The Impact of a Preoperative Screening Tool for Adults Ages 40 and older on Surgical Cancellations: A Quality Improvement Project

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Risk assessment, screening tool, surgical cancellation, older adult, preoptimization

Disciplines
Nursing

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The Impact of a Preoperative Screening Tool for Adults Ages 40 and older on Surgical Cancellations: A Quality Improvement Project

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Abstract

Patients ages 40 and older are at increased risk for postoperative complications but are often under-optimized preoperatively due to a lack of proper screening tools. The clinical question for this project was: In patients ages forty and older undergoing elective Otolaryngology (ENT) procedures, how does the use of a preoperative risk assessment tool compared to standard preoperative care influence the rate of same-day surgical case cancellations due to improper preoperative optimization? A pre- and post-implementation design was conducted at an academic medical center with ENT surgical cases. The primary outcome was the rate of same-day anesthesia-led cancellations. Eligible cases included patients forty and older undergoing elective procedures scheduled at least five days prior to surgery. The National Institute for Health and Care Excellence (NICE) tool was implemented preoperatively as patients were assessed by the team leaders. NICE tool recommendations were documented and reviewed by a Certified Registered Nurse Anesthetist (CRNA). The CRNA forwarded the recommendations to the ENT service. Data was collected for five weeks pre-implementation (n=107) and four weeks post-implementation of the NICE tool (n=109) to determine if cases were cancelled. Pre-implementation same-day anesthesia-led cancellation rate was 4.67%; post-implementation, the same-day anesthesia-led cancellation rate was 8.4%. Cancellations had no association with NICE tool implementation ($\chi^2(1) = 1.144$, $p = 0.285$).

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The risk of mortality in the perioperative period has been shown to increase linearly with age (Smetana, 2020). The use of an appropriate preoperative screening tool can assist in risk stratification of patients to ensure they receive a comprehensive preoperative evaluation and appropriate allocation of resources including consultations, diagnostic testing, imaging, and optimization. Early identification of specific patient needs and tailoring of preoperative care may prevent cancellation of cases due to the need for further assessment and testing preoperatively. Many preoperative risk stratification tools tend to focus on the geriatric population (ages 65 and above), but few target the ‘older adult’ population (i.e., over the age of 40) that also includes the geriatric population. This age group is therefore vulnerable and at an increased risk for morbidity with no well-defined screening tool to assist in preoperative risk screening.

Background and Significance

Perioperative risk assessment is a critical component to an individualized anesthetic plan of care throughout all stages of the operative period. In addition to providing an algorithmic approach to quantifying patient risk, the use of a preoperative risk stratification tool can predict immediate and extended postoperative period risks and indicate risk reduction steps to be taken in the preoperative period. A standardized risk stratification tool is a readily available adjunct to the standard preoperative anesthesia patient interview and physical exam that can highlight abnormalities in the patient’s condition that require additional attention. More importantly, these tools focus on patient factors rather than surgical factors to determine the potential risk for adverse patient outcomes (Ajitsaria, 2018). By preoptimizing a patient, ideally an individualized plan of care can be created and same-day surgical cases cancellations due to the need for further testing will be avoided. This additive feature of a risk stratification tool and resulting risk optimization and reduction is congruent with the project site’s Enhanced Recovery After Surgery (ERAS) program that prioritizes a reduction in the rate of postoperative complications, shorter
length of stay, and lower patient healthcare costs. This site therefore provided an opportune environment to institute a preoperative risk stratification tool that aligns with the hospital’s ERAS goals.

