureus* colonization increases the risk of surgical site infection. Transition from preoperative treatment of nasal MRSA colonized patients with mupirocin to treatment with povidone-iodine nasal swabs added value to the treatment of nasal colonization modality. It is more effective in the prevention of SSIs and less expensive. However, suboptimal adoption of the povidone-iodine nasal swab minimized its benefits. This pilot QI project aimed to increase the compliance of clinicians with the use of the preoperative povidone-iodine nasal swab to decrease surgical site infection rates.

Baseline data analysis that included the use of pareto chart systematically identified vascular surgery and neurosurgery units at Kettering Hospital Main Campus as having the biggest opportunity for improvement. Using the fishbone diagram and the 5 Why's, the barriers to compliance and the interventions for improvement were identified by a project team. Over a period of four months (Jan – April 2021), intensive education, an awareness campaign and introduction of cognitive aids for physicians (Best Practice Advisory, BPA) and for nurses (administration verification reminder) in the work process were applied using PDSA. A pre- and post-intervention data analysis were done.

The project significantly improved the order compliance rate in vascular and neurosurgery from a historical mean of 79.6% to a monthly average of 95.7%, over 3SD on the control chart. The administration compliance rate of the nasal swab was also increased from a baseline mean of 72.29% to monthly average of over 80%, over 2SD on the control chart. At the end of the pilot project, the increased compliance resulted in decline in SSIs rate by 70%. Improving the order and administration compliance of preoperative povidone-iodine nasal swab by clinicians led to improved prevention of SSIs.

Introduction and Literature Review

The nasal mucosa is the main depot for *Staphylococcus aureus* colonization and transmission to other body parts, and as high as 30% of the general population has been shown to have nasal *S. aureus* colonization (Kuehert MJ et al., 2006). Multiple studies have also shown that *S. aureus* colonization prior to surgery is a risk factor for subsequent surgical site infections (SSI) (Kluytmans JA et al, 1995; Yano K et al, 2009; Bertelot P, 2010). In 2006, five recommendations from the Surgical Care Improvement Project guidelines were applied to prevent SSIs but that did not significantly decrease risk-adjusted SSI rates (Hawn MT, 2011).

SSIs are defined by the National Healthcare Safety Network (NHSN) as those infections that occur up to 30 days post-surgery and up to 90 days after surgical implantation of a medical device (Anderson et al., 2015). They can sometimes be superficial infections involving the skin only but also can be more serious and involve tissues under the skin, organs, or implanted material. SSIs are common with an average rate of 2.8% but the rate is dependent on the class of the wound. The rates increase with worsening class of surgical wound with clean-contaminated, contaminated, and dirty wounds associated with SSI rates of 6.67%, 8.61%, and 11.80% respectively (Ortega G et al, 2012).

The Center for Disease Control and Prevention, CDC (2021) reported that SSIs remain a substantial cause of morbidity, prolonged hospitalization, and death with an associated mortality rate of 3%. In a meta-analysis of 26 studies conducted between 1998 and 2013, it was demonstrated that SSIs are the third most costly healthcare associated infection (HAI) on an individual case basis, at $20,785, mostly because of the profound impact SSIs have on length of stay (LOS) (Zimlichman et al., 2013). SSIs accounted for the largest proportional cost, 33.7% of the estimated $9.8 billion attributable to the five most significant HAIs including SSI, Central

Line Associated Blood Stream Infection (CLABSI), Catheter Associated Urinary Tract Infection (CAUTI), Ventilator Associated Pneumonia (VAP) and *Clostridium difficile* infection (Zimlichman et al., 2013). Additionally, SSIs account for 20% of surgical readmissions and directly contribute to the doubling to quadrupling of mortality rate of surgical patients (Sullivan et al, 2017). In the analysis of human-level cost of SSIs, Sullivan et al (2017) brought to light some of the consequences of SSIs that are not often discussed and include pain, loss of income, reduced quality of life, and the more difficult to quantify economic and non-economic burden to patients' families.

S. aureus nasal colonization increases the risk of SSIs by as high as nine-fold (Kluytmans, 1995; Yano et al., 2009; Torres et al., 2016) and increases the risk of Methicillin Resistant *Staphylococcus aureus* (MRSA) bacteremia by almost 20-fold (Marzec and Bessesen, 2016). Most cases of MRSA bacteremia are secondary to a primary site of infection which include SSIs among others (Klevens et al., 2007). A genotyping study found that up to 80% of *S. aureus* infection arises from patient's own nasal flora (Wertheim et al., 2005). In device-related surgeries, *S. aureus* has been documented to be the most common causative pathogen due to its virulent nature and ability to adhere to prosthetic implants (Felden et al., 2011; Sanchez et al., 2013). MRSA bacteremia has significant reputational downstream impacts on hospitals (CMS, 2021).

Multiple hospital policies and protocols have been implemented in the past to reduce infections due to MRSA. These include MRSA screening, chlorhexidine gluconate baths, preoperative chlorhexidine wipes, and mupirocin nasal treatment (Torres et al., 2016). Other protocols include perioperative and intraoperative antibiotics, sterile technique, and povidone-iodine soaks intraoperatively (Torres et al., 2016). Patients undergoing device-related orthopedic,

vascular, cardiothoracic or neurosurgery procedures have been traditionally screened preoperatively in the clinic for MRSA using a polymerase chain reaction test (PCR). Those that test positive are treated with intranasal mupirocin for five days prior to the surgery and this has been shown to be effective in reducing SSIs (Pearl, 2002 and Edmiston, 2016). This treatment was 83% effective but only 86% of patients applied the mupirocin (Ramos et al., 2011). Although this intervention was effective in reducing SSIs, it was associated with high cost and suboptimal patient compliance due to cost, and it led to canceled surgeries, MRSA recolonization also leading to surgery cancellation, failure to recheck clearance of colonization prior to surgery and MRSA resistance to mupirocin (Ramos et al., 2011). In addition, this treatment strategy excluded individuals with only Methicillin Sensitive *Staphylococcus aureus* (MSSA) colonization because during testing, MSSA colonized patients are not captured for treatment in the first place.

To overcome these problems, a one-time application of preoperative nasal povidone-iodine swab within two hours of surgery has been introduced and demonstrated to be effective in the reduction of SSIs through prophylactic suppression of *S. aureus* (Philips et al., 2014; Anderson et al., 2015; Torres et al., 2015; Peng et al., 2018; Ghaddara et al., 2020). While Phillips et al (2014) and Anderson et al (2015) suggested that preoperative povidone-iodine swab may be better in preventing Staphylococcus SSIs than preoperative mupirocin treatment, Torres et al (2016) showed that both treatment modalities are equally effective. Povidone-iodine has a broad-spectrum antibacterial activity, *in vitro* bactericidal effect within 15 to 20 seconds, a duration of action on the skin of 12 to 14 hours, and minimal potential for development of resistance to povidone-iodine due to its multiple cellular targets (Anderson et al., 2015). Other benefits of preoperative povidone-iodine nasal swab include cost reduction (Torres et al., 2016), better

patient satisfaction (Philip et al., 2014), suppression of both MRSA and MSSA, avoidance of patient's noncompliance and prevention of resistance to mupirocin (Ramos et al., 2011; Anderson et al., 2015).

Implementing a change in process in an organization can be fraught with a disconnect between the leadership and the frontline staff. Barve and Kruer (2018) identified that the frontline staff were often not aware of the goals and targets set by senior leaders in their organization; they accomplished their improvement goals using three components of a Daily Management System including 1) alignment of goals and efforts; 2) visual data management, daily huddles and problem-solving; and 3) leader standard work. The authors were able to improve turnaround time for radiology orders from the emergency room from 40 minutes to less than 30 minutes; improve time-out documentation compliance for radiology procedures from 76% to 95%; and increase the rate of medication scanning compliance from less than 70% to greater than 90%, among other positive outcomes.

The psychology of staff plays a role in this subject. Deming (2018) defined psychology as the way people think and feel, what motivates them, what demotivates them, the problematic effects of incentives, and how they behave, including when they encounter change. Judson, Volpp and Detsky (2015) discussed the importance of balance of extrinsic motivators, e.g., financial reimbursement or other forms of recognition such as awards and intrinsic motivators, e.g., personal satisfaction derived from doing good work or internal desire to achieve a particular objective. Recognizing that both the extrinsic and intrinsic motivators can be effective or ineffective depending on the context and expectations, the authors posited that the challenge was how to select an appropriate mix of intrinsic and extrinsic motivating interventions that will give optimal results (Judson, Volpp and Detsky, 2015). It has been documented that once an

employee feels that he or she is being paid appropriately, promoting autonomy, mastery and purpose become the key to improving performance (Judson, Volpp and Detsky, 2015).

Hilton and Anderson (2018) noted that the rate at which improvements spread relies at least in part on the people who are implementing, spreading, and communicating about the change in practice. It has also been documented that countless evidence-based improvements and innovations across health disciplines take years to be adopted, or do not become common practice due to low rates of adoption and sustainability (Bastian, Glasziou and Chalmers, 2010). Abbott et al (2018) noted that partial use or implementation of a checklist may result in limited or short-term improvement. Other authors suggested that the benefits of a checklist depend on relevant design and content, adequate introduction and training, appropriate implementation, and enthusiastic adoption by the surgical team, as well as full compliance with its use (Bosk et al., 2009; Leape LL, 2014; Burian et al., 2018).

Bosk et al (2009) reported that the adaptive work of the team is thought to be the critical factor in generating measurable improvements, rather than the technology of the checklist itself. In his 2003 book, Rogers posited that innovation must be widely adopted to become self-sustaining (as cited by Hilton and Anderson, 2018). Hilton and Anderson (2018) also reported that while health care improvers are equipped with science of improvement, i.e., the best evidence-based interventions and implementation strategies, they struggle with the adaptive side of change which relates to unleashing the power of people and their motivations to advance and sustain improvement, which are the two most cited reasons for the failure of improvement initiatives. The Institute for Healthcare Improvement (IHI) psychology of change framework emphasizes the inherent value of each person regardless of his or her identity or position in the organization as well as the importance of identifying ways in which all persons affected by the

improvement can meaningfully contribute to the solution (Hilton and Anderson, 2018). The five recommended domains of practices that organizations can use to advance and sustain improvement are to unleash intrinsic motivation, to co-design people-driven change, to co-produce an authentic relationship, to distribute power, and to adapt in action (Hilton and Anderson, 2018).

The science of safety is based on the premise that everyone makes mistakes and that specific processes can be implemented to prevent mistakes or minimize their adverse impact (Kohn et al., 1999). According to Carayon et al. (2006), patient safety and designing systems that produce safe patient care can be accomplished by using the System Engineering Initiative for Patient Safety (SEIPS) model. This model integrates Donabedian's structure-process-outcome framework and the work system model. The structure of an organization or, more generally, the work system affects how safely care is provided which is the process; and the means of caring for or managing the patient affects how safe the patient is which is the desired outcome (Carayon et al., 2006).

Human errors can be action-based errors when the error is a result of the clinician's skills, decision-based errors when there is faulty knowledge or judgement resulting in critical thinking failure or cognitive biases (Stiegler et al., 2012 and Neuhaus et al., 2018) and communication-based errors when there is failure in communication. Decision-based errors can be improved by increasing awareness and insight into cognitive biases and increased consideration of alternative possibilities (Croskerry P., 2003). Some strategies to achieve that include cognitive aids that will decrease reliance on memory such as computerized decision support, algorithm, or mnemonics (Uptodate, 2021). Other strategies include simulation training to develop "cognitive walkthrough" strategies for specific clinical scenarios and implementation of evidence-based

clinical practice guidelines (Uptodate, 2021). Like SEIPS, human errors can be mitigated by modifications in information technology (IT) systems required for patient care to improve their safety and outcome. This can be achieved via certain specific processes such as use of forcing functions to prevent human errors. It is therefore imperative that well-designed systems must be in place to detect and help prevent errors before they reach the patient. Such layers of preventive mechanisms were described by James Reason in his Swiss cheese model (Reason J, 1990).