**Problem Statement**

Elective procedures are increasingly common in both inpatient and outpatient settings across the United States (National Quality Forum, 2017). A large portion of patients undergoing these procedures include a vulnerable age group of patients 40 years old and older, who are at an increased risk for postoperative complications and morbidity as they age but are often under-optimized prior to surgery due to a lack of proper screening tools (Ajitsaria, 2018). A comprehensive and detailed tool that can be utilized and validated for all adults ages 40 and older undergoing elective surgical procedures is necessary to ensure that patients are safely assessed, prepared, and optimized prior to undergoing any surgical procedure. If a risk stratification tool is not utilized prior to surgery to identify high-risk patients, patients may not be optimized appropriately. If these poorly optimized high-risk patients are not detected prior to the day of surgery, this may cause a same-day cancellation of the surgical case. When this occurs, the indirect effects are increased organizational costs and wasted resources, both of which are critically important organizational concerns. The clinical question for this project was: In the older adult surgical population ages forty and older undergoing elective Otolaryngology procedures (P), how does the use of a standardized preoperative risk assessment screening tool (I) compared to standard preoperative care without a risk screening tool (C) influence the rate of same-day surgical case cancellations due to improper preoptimization (O) in the preoperative period (T)?

**Literature Review**

On September 5th, 2020, PubMed and Cochrane databases were searched after consultation with a research librarian at the University of Pennsylvania for guidance on high yield MESH and EMTREE terms targeting the purpose of the PICO question. The following search terms and combinations were used in the search fields for both databases: ("Risk Assessment"[Mesh] OR ("Risk"[Mesh] OR "Risk
Factors"[Mesh] AND (assess* OR evaluat* OR screen* OR measu*)) OR "risk assessment"[title])
AND (pre anesthesia OR Preanesthesia OR "Preoperative Period"[Mesh] OR "Preoperative Care"[Mesh]
OR preop* OR presurgical*) AND ("Elective Surgical Procedures"[Mesh] OR elective[title]) AND
("Postoperative Period"[Mesh] OR "Postoperative Care"[Mesh] OR "Postoperative
Complications"[Mesh] OR postop* OR postsurgical*) AND((y_5[Filter]) AND (english[Filter]) AND
(middleagedaged[Filter])).” This search resulted in 290 articles. Filters for the English language and
articles in the last five years were utilized for initial searches. After duplicates were removed, a total of
276 articles were identified. Articles were then screened by abstract for relevancy, resulting in a total of
90 articles. Articles were then excluded if they were not specific to preoperative evaluations for surgical
procedures, if they did not include older adults and/or the geriatric population, or if they were only
specified for use in cardiac surgical procedures. This resulted in a total of 22 articles as seen in the
PRISMA diagram (see Figure 1). Articles were divided amongst the three project leaders, and the design
and quality of the studies were assigned a level of evidence based on the Johns Hopkins Nursing
Evidence-Based Practice Research Appraisal Guidelines (Dang, 2017).

The articles were further evaluated based on the type of study, design, strengths, weaknesses,
prominent findings, and conclusions. Articles were excluded if they focused on cardiac or neurological
surgical procedures or if they focused on other ERAS protocol interventions such as nutrition or physical
therapy in the preoperative period for patient optimization. This resulted in a total of 12 articles included
in this integrative review. It should be noted that dividing articles between project leaders subjected this
review to potential bias due to the subjectivity of grading the evidence between the project leaders. The
most prominent themes derived from the 12 articles included assessments of standard preoperative
assessment tools and specific validated risk stratification tools, the importance of utilizing frailty and
mobility as predictors of postoperative outcomes, and the effectiveness of a preoperative clinic
assessment for risk stratification prior to the day of surgery. The table of evidence (see Table 1) highlights the significant findings of each included study.