In the operating room (OR), general approaches to risk reduction during procedures include review of the patient's informed consent, timeouts, checklists, surgeon-led briefings, techniques to minimize distractions and disruptions, cognitive aids for emergencies, formal handoff procedures, and debriefings. It is recommended that a standardized checklist should be employed in the OR prior to the start of every case because it serves as a cognitive aid with a structured presentation of information to ensure that no steps of a process are missed and that safety measures are followed (Weiser and Haynes, 2018). The World Health Organization (WHO) surgical safety checklist provides a set of checks to be done at three stages of a surgical procedure (sign in, time out, and sign out). In a meta-analysis that included eleven observational studies, Abbott et al. (2018) showed that the use of the WHO checklist was associated with reduction in postoperative mortality compared with no checklist use.

At the community hospital where the project was completed, the overall rate of SSIs in device-related surgeries is 0.8%; however, the rate is higher in vascular surgeries, which average 2.7%, and in neurosurgeries, the average rate of SSI is one percent. The current improved rates of SSIs followed the introduction of preoperative povidone-iodine nasal swab in 2016. Despite the demonstrated benefits, the rate of compliance with the use of povidone-iodine nasal swabs remained suboptimal, both with the ordering and administration of the nasal swab. These

suboptimal compliance rates were more notable and significant in vascular surgeries and neurosurgeries. One of the early observations made was that there was a disconnect between the taskforce responsible for the implementation and roll out of the preoperative nasal povidone-iodine swab and the frontline team. There were varying degrees of adoption of the new practice across different hospitals in the network and across different specialties within the same hospital. The average administration compliance rate in the network was 72% with a range of 52% to 85%. The lower compliance in vascular and neurosurgery service lines also correlated with higher rates of SSIs. The cardiovascular unit compliance rate was the lowest and the infection rate was the highest; however, their volume of surgeries is low, and therefore the impact of a performance improvement project would not be as significant. This baseline information underscores the importance of improving the rate of order and administration compliance of the preoperative povidone-iodine nasal swab. To optimize the benefit of this new practice, the compliance of providers must be improved by mitigating the barriers to the adoption of the new practice.

This project aims to seek out the barriers to adopting the new practice, develop solutions to mitigate them and apply the interventions to improve compliance, and ultimately reduce and sustain the reduction of SSIs. The other potential benefits to achieving those goals are ensuring evidence-based quality care of surgery patients, meeting and sustaining superior status for regulatory bodies' benchmark for SSI rates and improving hospital rating and reimbursement via improved performance on reported data.

Methodology

Project design

This is a pilot quality improvement project to improve the compliance with preoperative povidone-iodine nasal swab in a community teaching hospital, Kettering Health – Main Campus (KHMC). KHMC is the main campus of Kettering Health (KH), a non-profit organization with nine hospitals in its network in southwest Ohio. In the entire network, there are multiple service lines that engage in device-related surgeries, including orthopedics, cardiothoracic, vascular and neurosurgery service lines. KHMC, through its size, available service lines and perhaps location, attracts the largest number of patients within the network. The vascular surgery service line at KHMC performs 44% of all vascular surgeries in the network with an average of 283 surgeries annually while the neurosurgery service line performs 72% of all device-related neurosurgeries in the network with an average of 1045 surgeries annually. There are 11 surgery attendings in the vascular and neurosurgical units. The vascular surgery unit has four surgeons, and the neurosurgery unit has seven surgeons. The vascular service line has resident trainees and advanced practice professionals (APPs) while the neurosurgery service line has only APPs. The nursing team consist of nurses with a wide range of experience from new hires to nurses with over 20 years of experience. Communications among the physicians, residents and APPs, and the nursing team are through the electronic medical record (Epic), verbal communication either directly or through the phone, and until recently, through scanned papers. In the last few months, all paper orders have been switched to electronic order sets.

At KHMC, there are three sources of surgery patients in the vascular and neurosurgery units, including outpatient clinics, the emergency room and the floors, and transfers from other facilities. Once patients are determined to require surgery in the clinic, they are channeled

through central scheduling during which order sets for the surgery are placed. This set of patients accesses the operating room (OR) from the outpatient preoperative area. Patients from the Emergency Room (ER) and the floors have their orders entered in those locations and they access the OR via the inpatient preoperative area. Quite frequently, patients are added on to the surgery list from all the above sources in which case, they bypass the central scheduling. Patients from other facilities are either admitted to the floor or they are added-on to the surgeries list. The add-ons typically get verbal orders for surgery. If povidone-iodine is ordered, they are typically administered either in the outpatient or inpatient preoperative area by the preoperative nurses at most two hours prior to the start of the surgery. This surgery patient flow is shown in Figure 1.

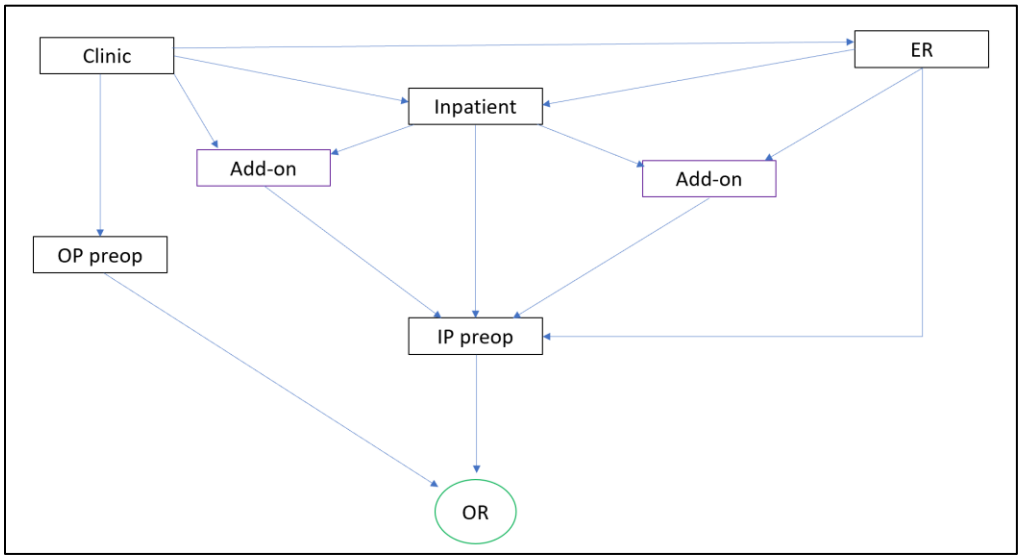

Figure 1: Surgery patient flow

The team investigated the potential causes of physicians', residents', and APPs' failure to order povidone-iodine. Nurses' failure to administer the swab when it was ordered was also investigated. Baseline data of all device-related orthopedic, vascular, neurosurgical, and

cardiothoracic surgeries was first obtained by the data analyst from Epic using ICD-10 codes. The data were analyzed by the project manager and the team to identify the hospital and service lines with the most opportunities to improve order and administration compliance with preoperative povidone-iodine nasal swab. KHMC was found to be the hospital site with the biggest opportunity for improvement particularly in the vascular and neurosurgery service lines. The vascular and neurosurgery units correspondingly have the highest rates of device-related SSIs. The two specialties contributed 70% of the SSIs in all the specialties under review. Workflow mapping was conducted in one of the vascular outpatient clinics and the same was done at the outpatient and inpatient preoperative areas. Frontline physician and nurse champions were identified and constituted a 13-member taskforce that also included representatives from middle management, the Process Excellence department and leadership.

The taskforce used a combination of the Ishikawa diagram and the 5-WHY's tools to brainstorm the barriers to compliance in ordering preoperative nasal povidone-iodine. It was identified that lack of awareness of the preoperative povidone-iodine nasal swab among physicians, residents, and APPs and failure to use order sets were contributing factors. Other contributors were lack of policy mandating use of an order set for all surgeries including add-on cases, the use of verbal orders and circumventing order sets by using individual orders (Figure 2A). The taskforce also brainstormed potential interventions during which four interventions were identified. These include:

1. Educate physicians, residents, and APPs on preoperative povidone-iodine nasal swab and its necessity during departmental meetings and with the use of fliers and emails.

2. Develop an automatic cognitive aid, best practice advisory (BPA) pop-up in Epic for relevant surgeries whenever an individual order is utilized to limit circumventing order sets or use of verbal orders.
3. Develop standard order compliance metrics and report them to the providers during service line meetings both to promote awareness and to give feedback on performance.
4. Change the policy to make KH-built order sets mandatory for vascular surgeries and neurosurgeries.

The task force repeated the same exercise to identify the barriers to administration of preoperative povidone-iodine nasal swab (Figure 2B) and the necessary interventions. The following interventions emerged:

1. Educate nurses on preoperative povidone-iodine nasal swab and its necessity during meetings through a HealthStream course and with the use of fliers and emails.
2. Develop a cognitive aid administration verification reminder for the application and documentation of preoperative povidone-iodine nasal swab prior to moving a patient from preoperative area into the OR.
3. Develop standard administration compliance metrics and report them to the nurses during meetings and hurdles both to promote awareness and to give feedback on performance.