**Risk Stratification Tools**

The current standard of care in regard to a preoperative assessment typically involves a physical assessment and review of systems at the surgeon’s office prior to the procedure, in conjunction with a brief review of systems on the day of surgery by a member of the anesthesia team. Typical markers used in this assessment include the American Association of Anesthesiology score (ASA) and the patient’s Body Mass Index (BMI); the higher a patient’s ASA score or BMI, the more at risk the patient is determined to be for perioperative complications. Reponen et al. (2017) aimed to compare these typical risk stratification tools to the use of patient reported data regarding their preoperative health status and mobility. This study found that patient-reported data was more predictive of postoperative complications and mortality, suggesting that nonspecific tools like the ASA and BMI risk stratification tools may not be individualized enough for older adults undergoing surgical procedures (Reponen et al., 2017). Standard preoperative measurements of risk stratification may not be specific enough for patients, particularly for those older adults who may otherwise appear healthy. A more in-depth risk stratification tool that facilitates patient involvement and assesses other aspects of health is necessary to optimize patients preoperatively for surgery.

Moonesinghe et al. (2013) conducted a systematic review to identify effective preoperative risk stratification tools and their use in clinical practice. The study found that the Surgical Risk Scale and the Portsmouth Physiological and Operative Severity Score (P-POSSUM) were more accurate risk stratification tools when compared against the use of ASA scoring. The P-POSSUM is much more complex and time-consuming for the provider than ASA scoring due to its large number of variables. However, this systematic review repeatedly proved that the P-POSSUM tool provides high predictive validity in identifying patients at risk for postoperative complications.
Frailty

Use of a comprehensive preoperative frailty assessment for older adult or geriatric patients undergoing elective surgery was a significant predictor of postoperative complications. The comprehensive geriatric assessment (CGA) included physical status, nutritional status, and cognitive status, in addition to other tests and labs. The CGA was validated by Abete et al. (2015) and Samuelsson et al. (2019). Choi et al. (2015) validated the use of the Multidimensional Frailty Score (MFS) and also included serum albumin and midarm circumference in their assessment, which additionally assesses nutritional status. Mrdutt et al. (2019) utilized a modified version of the MFS, the Modified Hopkins Frailty score (MHFS) and also supported the importance of assessing frailty in the older adult population. Similarly, Samuelsson et al. (2019) assessed nutritional status as a measure of frailty as well. Abete et al. (2016) added the number of preoperative prescription medications to their assessment as another means to stratify preoperative health status. All three studies found that a higher preoperative functional status in the elderly correlated with fewer postoperative complications and reduced hospital length of stay. Of note, Choi et al. (2015) excluded any patient with an ASA score of greater than two, while Abete et al. (2016) did not exclude based on ASA status. All three studies excluded emergency surgeries, as patients undergoing an emergent procedure are already at an increased risk for postoperative complications.

One study in particular, McIssac et al. (2019), assessed frailty by comparing three separate tools--the Clinical Frailty Score (CFS), the Fried Phenotype (FP), and the Frailty Index (FI). This study found that adding a frailty assessment to a standard of care assessment was significant for identifying high risk patients; specifically, it found that the CFS was the most accurate tool, correctly classifying 30-50% of patients at increased operative risk than otherwise previously determined (McIssac, et al., 2019). The significance of assessing preoperative frailty was validated in multiple studies and indicates that frailty is important in stratifying risk in the older adult population prior to undergoing surgical procedures.

Mobility
Similarly, another important finding from the literature was the use of preoperative mobility as an indicator for postoperative surgical complication risk. Both Galuser et al. (2020) and Kimodiki et al. (2020) utilized and validated risk stratification tools that focused on the older adult’s preoperative mobility. While Glauser et al. (2020) focused on the relationship between preoperative mobility and postoperative complications with the Risk Assessment and Prediction Tool (RAPT), Kimodikis et al. (2020) assessed the relationship between preoperative mobility and postoperative discharge planning related to postoperative complications with the Timed Up and Go (TUG) assessment. Both studies highlighted the significance of measuring preoperative mobility as a means to stratify risk for developing complications in the postoperative period for the older adult. This is a quick, cost-effective assessment tool that is significant in identifying higher risk patients in the perioperative period.