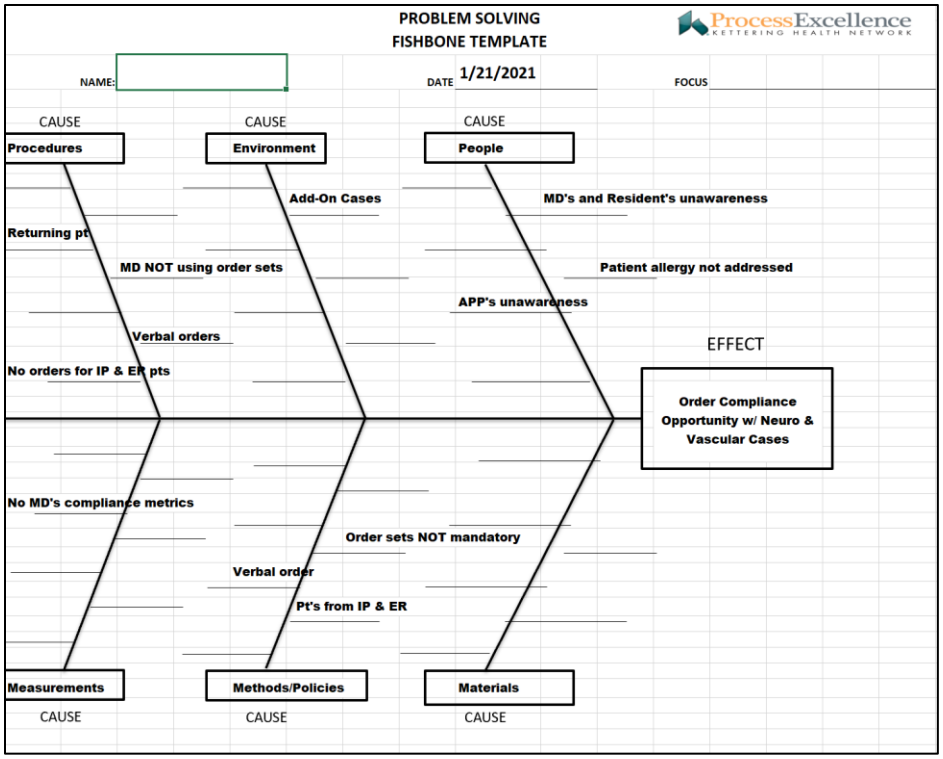

Figure 2A: Fishbone analysis – order compliance

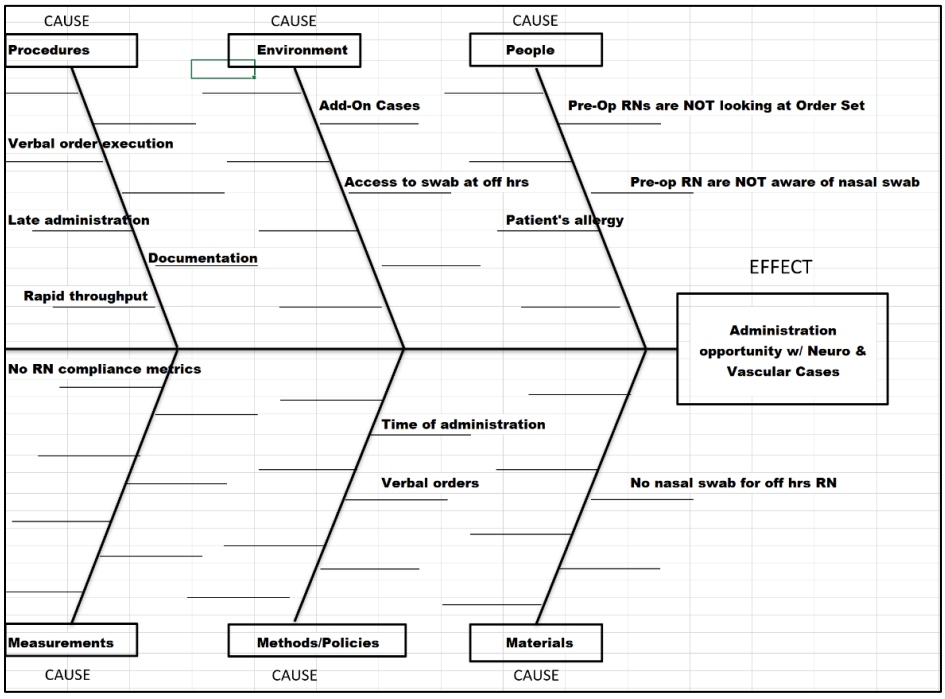

Figure 2B: Fishbone analysis – administration compliance.

A comprehensive driver diagram (Figure 3) was created to facilitate visual conceptualization of the mechanisms through which the interventions will lead to the desired goal of the project. The identified interventions to improve both the ordering and administering of the nasal swab was prioritized using the payoff matrix tool (Figure 4). Those that fall into the high-impact and easy-to-do bucket were prioritized for a Plan-Do-Study-Act (PDSA) cycle, the Do phase. The taskforce collected relevant data to inform the measures and metrics that were used to monitor outcomes. Adjustments in the interventions were made as needed and iterative PDSA cycles were conducted as needed to further refine the interventions in preparation for spreading the initiative to other specialties and hospitals in the network.

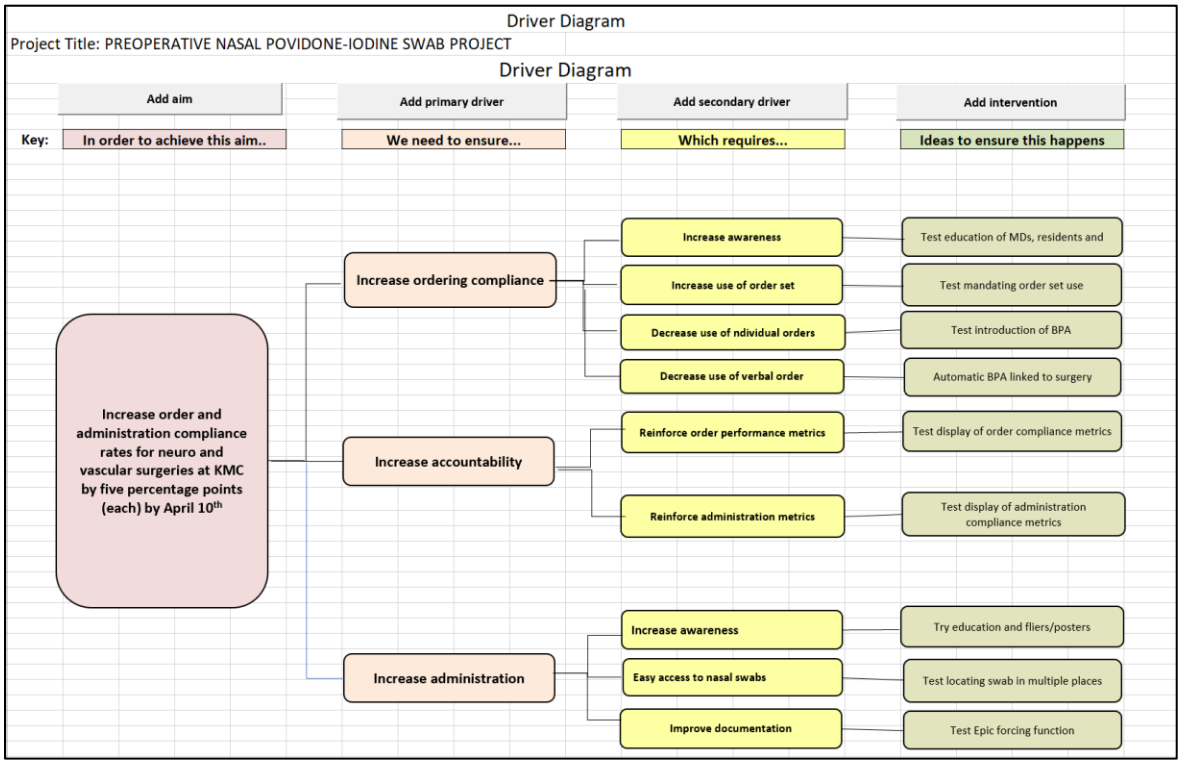

Figure 3: Driver diagram

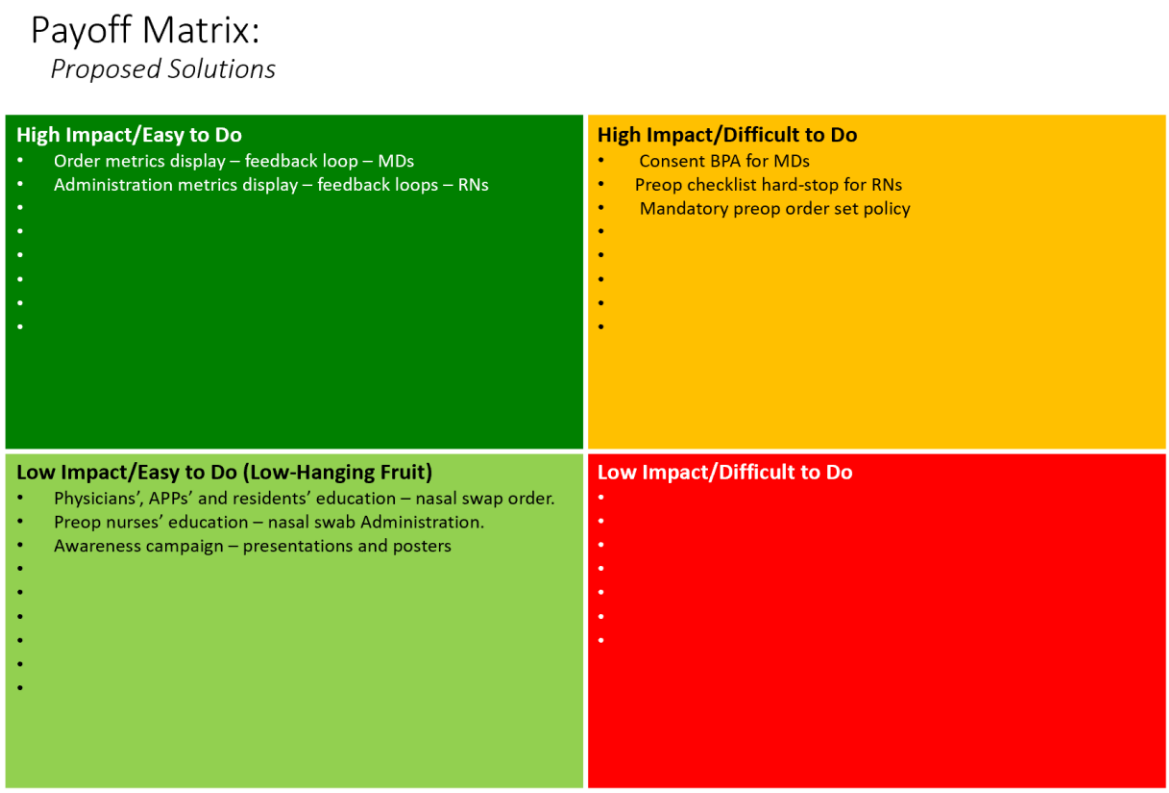

Figure 4: Payoff matrix.

To track the progress of this project, the team set out milestones and wins to be achieved at preset times. This is represented in Table 1 below:

Milestones	Timelines	Comments
Meeting with hospital leadership	10/01/2020	Completed
Approval of Project Manager	10/06/2020	Completed
Completion of baseline data analysis	11/11/2020	Delayed due to error. Completed on 12/18/2020
Formation of taskforce team	01/08/2021	Completed
Identification of interventions using QI tools	01/28/2021	Completed
Completion of first cycle of PDSA	02/28/2021	Completed

Table 1: Project timelines.

Through this pilot project, the team aimed to increase the composite order and administration compliance rates of preoperative povidone-iodine nasal swab for neurosurgery and vascular surgeries at KHMC by five percentage points by April 30th, 2021. The secondary goal was to reduce the current composite rate of SSIs in the vascular surgery and neurosurgery units by 30% by the end of June 2021.

Scope

The scope of data for this project was the minimum amount of data required to achieve the project's aim. At baseline, the composite order compliance rate of the vascular and neurosurgery service lines at KHMC was 79.5% while the administration compliance rate was 72.29%. To achieve the five-percentage point increase in each of the above metrics, it was important to recognize that there were three concepts in this project aim, and these include order compliance,

administration compliance and patient harm (SSIs). The team focused on data that measured the following:

1. Process measure: 90% or more of ordering providers and preoperative nurses were educated on povidone-iodine nasal swab by April 30th, 2021
2. Process measure: at least 30% of all fired BPA are opened by ordering providers by April 30th, 2021
3. Process measure: at least 70% of preoperative nurses used the administration verification reminder by April 23rd, 2021
4. Outcome measure: at least a five-percentage point increase in the number of surgery patients that have an order for and received povidone-iodine nasal swab preoperatively by April 30th, 2021
5. Outcome measure: reduction in the composite rate of SSIs in the vascular and neurosurgery patients at KHMC by 30% by June 30th, 2021
6. Balancing measure: no decrease in staff satisfaction with introduction of cognitive aid in the processes of ordering and administration of nasal swab

Given that the case volume of vascular and neurosurgeries are not excessive, after interventions the team collected 100% of the desired data for device-related surgeries in these specialties. The team obtained retrospective data for spinal surgeries, total knee arthroplasties, total hip arthroplasties, coronary artery bypass graft (CABG) and cardiac valve surgeries, and vascular surgeries for the period of almost three years (Jan 2018-Nov 2020) to determine whether the pre-op intranasal povidone-iodine prophylaxis for *S. aureus* was administered prior

to surgery. For each surgery that falls under the domain of one of the previously mentioned surgery types, the data elements collected are show in table 2.