**Anesthesia Preoperative Assessment Prior to the Day of Surgery**

Blitz et al. (2016) sought to determine if an anesthesiologist-led preoperative clinic had a significant impact on improving patient outcomes in the postoperative period. Patients were selected for an appointment in the clinic if they were considered “high-risk” when assessed in the surgeon’s office with a basic screening tool. Low risk patients would meet with a nurse practitioner who was trained in a focused preoperative assessment, while high risk patients met with an anesthesiologist. The patients who were seen in the preoperative clinic had a lower rate of postoperative death than those who were not seen in the preoperative clinic. Interestingly, the patients who were seen were more likely to be older, have a higher ASA score, and be undergoing more high-risk surgeries than those who were not selected to attend the preoperative clinic.

Alternatively, Dogan et al. (2017) studied the usefulness of a cardiology consultation prior to noncardiac nonvascular surgeries (NCNVS). While cardiology consultations may prove helpful in preventing intra- or postoperative cardiac complications in patients undergoing a cardiac procedure, their effectiveness in NCNVS had not yet been proven. However, this study found that only about a quarter of
the patients referred to cardiology underwent any additional testing or change in their care prior to surgery and 2.9% of the cases were postponed or cancelled due to a cardiology recommendation, such as coronary stent implantation. Dogan et al. (2017) did not find any benefit in a preoperative cardiology consultation for those undergoing NCNVS, and in turn, unnecessary consultations could result in expensive and time-wasting tests with very little benefit. From this, it is suggested that a cardiac consultation may not be a necessary requirement for non-cardiac surgery workups for older adults undergoing elective procedures.

**Literature Review Conclusion**

From the literature review, factors that best identify at-risk patients include age, ASA score, preoperative mobility, and frailty. When discerning which preoperative risk stratification tool is most appropriate for use in the older adult population 40 years old and older, the tool should address one or more of these considerations to most accurately predict patient surgical risk and how to best individually preoptimize each patient. Perhaps most interesting and impressive for this implementation project was the evidence that an anesthesia-led preoperative clinic has a positive effect on postoperative outcomes for patients that are determined to be high-risk due to their ASA score.

**Organizational Assessment**

The project site previously had a preoperative clinic run by the anesthesia department where patient interviews, physical exams, and further work up were completed well in advance of patients’ surgery dates. Whether due to budgetary, staffing, or time management concerns, this preoperative anesthesia clinic was ended. This site was in the developmental stages of reintroducing a preoperative clinic with the goal of interviewing and examining patients in advance of their surgery date to determine risk factors and optimization methods that could be implemented before the receipt of anesthesia. The motivating factor for the initiation of this renewed anesthesia preoperative clinic was to decrease the rate of same-day surgical cancellations due to improper preoptimization, especially in the targeted age group of adults 40 and above, but younger than the defined geriatric age. While the reinitiation of this clinic is
currently in early stages with delays from the COVID-19 pandemic, there was a significant desire from the project site to determine if a preoperative risk stratification tool would be beneficial for their surgical patients. Risk stratification tools are often not targeted or not validated for the 40 years and older age group as they are not an “extreme of age”; however, surgical risk increases with age, and thus, this age group is vulnerable to postoperative complications (Ajitsaria, 2018). A risk stratification tool was desired for implementation to identify older, pre-geriatric adults who need additional evaluation before surgery in order to be properly optimized. The project leaders therefore decided to use the validated National Institute for Health and Care Excellence (NICE) preoperative screening tool for project implementation. The NICE tool was designed to be applied based on patient’s overall health status and the severity, or complexity, of the procedure. Based on NICE tool’s directed recommendations, the provider determines what preoperative testing, imaging, and/or consultations to complete. If the use of this risk stratification tool significantly decreases cancellations, this could bolster support for the renewed preoperative clinic.

The successful implementation of the risk stratification tool potentially benefits patients and all of the stakeholders involved in this project. Initial implementation of the risk stratification tool will begin with the Otolaryngology (ear, nose, and throat ENT) service due to the high volume of patients on this service, the large number of adults ages 40 years and older in this patient population, and a stated need for a more thorough patient assessment by the ENT surgeons. Therefore, the primary stakeholders for this project include the anesthesia providers at this hospital, which includes a private group consisting of medical doctors of anesthesiology (MDA) and Certified Registered Nurse Anesthetists (CRNA), the ENT surgical team for each patient, the Preoperative and Postoperative Anesthesia Care Units (PACU) and their staff, and the executive board at the project site. Currently, anesthesia providers conduct preoperative assessments on the day of the surgical procedure and rely on the surgical team to ensure that a patient is optimized with appropriate laboratory and diagnostic testing prior to their procedure. If not
properly optimized in advance, cases may be cancelled on the day of the surgical procedure resulting from the same-day preoperative assessment by anesthesia providers.

With project implementation, anesthesia providers at the project site would be caring for patients who have been effectively optimized to undergo the stress of both surgery and anesthesia. Optimized patients allow for a decreased chance of same-day case cancellations, decreased postoperative complications, and more rapid turnover of patients. This could possibly lead to an increased number of surgical procedures and potential cost benefits for patients, hospitals, and provider groups.

Because the preoperative clinic was not yet developed and in use at the time of project implementation, it was determined that implementation of the NICE tool would need to occur at an early step in the patient assessment process. Therefore, the project leaders decided to implement the NICE tool on ENT patients within one week of their scheduled surgical date. Recommendations from the tool were forwarded to the ENT service to be ordered prior to surgery. A potential barrier to the implementation of the risk stratification tool was ENT staff awareness and willingness to accept the provided recommendations from the project leaders due to the large volume of ENT patients and the potential increased workload and time commitment placing the orders. Another barrier was the timeframe between the patient preoperative interview and surgery date, as well as patient participation. If a patient has risk factors identified on the risk stratification tool but there is not adequate time for optimization or the patient does not actively engage in further surgical work-up, the employment of the risk stratification tool would be futile. Providing education to patients about the necessity and rationale for preoptimization procedures potentially reduces this barrier.

**Project Purpose**

The current standard of care preoperative risk assessments does not evaluate for unique risk factors of the older adult pre-geriatric patient population. Rather than making assumptions about perioperative risk based on age, patient self-reported history, or an isolated physical exam on the day of
surgery, a specific preoperative risk stratification tool for this population could be beneficial. The aim of this project was to implement a standardized and validated preoperative risk assessment tool that identifies at-risk patients ages 40 and older who require further work-up prior to their procedure. The ultimate project goal was decreasing same-day anesthesia-led surgical cancellations through adequate preoperative patient preoptimization.

**Conceptual and Theoretical Framework**

**Conceptual model**

The Iowa Revised Model for Evidence Based Practice presupposed the development and implementation of the PICOT question for this project. This model highlights a problematic trigger that warrants an evidence-based practice change and determines the level of the organization at which this problem occurs. Next, an interdisciplinary team with key stakeholders is developed both to conduct a literature review regarding the problem and to create a PICOT question that is relevant; it is key that this literature review must support the need for a practice change. With the support from the literature review, the intervention can be implemented in a small, controlled pilot program rather than initiating a complete institutional change. Project impact and sustainability analysis then occurs to determine if the project improved outcomes and if a large-scale adaptation is appropriate. With each implementation step, data collected must be thoroughly analyzed. Furthermore, it is imperative in this model that the project in question have a sustainability plan (Figure 2).

The implementation of a preoperative risk stratification tool aligns well with the Iowa Revised model. A project team was created that involved interdisciplinary members including the anesthesia team, the ENT surgical team, and the ENT preoperative advanced practice providers (APPs). A literature review of the developed PICOT question supported the need for the planned practice change. After examination of evidence and assessment of the need for implementing a preoperative risk stratification tool, it was established that there is sufficient evidence that preoptimization prior to undergoing a procedure under
anesthesia is beneficial in reducing postoperative morbidity complications and mortality rates. The NICE preoperative screening tool was selected and adapted to fit the needs of this project site. This adapted version was implemented in a pilot project for select preoperative ENT patients ages 40 and above. Data was collected and analyzed on this small-scale project, results were disseminated to determine if larger scale implementation is warranted, and a sustainability plan was developed.