Data Collection: Data elements for preoperative povidone-iodine nasal swab

	Spinal surgeries	Orthopedics (total knee arthroplasties and total hip arthroplasties)	Cardiac surgeries (coronary artery bypass graft (CABG) and cardiac valve surgeries)	Vascular surgeries
Date/Time of Surgery				
Campus				
Name of Surgeon				
Surgery Procedure Name				
CPT Code(s)				
Date/Time of Pre-op Intranasal Povidone-Iodine Prophylaxis for *S. aureus* administration				
Did patient suffer ANY surgical site infection post-surgery and if so, what type of site infection?				
Was Pre-op Intranasal Povidone-Iodine Prophylaxis for *S. aureus* unchecked in the order set prior to surgery?				
Title/Name of person who administered nasal swab				

Table 2: Data elements for preoperative povidone-iodine nasal swab

The baseline data were sourced from the data analyst who is an Epic reports analyst and is part of the Information Systems (IS) team. The data were stored in an uncompressed and unencrypted Excel file in a KH computer behind a KH firewall protection. These baseline data were organized and interpreted by the project manager from the Process Excellence department. Pre-intervention qualitative data were also obtained from staff of the clinic and preoperative area through interviews. Post-intervention, the team collected the above data elements and monitored the effect of the interventions. The data were analyzed on a weekly basis for real time

monitoring. At the end of the intervention, staff satisfaction surveys were conducted using a combination of Likert scale and qualitative information. The data on the Excel spreadsheet were organized into bar charts, pie charts, pareto diagrams, line graphs and run charts. The project manager was responsible for data collection, data organization and analysis.

Data collections require specific details for standardization purposes. In the absence of such specifics or operational details, data collected will be difficult to interpret or will introduce problems of validity and reliability. To ensure accuracy of data collection, operational definitions were established including the specific number of educational programs attended by a staff which were then recorded as met criteria, and documentation of ordered and administered nasal swabs. Data in Excel were cleaned, and statistical analysis performed on the data with MiniTab and/or STATA. To achieve valid statistical inference, the data were either normally distributed or there were enough observations ($n>300$) to leverage the Central Limit Theorem to ensure asymptotic normality. Since there has not been a study to document compliance with preoperative povidone-iodine nasal swab in the surgery types of focus, benchmarking with external data was not possible. Internally, benchmarking was done with the performance in the years preceding the intervention. Regarding SSIs, internal SSI rates in the year preceding intervention were used for benchmarking.

Other approaches to ensure reliable data included use of a project manager who is well trained in data collection to collect the data. The collected data were stored electronically in a computer and detailed notes on data storage were kept by the project manager and the project owner. The data was de-identified and stored on an external drive.

The process and outcome data of this project will be disseminated at the end of August 2021. This will be done passively by posting the above data on the hospital website and LinkedIn page. The data will also be submitted to journal articles for publication. The budget for this project was covered by the office of the OR director at KHMC, although most of the participants of the project are volunteers.

Stakeholders

In conducting this project, the team was aware that the interventions involve the input of other microsystems within the complex healthcare system, and they will also have downstream effect on other microsystems and activities. As a result of this, the team conducted a stakeholder's analysis to anticipate potential barriers and determine mitigating strategies to ensure sustainability. At the same time, the team worked within the confines of hospital policies as well as the provisions of regulatory bodies. The stakeholders in this project include the personnel involved in the care of the patient and all other individuals or bodies with an interest in SSI. Stakeholders can be internal or external.

Internal stakeholders

Internally, the stakeholders include the hospital leadership and administrators who showed leadership by example through active participation to reinforce trust and credibility as well as common goals. They were also expected to help the team with removal of barriers, addressing the frontline team's concerns and encouraging hard work. Hearld et al. (2012) showed that a strong alliance is promoted by leadership credibility and trust. One of the operational strategies of the team is to bridge the communication gap between the leadership and the frontline staff. To

achieve that, the team included the members of the frontline staff in the task force. This created the opportunity for closer collaboration in co-designing interventions to achieve shared goals while promoting the leadership credibility and further strengthening alliance. The frontline staff, including surgeons, trainees, and nurses, were motivated by the visible leadership that was shown during this initiative. There was reassurance that the frontline team was in lockstep with the leadership on the initiative. There was a sense of purpose through having a voice in co-designing people-driven processes in which everyone worked for the ultimate benefit of patients and the community.

The project manager is from the Process Excellence department, which has an advisory role to guard against the team's activities from conflicting or duplicating the activities of other ongoing projects in the hospital. The team also partnered with the medical informatics department that assisted with developing the BPA as a cognitive aid to ensure compliance with ordering and administration of the povidone-iodine nasal swab preoperatively and at the right time. The concern of having an additional click on the computer which could be a burden to the frontline team was minimal, as the intervention was suggested and accepted by the frontline team members. That was the intention of the team, to co-design people-driven practical solutions to address the problems that were also identified by people in their workspaces. The result of this approach was that the frontline team owned the success of the initiative. Table 3 shows the internal stakeholder analysis table.

Internal Stakeholder Analysis

Stakeholder (Name or Group)	Strongly Supportive	Supportive	Neutral	Against	Strongly Against	Issues/ Concerns	Influence Strategy
Surgeons		X				- Limited knowledge of preop povidone-iodine swab. - Insufficient time to get education on swab - Paternalistic approach to planned intervention. - Inadequate leadership support. - Question of value added	- Educational sessions will be provided. - Departmental meetings will be used for education. - Leadership are sponsors of the project and are already engaged. - Taskforce will include the surgeons and the leadership - Ultimate excellent outcome for surgery patients.
Nurses				X		- Limited knowledge of preop povidone-iodine swab. - Insufficient time to get education on swab - Paternalistic approach to planned intervention. - Inadequate leadership support. - More work to do - Throughput concern	- Educational sessions will be provided. - Departmental meetings will be used for education. - Leadership are sponsors of the project and are already engaged. - Taskforce will include the nurses and the leadership - Ultimate excellent outcome for surgery patients. - Use of technology to make work seamless.
Non-clinical staff/Secretaries			X			- Additional responsibility to organize meetings. - Increased correspondence	- Information will be incorporated into usual meetings

Stakeholder (Name or Group)	Strongly Supportive	Supportive	Neutral	Against	Strongly Against	Issues/ Concerns	Influence Strategy
Support staff – Process excellence/IT/Informatics	X					- Clinician's resistance to changes. - Additional work to develop new process.	- Clinicians will be well educated. - Clinicians and support staff will be part of taskforce to develop common goals. - Reputation for superior performance.
Hosp Administration and leadership	X					- Clinicians may not engage. - Limited resources.	- Leadership by example will communicate strongly to clinical providers. - Efforts to make provision of resources available and open/honest explanation of limitations. - Genuine and honest conversation to address providers' concern. - Recognizing providers hard work and celebrating wins is important.
Patients**		X				- Concern of effectiveness. - Concern of irritation and discomfort.	- Educate patient on effectiveness. - Decrease length of stay (LOS). - Decrease morbidity and better outcome. - Improved personal and community health. - Lower cost in the long run.

Table 3: Internal Stakeholder Analysis

External stakeholders

As noted earlier, SSIs account for the largest cost of the five most common HAIs and causes significant morbidity and mortality. Efforts are continuously being made to address the problem

of SSIs. Five days preoperative treatment of nasal colonization with MRSA using intranasal mupirocin was not part of CDC's recommendation for prevention of SSI; instead, the CDC specifically recommended a whole-body soap bath at least a day prior to surgery for prevention of SSI (CDC, 2017). The CDC, through its National Healthcare Safety Network (NHSN) which is the nation's most widely used HAI tracking system, monitors HAIs including SSIs. NHSN provides facilities, states, regions, and the nation with data needed to identify problem areas, measure progress of prevention efforts, and ultimately eliminate or reduce healthcare-associated infections (CDC, 2017). To the best of the team's knowledge, the use of preoperative povidone-iodine nasal swab instead of mupirocin treatment is not in any regulatory body's recommendation but it is a promising strategy based on several studies (Philips et al., 2014; Anderson et al., 2015; Torres et al., 2015; Peng et al., 2018; Ghaddara et al., 2020).

The Centers for Medicare and Medicaid Services (CMS) does not financially penalize SSIs from vascular surgeries and neurosurgeries as it does with publicly reported SSIs from colon and total abdominal hysterectomies under the hospital-acquired condition (HAC) reduction program (CMS, 2020). However, it has been an area of interest and focus of CMS leading to the development of SCIP, and there have been debates on whether CMS should revive SCIP for prevention of SSIs (Yokoe, 2017). Nasal *Staph aureus* colonization increases risk of MRSA bacteremia by almost 20-fold (Marzec and Bessesen, 2016). Most cases of MRSA bacteremia are secondary to a primary site of infection which include SSIs among others (Klevens et al., 2007). MRSA bacteremia is one of the domains of the safety of care for CMS stars (CMS, 2021). Although CMS stars do not have a direct financial penalty, MRSA bacteremia has significant reputational downstream impacts (CMS, 2021).

Barriers

One of the early observations that was made was that when the nasal swab was introduced in 2016, there was a disconnect between the frontline team and the taskforce responsible for the implementation and roll out of the preoperative nasal povidone-iodine swab. There was also the challenge of how to select an appropriate mix of intrinsic and extrinsic motivating interventions that would give optimal results. Therefore, an important approach was to include the frontline surgeons and preoperative nurses in the project team to improve awareness and engagement. Adding frontline staff to the project team also helped them in seeing how the work of frontline staff contributes to the success of the project and creates a sense of purpose. After identifying the service lines to use for the pilot project, early adopters in those service lines were identified. Two surgeons and three nurses each from the inpatient and outpatient preoperative areas as well as the preoperative area nurse manager were included in the task force. This provided an invaluable insight into the barriers and practical solutions to the problems identified during multiple brainstorming sessions.

Having conducted the root cause analysis using the fishbone diagram and the 5-WHY's and constructing a driver diagram, the team arrived at three main areas of focus: increasing ordering of the preoperative nasal povidone-iodine; increasing administration of the nasal swab; and ensuring accountability. The interventions are prioritized using a payoff matrix as shown in Figure 4. To achieve this increased compliance, three strategies akin to those deployed by Barve and Kruer (2018) were used. Barve and Kruer (2018) accomplished a set goal using three components of daily management including 1) alignment of goals and efforts; 2) visual data management, daily huddles and problem-solving; and 3) leader standard work. In this project, the team aligned goals and efforts through presentations, awareness campaigns and education in the

vascular and neurosurgery service lines. The team presented at staff meetings to raise awareness of the process and educate staff of its significance as well as highlight upcoming interventions such as the BPA. The team also created posters for common areas including physician lounges, changing rooms and other notice boards as well as nurses' breakrooms and notice boards. Other educational components included creating a HealthStream module, a mandatory annual web-based learning for staff. The formal education and awareness campaign began February 3, 2021. Data were collected and the impact of the education was evaluated in mid-March 2021.

The BPA was developed and initiated on April 6, 2021. The BPA ensured that surgeons do not bypass the order set when entering preoperative orders. In the preoperative order set, the nasal povidone-iodine order has been prechecked and the use of preoperative order set automatically ensures that the povidone-iodine will be ordered unless the ordering provider deliberately unchecks it. At the preoperative area, another cognitive aid, an administration verification reminder, will flag for the nurses if administration of the nasal povidone-iodine swab has not been checked to indicate that it has been administered. The introduction of administration verification reminders was delayed due to concerns about throughput in the preoperative area. To overcome this concern, a manual administration verification reminder was successfully piloted for four weeks from March 29 through April 23, 2021. This validated the process, and it was eventually approved for build on to Epic.

Accountability was ensured through the physician and nurse champions as well as other leads. The team created simplified performance graphs for the rate of attendance of educational sessions and presentations, percentage of staff that completed HealthStream module, the percentage of BPA that were opened, the percentage of nurses that utilized the administration verification sticker, the compliance rate with surgeons ordering nasal swabs and the nurses'

administration of the nasal swab. These visual data were displayed in strategic locations where daily huddles take place and used in real time for planning and modifications to improve outcome. The project owner, project manager and senior leadership rounded at intervals to provide visible leadership for the project and create the mental connection that reassures the frontline team of the leadership's support for the initiative. The senior management is currently addressing policy changes to mandate use of the KH preoperative order set for appropriate surgeries. Scaling the project network-wide has also been approved.

Financial considerations

In addressing the problem of SSIs in device related surgeries, there was an overhead cost. The main cost was for printing awareness campaign posters. Fortunately, the effort to optimize the use of povidone-iodine nasal swab to reduce SSIs received the support of the leadership and the cost was easily absorbed by the OR director's office. Ensuring leadership and staff buy-in to improve engagement earlier in the project positively influenced individuals to volunteer their time and as such saved cost. In the long run, the financial benefits of decreasing the rate of SSIs will come from savings made from the reduction of SSIs.

Results

The pilot study spanned from October 2020 to April 2021. It was conducted in steps starting with current state analysis from October to December 2020. During this time, baseline data of device-related surgeries in orthopedics, neurosurgery, vascular surgery, and cardiovascular surgeries in the entire Kettering health network were obtained. The data which ranged from January 2018 to November 2020 were analyzed. The rate of order and administration compliance of preoperative povidone-iodine nasal swab were 84.85% and 76.64% respectively (Appendix 2). When preoperative povidone-iodine nasal swabs were ordered, they were administered 86.81% of the time. Surgical site infection occurred in 0.82% of these selected surgeries and the probability of infection was reduced by about 69% when nasal swabs were administered (Appendix 2). Further analysis of the data drilled down on the specialties and hospital with the highest opportunities for improvement. The cardiovascular unit had the lowest order and administration compliance rates; however, the number of surgeries in this unit was small, with only 53 over the period under review. The vascular and neurosurgery units had some of the lowest order and administration compliance rates, but both had significantly larger number of surgeries, 1926 and 4347 respectively (Appendix 3A). In the vascular surgery specialty, the order compliance rate was 79% and administration compliance rate was 50%, the second lowest rates. Neurosurgery order compliance rate was 82.31% and administration compliance rate was 76.88% (Appendix 3A). Of all the surgeries under consideration, 47.9% (9,258 surgeries) took place at KHMC. The overall order and administration compliance rates at KHMC for all surgeries were 83% and 76% (Appendix 3B). In the entire health network, the vascular and neurosurgery specialties contributed 70% of all SSIs in device-related surgeries (Appendix 4). The surgical site infection rates of vascular and neurosurgery specialties were 2.7% and 1%

respectively (Appendix 5A). The average SSI rate at KHMC was 1.02% which was the highest in the network (Appendix 5B). In view of these findings from baseline data, the vascular and neurosurgery specialties at KHMC were identified to have the biggest opportunity for improvement in the network. The pilot QI project was then conducted in these specialties at KHMC location.

In January 2021, the preoperative povidone-iodine nasal swab improvement taskforce was formed. The team brainstormed the root causes for suboptimal adoption of the preoperative povidone-iodine use as well as the interventions to apply. The strategy adopted was to sequentially apply multiple interventions focused on improving order compliance, administration compliance and increase accountability. To increase order compliance, the interventions included education, awareness campaign, and development of Best Practice Advisory, BPA (Appendix 6) in Epic for a cognitive aid and sustenance of the practice. In the educational programs, 86.3% (19 out of 22) of ordering providers attended the sessions (figure 5) which fell short of the project's goal. After the introduction of the BPA on April 6, 2021, there were 36 BPA firings in April. Thirteen ordering providers (36%) of those that received the firing opened the BPA and proceeded to use the preoperative order set for the planned procedure. Another nineteen ordering providers (53%) acknowledged the BPA but did not open it while only four (11%) canceled the BPA.

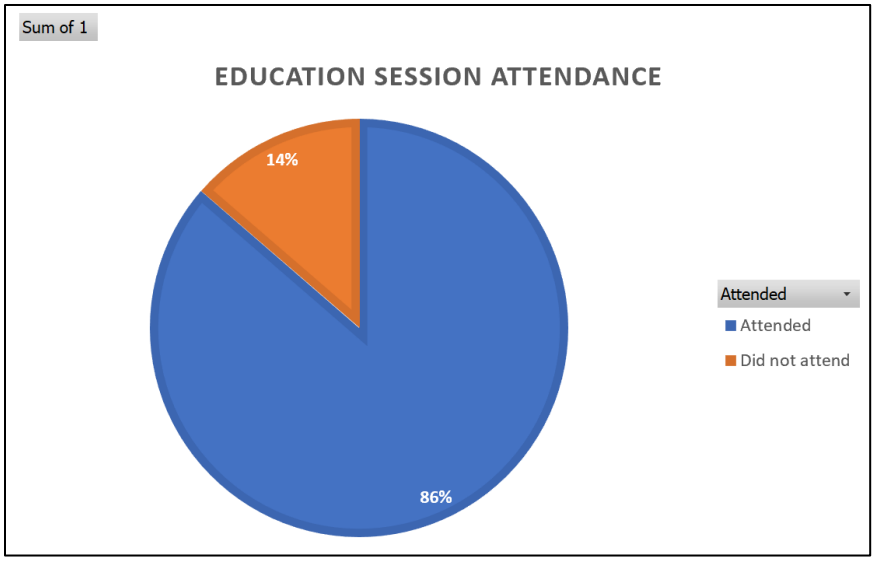

Figure 5: Education session: Attendance by ordering providers.

However, in the four months (January to April 2021) of applying these interventions in vascular and neurosurgery specialties at KHMC, the order compliance rate of preoperative nasal povidone-iodine swab improved from a baseline of 79.6% to a monthly average of 95.7%, over 3 Standard Deviations (SD) on the control chart. This exceeded the goal for this project of a five-percentage point rise by three-fold (figure 6).

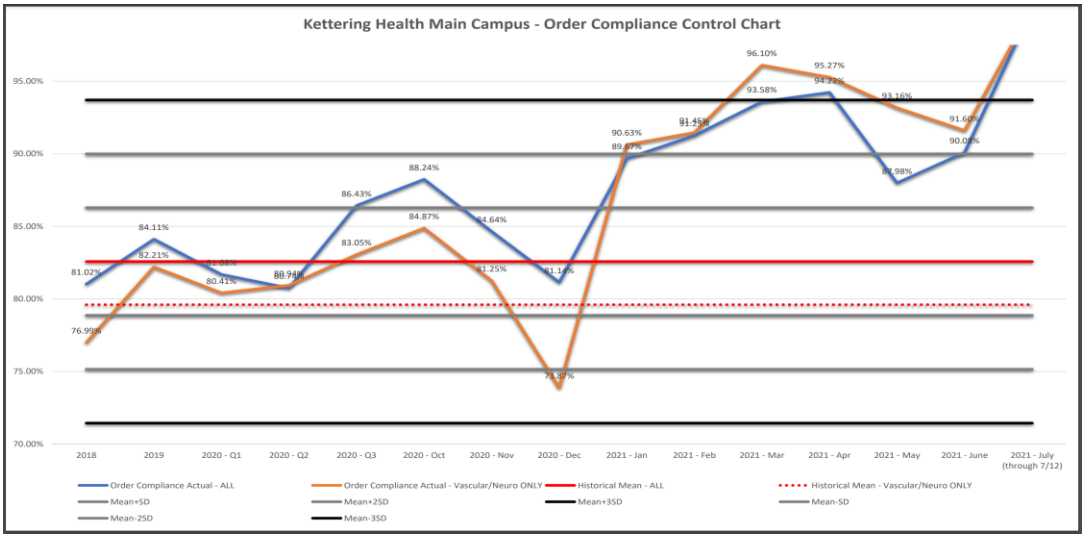

Figure 6: Order Compliance Control Chart.

Similarly, to increase the administration compliance rate, the interventions that were serially applied were education, awareness campaign and development of nurse's administration verification reminder that acted as a cognitive aid. 85.7% (48 out of 56) of nurses took the HealthStream educational course (figure 7).

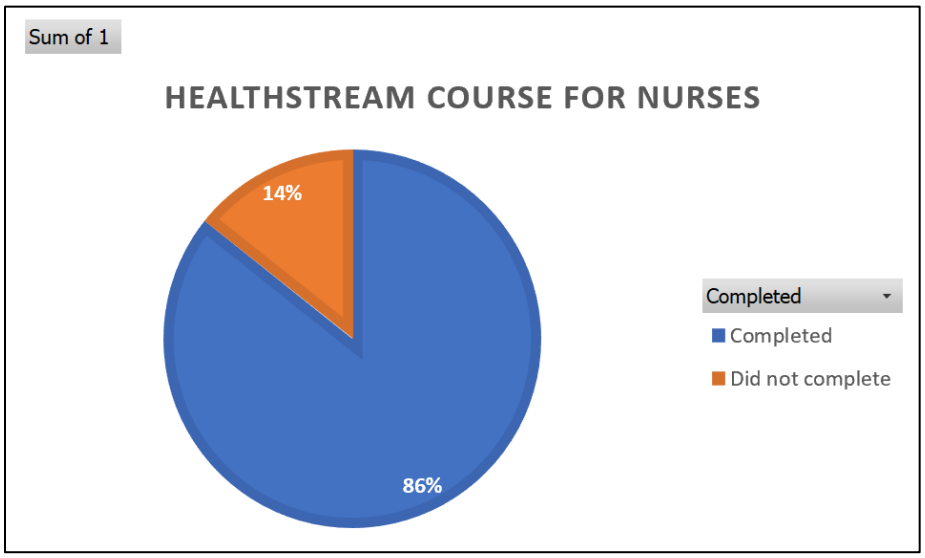

Figure 7: Educational Course for Nurses.

The introduction of the administration verification reminder was resisted by the nursing management for concern of slowing throughput in the preoperative area. To overcome this, the taskforce developed a manual administration verification reminder in which a nurse member of the taskforce volunteered to print out a list of all surgeries for the day. She supervised preoperative nurses who placed patients' identification stickers against the patient's name on the list, and signed, dated, and timed it when the nasal povidone-iodine swab had been administered. This was done before a patient was taken into the operating room. This manual cognitive aid was

developed with the intention to validate the process and it was applied for four weeks in March 2021. The rate of use the manual administration verification reminder in the inpatient preoperative area, with the highest opportunity for improvement, increased from 25% to over 95% within the first week of its introduction. This rate was sustained for the remaining time of the trial of the manual administration verification reminder. Between January and the end of April 2021, the administration compliance rate of povidone-iodine nasal swab in vascular and neurosurgery specialties at KHMC improved from historical mean of 72.29% to monthly average of over 80%, over 2SD on the control chart. This also exceeded the set goal of five percentage point rise by almost 2-fold (figure 8).

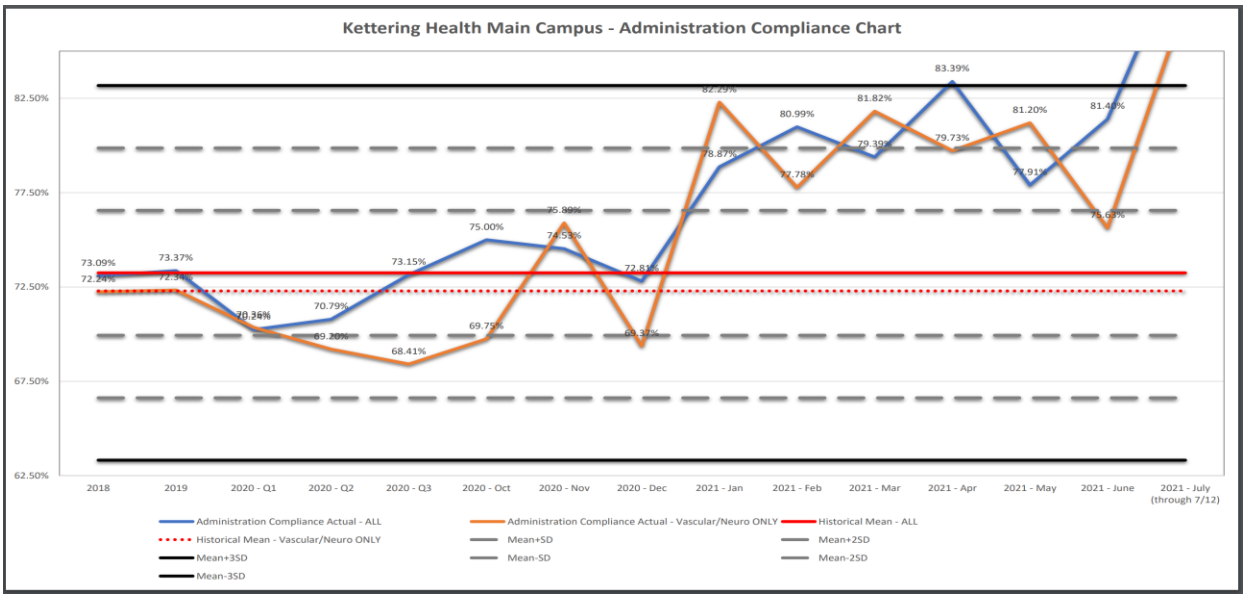

Figure 8: Administration Compliance Control Chart.