The integration process began with the team noted above. As previously stated, buy-in from the preoperative prescribing providers was essential, as implementation was not possible without their involvement. NICE tool context-specific adaptations were implemented; information and education regarding the project purpose, the NICE tool function, and the project goals was provided to the ENT surgical team. Data was collected to determine if the use of the tool in the preoperative period prior to the day of surgery influenced anesthesia-led same-day surgery cancellations compared to a same-day preoperative patient interview and physical assessment. Same-day cancellations were determined to be the primary outcome variable to assess if patients were being adequately preoptimized, or if cases were being cancelled due to high-risk patients not receiving proper testing prior to their surgical date.

**Theoretical framework**

In Dimaria-Ghalili’s interdisciplinary middle range nursing theory entitled “Development of an Integrated Theory of Surgical Recovery in Older Adults” (2016), the phenomenon of the older adult population requiring unique preoperative considerations is addressed. Dimaria-Ghalili’s theory “Surgical Recovery in Older Adults” stems from a research project that highlighted differences in how young adults and older adults recover from surgical stress (2016). The theory relies upon the components of activators (such as undergoing surgery), reaction to the activator (surgical stress), consequences (recovery in each stage), and mediators (factors that affect all aspects of surgery and recovery).

The theory is largely rooted in Elliot and Elisdorfer’s “stress theory,” which evaluates interactions between an individual and the environment (Dimaria-Ghalili, 2016). Demaria-Ghalili’s theory
additionally considers mediators that can lead to variation in individual outcomes like nutritional status, frailty, or functionality. The Surgical Recovery in Older Adults theory relies heavily upon the idea that healing from surgical stress is an “energy-requiring process” and that this ability can be impaired with age due to these various overlapping mediators (Dimaria-Ghalili, 2016). The recovery phase is delineated into three independent phases-- early (from the operating room [OR] until discharge from the PACU), intermediate (from PACU to hospital discharge), and late (from discharge from the hospital to return to normal functional status). It should be noted that phases of recovery are typically prolonged for the older adult, indicating that their return to baseline often takes much longer.

The “Surgical Recovery in Older Adults” theory was used as a theoretical framework for this project initiative. It was applicable to the overarching ERAS goals at this project site, which prioritize enhancing postoperative recovery via preoptimization. It provided a foundation for the importance of focusing on preoperative optimization in the older adult population and was applied with the adult population ages 40 and older in this project. The evidence clearly indicates risk for postoperative complications is incremental, even among adults 40 years and older.

Many factors not traditionally examined in the preoperative period including nutritional status, functional mobility, and frailty are predictive of postoperative outcomes in the older adult population. However, these factors are often not evaluated prior to surgery and were not assessed at the project site preoperatively in a standardized process using a validated risk assessment tool. It is imperative that, for adults 40 years and older, a standardized risk stratification tool be utilized preoperatively to identify at-risk patients early on. If identified, these patients can be optimized prior to their scheduled procedure. Not only does this ensure that their postoperative surgical complication risk is as low as possible when entering the perioperative period, but it also decreases the likelihood of an anesthesia-led same-day surgical cancellation due to missing data points from preoperative testing.

Methods

Setting
The intervention was performed at a large, urban, academic medical center. Anesthesia services are provided by a private, physician owned anesthesia group, which consists of certified registered nurse anesthetists and physician anesthesiologists. This institution provides access to most surgical specialties with the exception of transplant and trauma. The hospital has 18 general ORs, two endoscopy suites, two electrophysiology labs, four vascular/cardiothoracic ORs, two cardiac catheterization suites, one transesophageal echocardiogram suite, three obstetrical ORs, and six short procedural unit ORs. Anesthesia is administered via a care team model with typical medical direction ratios of 3-4:1.