The lagging indicator and outcome metric of this project was the SSI rate. Over the period of the intervention, the SSI rate in vascular and neurosurgery specialties decreased by 70% (figure

9). This figure also showed that the decline in SSI rates in the pilot project correspondingly influenced the decrease in SSI rate of all specialties by 63% over the period of the project.

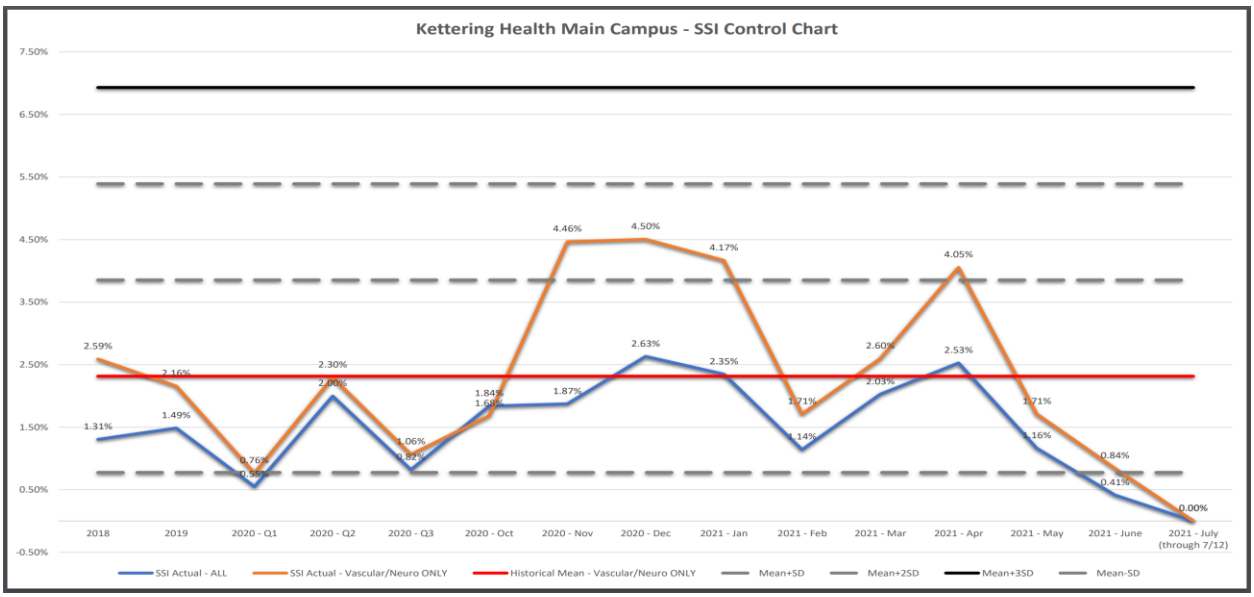

Figure 9: Surgical Site Infection Control Chart.

A post manual administration verification reminder intervention survey was conducted among the nursing staff and 25% of the nurses responded (Appendix 7). Less than a third (28%) of respondents reported that the process was either ineffective or highly ineffective in helping the nurses to complete the task (Figure 10). However, 93% of the respondents want the manual administration verification reminder developed into a hard-stop on Epic (Figure 11).

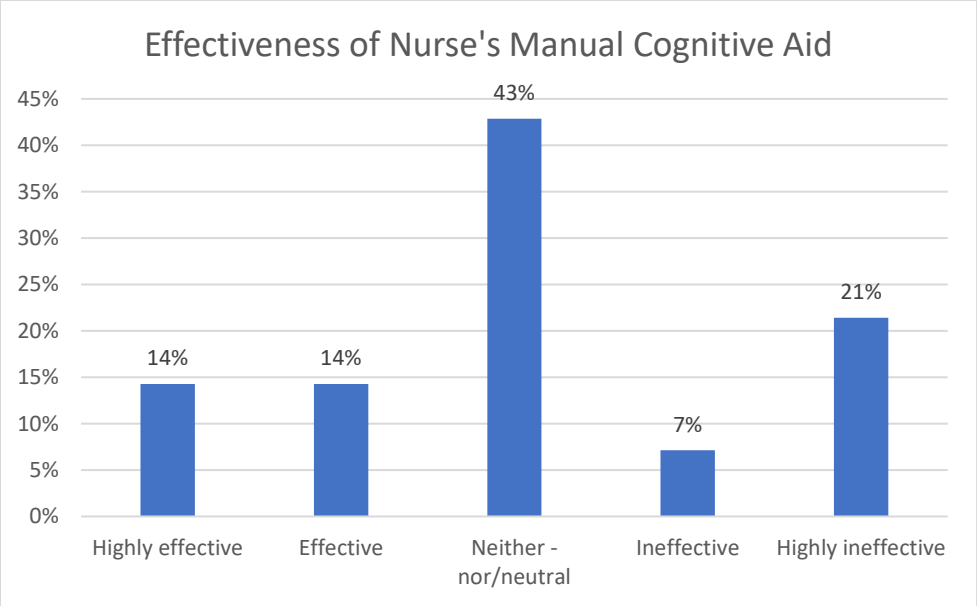

Figure 10: Effectiveness of Nurse's Manual Cognitive Aid

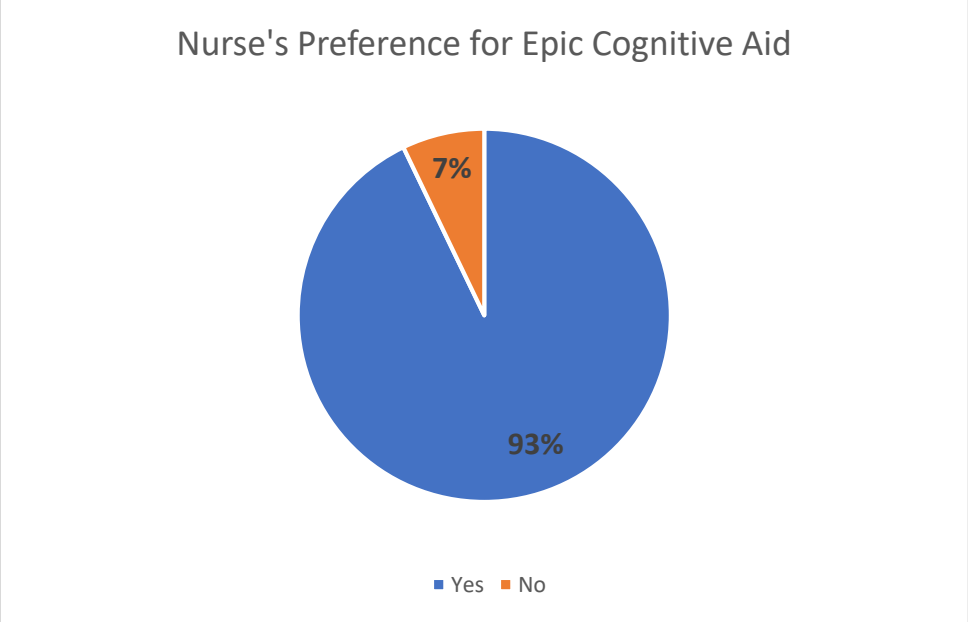

Figure 11: Nurse's Preference for Epic Cognitive Aid

The process and outcome metrics of this project were presented at departmental meetings and huddles as well as posted in strategic common locations such as break room, locker rooms, and preoperative areas notice boards. These acted as feedback loops that further motivated the staff. The results were presented to the perioperative surgical executive council (PSEC) quality subcommittee and later to the PSEC at large. The council has approved the building of nurses' povidone-iodine nasal swab administration verification reminder. Spreading the interventions to all relevant specialties and across all the campuses on the network was also approved on June 9, 2021. The implementation of the nurses' povidone-iodine nasal swab administration verification reminder will be followed by spread of the pilot project across the Kettering health network.

Discussion

Preoperative povidone-iodine nasal swab for the prevention of SSI was introduced at Kettering Health five years ago. For the past three years, doctors, residents, and APPs in vascular and neurosurgery at KHMC have been ordering the nasal swab at an average rate of 79.6% while preoperative nurses administer it at an average rate of 72.94%. While some physicians were not paying much attention to placing the order for the nasal swab to be administered, others were simply missing it out because they do not use preoperative order set. In the preoperative order set, the povidone-iodine has been prechecked. The physicians place orders individually and, in the process, forget to order the preoperative nasal povidone-iodine swab. When the ordering provider orders the nasal swab, nurses sometimes do not administer it because some of the experienced nurses are confident that they already know all that is ordered. As a result of this, some preoperative nurses do not refer to the orders. Some nurses are simply unaware of the nasal swab and its importance, and this results in either the swab is not administered or when pressed with time the nurses do not consult with the ordering provider who has mistakenly missed the order. The team identified that extensive education and awareness campaign as well as cognitive aids through system modification made it easier for the right thing to be done. Such system modification as BPA and administration verification reminder were considered necessary for introduction into the workflow of the ordering providers and the administering nurses respectively. In the four months of applying these interventions as well as sharing the process and outcome metrics in vascular and neurosurgery specialties at KHMC, the order compliance rate of preoperative nasal povidone-iodine swab improved beyond the goal for this project by three-fold, and the administration compliance rate improved by almost two-fold of the goal for this project. The composite SSI rate in the vascular and neurosurgery units at KHMC declined by

70 percent. This pilot project demonstrated that consistent use of preoperative povidone-iodine nasal swab reduced the SSI rate.

The outcomes of this project were mostly driven by evidence-based task force formation following stakeholders' analysis, and the subsequent successful engagement of the team as well as frontline staff. This was evident in the percentage of frontline staff that attended the educational sessions and took the training courses, although, the percentage attendance was below the set goal of 90%. The effective taskforce and the frontline staff engagement together with the interventions contributed to the success of this pilot project. The effectiveness of the team was ensured by the evidence-based team formation with members that cut across the stakeholders from leadership through to the frontline staff. The team does not only include members of management but also the frontline team members. It allowed for a healthy connection between leadership and frontline staff. The atmosphere in the team was that of a just culture that empowered everyone to speak out. The barriers to adoption of povidone-iodine nasal swab and the solutions to the barriers were proffered mainly by the motivated frontline team. The system Chief Safety Officer (CSO) provided visible leadership during this initiative and attended almost all the team's meetings. There was easy flow of information about organizational goals from the CSO to the frontline team. The governance structure for the project enjoyed great support and easy access to the senior leadership through the dedication of the CSO. The frontline team in turn experienced a sense of worth and purpose. Judson, Volpp and Detsky (2015) emphasized the importance of balance of extrinsic motivators and intrinsic motivators to produce optimal results in implementation of change. This project was almost devoid of extrinsic motivation other than thank you by word of mouth. In the absence of extrinsic motivator, it was apparent that the intrinsic motivation was prevalent in the team.

Bastian, Glasziou and Chalmers (2010) noted that evidence-based improvement and innovation in healthcare disciplines takes years to be adopted due to low rate of adoption and sustainability. The experience at Kettering Health was not different but the adoption of the new povidone-iodine nasal swab at KHMC was not optimal. Perhaps, the baseline intrinsic motivation and desire of the leadership and staff for quality care delivery were instrumental in the level of adoption of the new preoperative povidone-iodine nasal swab after its introduction five years ago. Hilton and Anderson (2018) highlighted the five recommended domains of practices that organizations can use to advance and sustain improvement which include unleashing intrinsic motivation, co-designing people-driven change, co-producing in authentic relationship, distributing power, and adapting in action. These were the guiding principles in the planning and operations of this project team.

Limitations

This pilot QI project has several limitations. First, a few months prior to applying the interventions, there was transition of all paper preoperative order set in the vascular clinics to electronic order set. The expectation was that this transition would lead to increases in order compliance of preoperative povidone-iodine nasal swab. However, the subsequent data did not support that expectation. The order compliance continued a downward trend several months after the transition. Upon the application of interventions of this project including educating the ordering providers, an awareness campaign and the use of a BPA, there was improvement in the order compliance rate. It is possible that a combination of the transition of paper order set to electronic form, the education and development of the BPA in Epic during this pilot project may have led to the improvement in order compliance. There was no statistical analysis to determine

if there was a possible relative impact of the transition from paper order set to electronic order set. Another limitation was that in January 2021 when the team began to brainstorm the barriers to compliance and the interventions, there was awareness among the frontline staff of the attention on compliance with use of the nasal swab. This awareness that the order and administration of preoperative povidone-iodine was under focus possibly led to increased compliance rate in the order and administration of the nasal swab prior to the application of the interventions. This was essentially a Hawthorne effect. The entire outcome of the QI project may not be a true reflection of the impact of solely the interventions. Additionally, the pilot project relied on the staff integrity that false documentations were not done for the administration of the nasal swab. It is possible that documentations were made that the nasal swab were administered when, they were not. Perhaps, the use of electronic Medicine Administration Records (MARs) to scan the administered nasal swab against the patient's record could have served better. Lastly, it is possible that the start of declining rate of COVID-19 virus infection in the community with intensified vaccination which coincided with the time of implementation of this project's interventions may have influenced the behavior of the frontline staff during their daily duty. This possible influence was not assessed in this pilot project.

Conclusion

In this project, it has been demonstrated that improving the use of preoperative povidone-iodine nasal swab through increasing order compliance by surgeons, residents, and APPs, as well as increasing administration compliance by nurses significantly optimized the benefits of povidone-iodine nasal swab such that a decrease in SSIs rate was achieved. The introduction of preoperative povidone-iodine nasal swab either equally prevented subsequent SSIs or it was

better in the prevention. It certainly reduced the cost for preoperative prevention of SSIs. Improving the compliance with preoperative povidone-iodine nasal swab translates to cost saving for hospitals by reducing cost of the preventive practice and translates to cost saving from decrease in SSIs. This should be of importance to the hospital administrators from a business perspective as well as from the perspective of organizational reputation in this era of value-based purchasing and national focus on HAIs.

The strategies for decreasing SSIs have traditionally been heavily reliant on provisions in clinical guidelines such as CHG bathing, preoperative antibiotics use, blood glucose control and temperature regulation. This project adds the evidence that an additional simple and inexpensive processes can significantly contribute to prevention of SSIs and add value to the surgical services provided. At Kettering Health, the spread of the interventions in this project to other service lines and across all campuses in the network has been approved. The sustenance of low SSI rate might ultimately depend on the continuous educational programs and on the cognitive aids (Epic BPA, and administration verification reminders) for the use of preoperative povidone-iodine nasal swab. Continuous quality improvement projects along the lines of use of the nasal swab such as trial of Medication Administration Records (MARs) for administration by nurses can further optimize the benefits of this new practice.

Hospitals in which preoperative povidone-iodine nasal swabs have been introduced and are not maximizing the benefits of the new practice due to suboptimal adoption can benefit from this project to optimize the adoption of the practice and its benefits. The interventions are simple and can easily be applied in organizations with computerized physician order entry or other computer systems that can fire a cognitive aid such as a BPA or administration verification reminder. That together with a well-targeted educational program are easy and relatively inexpensive

interventions to achieve a significant reduction in SSIs and by implication, a cost saving for a hospital while optimizing the quality of care delivered to patients.

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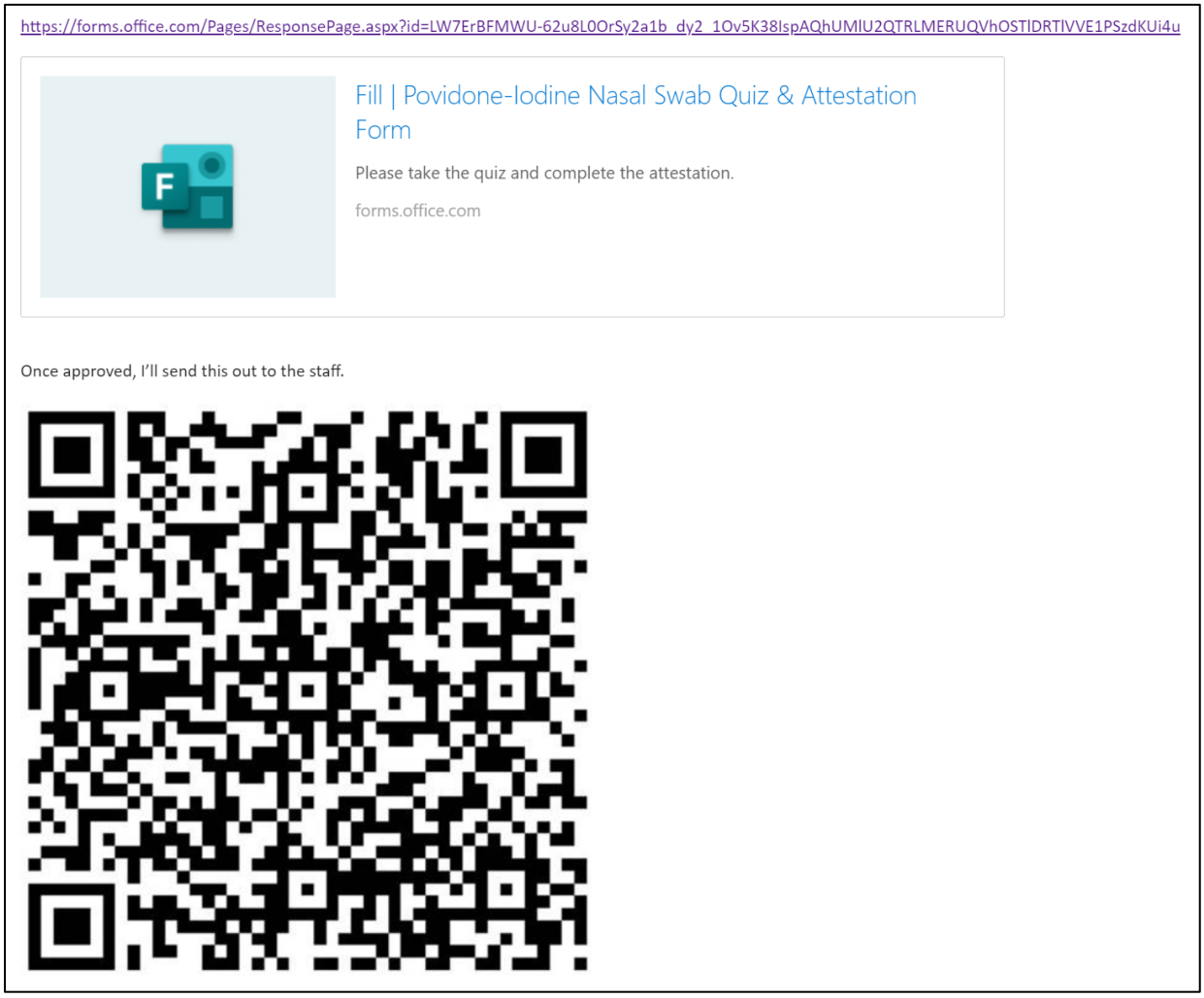
Appendices

Appendix 1: Microsoft Office Platform for Educational Course



Appendix 2: Network historical data

# of Observations (n): 19,330 Date Range: Jan 18'- Nov 20'

Key Findings

⇒ Ordered − to − Administer Compliance

Ordered?	Completed? 0	1	Total
0.00	2,352	576	2,928
1.00	2,164	14,238	16,402
Total	4,516	14,814	19,330

Swabs are administered for 76.64% of all surgeries.

$$\Pr(Swab\ Administered = 1) = \frac{14{,}814}{19{,}330} = .7664$$

When a swab is ordered, it is administered 86.81% of the time.

$$\Pr(Swab\ Administered = 1 | Swab\ Ordered = 1) = \frac{14{,}238}{16{,}402} = .8681$$

⇒ Administration − to − Surgical Site Infection (SSI) Relationship

SSI?	Completed? 0	1	Total
0	4,438	14,734	19,172
1	78	80	158
Total	4,516	14,814	19,330

Surgical Site Infections occur for 0.82% of all KHN surgeries.

$$Pr(Infection = 1) = \frac{158}{19{,}330} = 0.0082$$

$$\Pr(Infection = 1 | Swab\ Administered = 1) = \frac{80}{14{,}814} = 0.0054$$

$$\Pr(Infection = 1 | Swab\ Administered = 0) = \frac{78}{4{,}516} = .0173$$

The probability of infection is reduced by about 69% when swab is administered. [1]

[1] $\frac{\Pr(Infection = 1 | Swab\ Administered = 1) - \Pr(Infection = 1 | Swab\ Administered = 0)}{\Pr(Infection = 1 | Swab\ Administered = 0)} = \frac{.0054 - .0173}{.0173} = \frac{-.00119}{.0173} = -.6879 \rightarrow -68.79\%$

PROCESS EXCELLENCE

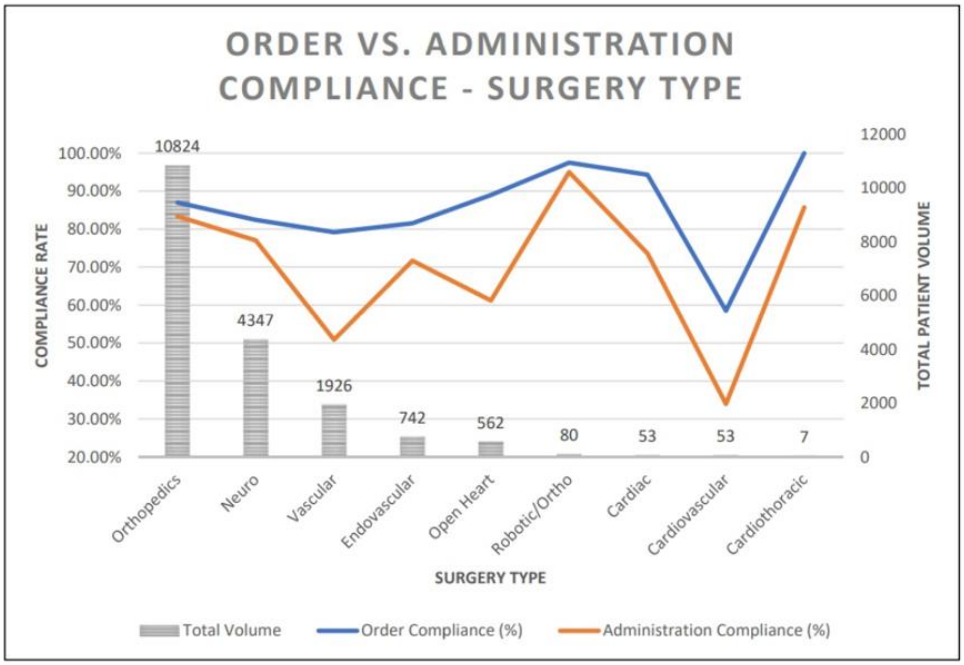
Nasal Swab Administration Compliance- 1

Appendix 3

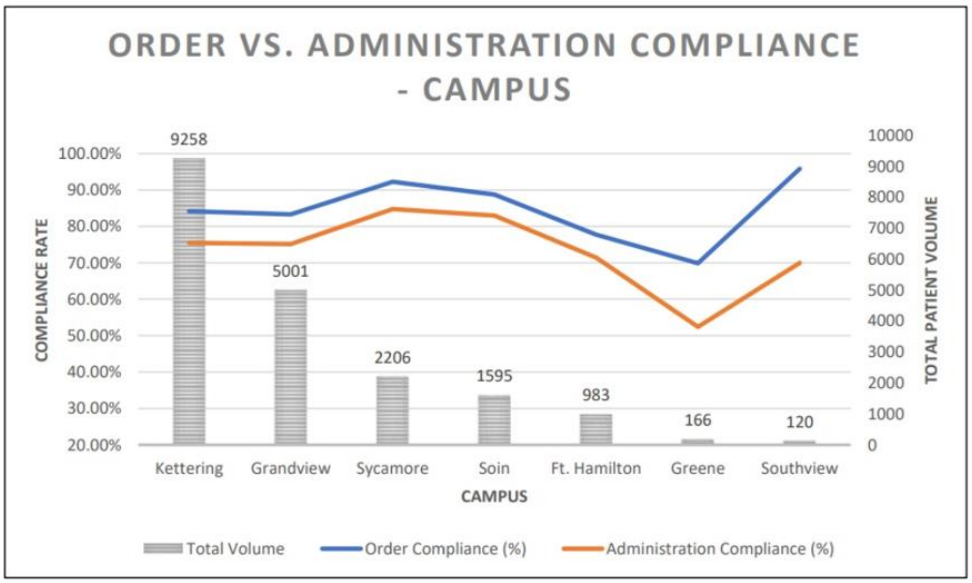
# of Observations (n): 19,330 Date Range: Jan 18'- Nov 20'

⇒ ***Nasal Swab Order Compliance Rate VS. Administration Compliance Rate***

A



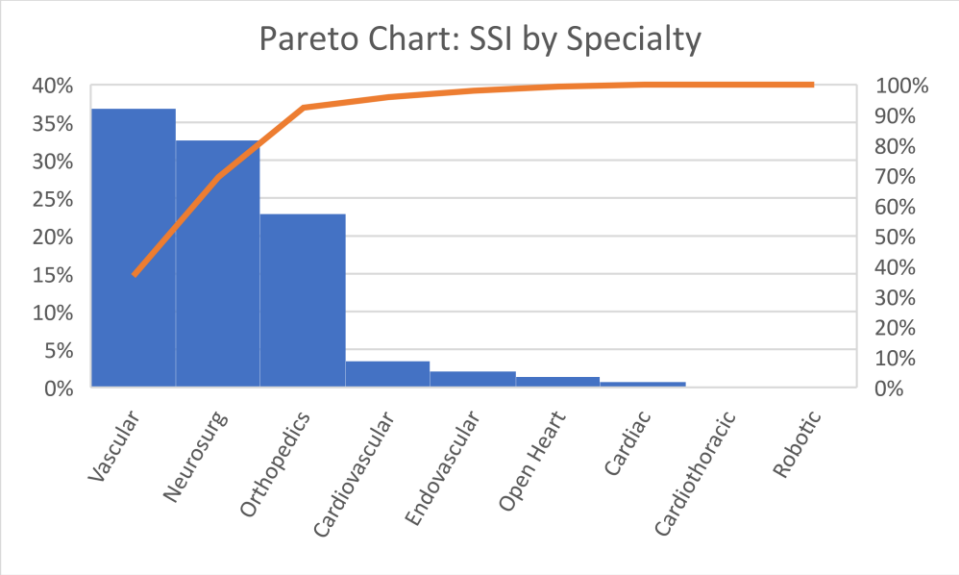
B



PROCESS EXCELLENCE

Nasal Swab Administration Compliance- 2

Appendix 4


Pareto Chart: SSI by Specialty
40%
35%
30%
25%
20%
15%
10%
5%
0%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Vascular
Neurosurg
Orthopedics
Cardiovascular
Endovascular
Open Heart
Cardiac
Cardiothoracic
Robotic

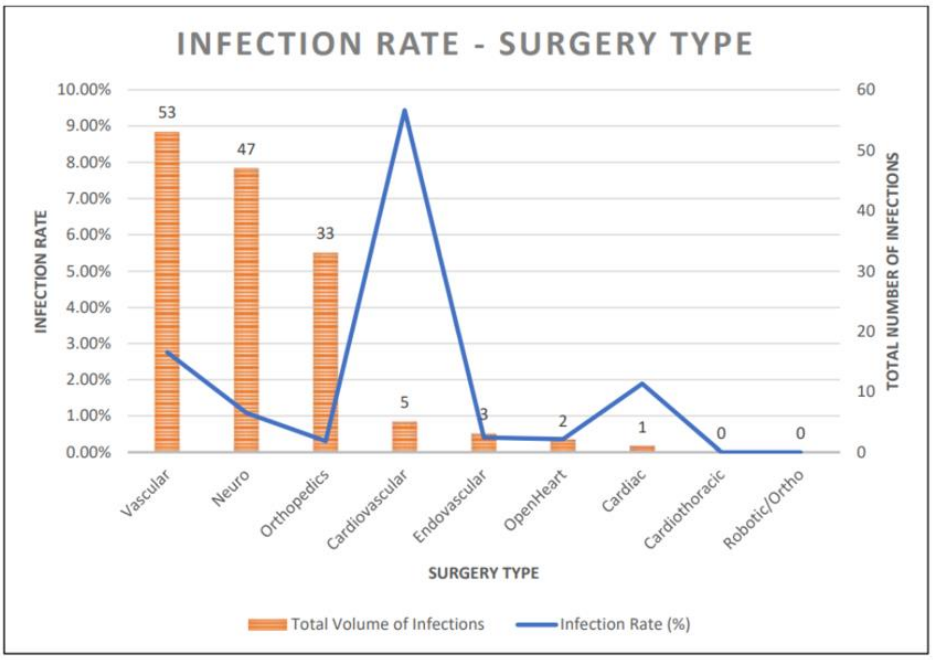
Appendix 5

# of Observations (n): 19,330

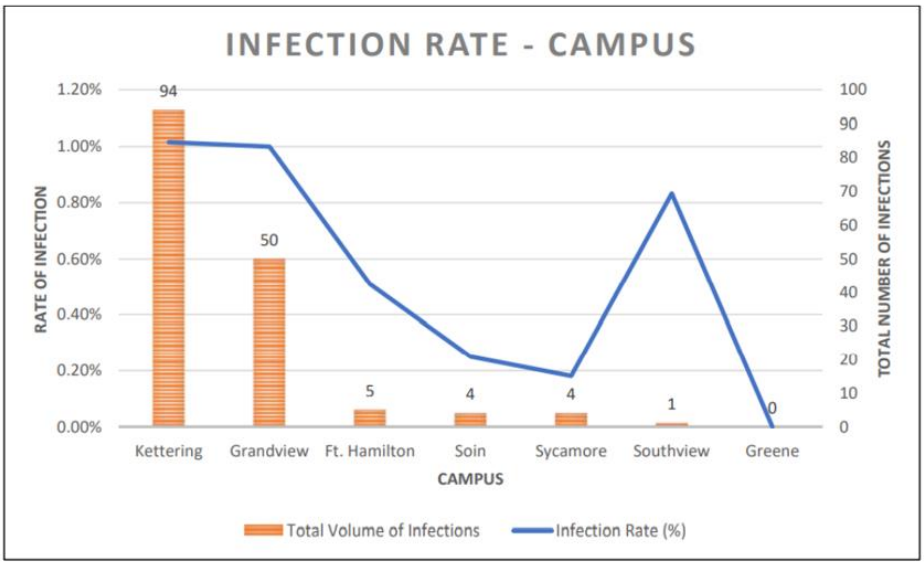
Date Range: Jan 18'- Nov 20'

⇒ ***Surgical Site Infection (SSI) Rate***

A



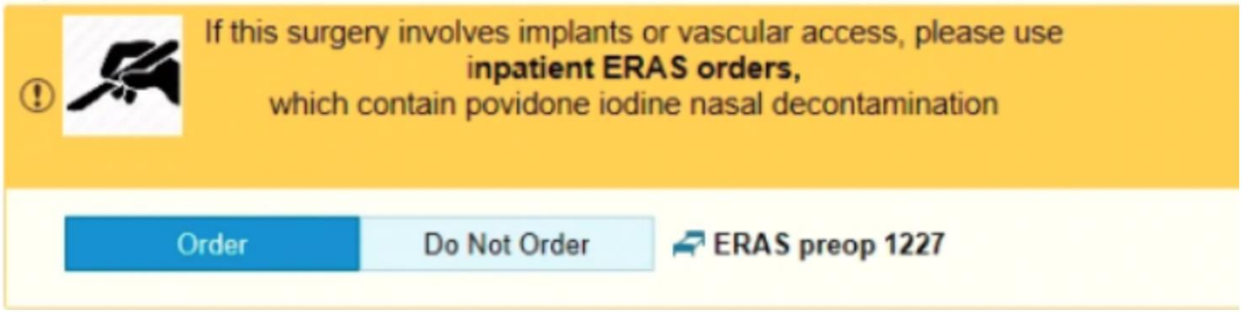
B



PROCESS EXCELLENCE

Nasal Swab Administration Compliance- 3

Appendix 6



Appendix 7

	F	G	H	I	J	K	L
1	How effective is the manual (paper) checklist at helping you co	The	The	Wha	Wha	Instead of a paper process hard-stop (like the one used in the pilot), do you think a hard-stop in EPIC would be more effectiv	What suggest
2	4 (Effective)	Neither	Agree	reminds	wastes	Yes	a reminder or
3	3 (Neither Effective Nor Ineffective)	Neither	Agree		anothe	Yes	
4	1 (Highly Ineffective)	Agree	Agree	none	waste	Yes	can't think of
5	3 (Neither Effective Nor Ineffective)	Neither	Neithe	If it wo	Just on	Yes	I believe a har
6	3 (Neither Effective Nor Ineffective)	Agree	Agree	nothing	just do	Yes	n/a
7	1 (Highly Ineffective)	Neither	Strongl	I guess i	Very in	Yes	Place a hard st
8	3 (Neither Effective Nor Ineffective)	Neither	Agree	I don't f	It slows	Yes	Creating a har
9	2 (Ineffective)	Neither	Neithe	valuable	extra w	Yes	ifn the family
10	5 (Highly Effective)	Agree	Agree	"hard st	Extra st	Yes	Cannot think
11	4 (Effective)	Agree	Agree	n/a	time co	Yes	n/a
12	1 (Highly Ineffective)	Strongl	Strongl	nothing	redund	No	none
13	5 (Highly Effective)	Disagre	Disagre	You had	There v	Yes	Have a "Time
14	3 (Neither Effective Nor Ineffective)	Neither	Neithe	n/a	n/a	Yes	n/a
15	3 (Neither Effective Nor Ineffective)	Neither	Disagre	its in fr	you car	Yes	Hard stop in e
16							
17							
18							
19							