**Participants**

All patients ages 40 and older undergoing elective ENT surgery at the project site were eligible to be included in the implementation pilot with the NICE risk stratification tool. Patients assigned ASA categories 1-4 were included, but patients classified as ASA level 5 or 6 were excluded due to extreme severity of patient conditions not applicable to elective procedures.

**Intervention**

The practice change implemented was the application of a preoperative tool that guides providers in ordering laboratory tests, electrocardiograms, or other diagnostic tests preoperatively depending on the severity of procedure and health status of the patient. A preoperative risk stratification tool (Appendix D) that was developed and validated by the NICE was implemented for patients 40 years and older undergoing elective ENT procedures at the urban hospital.

The intervention first involved identifying the type of surgery the patient was having performed; each type of surgery was labeled as minor, intermediate, or major. The surgical severity was assigned based on the length of procedure, the type of anesthetic required for the procedure, the risk of blood loss, or the risk of vascular, neurological, or other detrimental injury. This determined which table in the tool was used for recommendations for the provider. Next, the ASA risk score was applied based on the patient’s individualized comorbidities and past medical history, and the provider finds the appropriate column in the table. Taken together, the chart highlighted the patient’s overall risk and suggested evaluation required prior to their procedure in order to best optimize the patient. The chart was color-
coded based on the need for certain commonly used assessments, including a Complete Blood Count (CBC), coagulation tests, tests to assess kidney function (RFT), electrocardiogram, and lung function/arterial blood gas analysis. While the structure of the tool itself was not altered, the NICE tool was originally developed in the United Kingdom (U.K.), therefore language was adjusted for differences in terminology to ensure that the tool would be well understood by the providers at the U.S. project site.

**Project Implementation Plan**

The NICE tool was implemented for patients 40 years and older undergoing elective ENT procedures at the project site. The pre-implementation process, as referenced in the Process Flow Chart in Figure 3, began with patients being seen at their surgeon’s medical practice office for an evaluation, diagnosis, and pending surgical plan. The project leaders accessed the weekly OR schedule and performed chart audits on all patients undergoing ENT procedures. While performing these audits, the project leaders assessed surgical severity and ASA score and determined what preoperative testing was recommended based on the NICE tool. A password protected Excel spreadsheet with all recommendations was used to communicate NICE-derived recommendations with the project faculty site lead expert CRNA, who reviewed and approved all recommendations. The CRNA then forwarded the NICE-derived recommendations to the preoperative APPs. Based on the recommendation from the tool, orders for further clinical testing were to be placed and completed.

Pre-implementation data from a five-week interval was abstracted for comparative purposes. A time length of five weeks for pre-implementation data collection was chosen due to the amount of holidays in the month of December, for which there were no scheduled cases. To make pre- and post-implementation data more comparable, the pre-implementation period was five weeks (21 days of data collection) and the post-implementation data collection was four weeks (20 days of data collection). This data was collected via an EPIC electronic health record (EHR), the electronic medical record database used by the project site. The project leaders utilized an audit tool (Appendix D) that assessed for same-day surgical case cancellations for all eligible patients on the ENT surgical service ages 40 and older. Daily chart audits were performed, including reviewing the daily “cancellation” section in the EHR to
determine if a case was cancelled. In order to be included in analysis, this cancellation had to be initiated by the anesthesia team and be related to the need for further preoptimization.

Implementation of the NICE tool occurred in Spring 2021 on patients undergoing ENT surgeries. The tool was implemented on these patients due to the high volume of patients on this service, the high-risk nature of many ENT surgical procedures, and the lack of preoptimization that ENT surgeons had cited as a frequent problem on their service. The project leaders reviewed the EPIC EHR schedule one week in advance to locate patients scheduled for an ENT procedure. If the patient was 40 or older, the chart was reviewed and the NICE tool was implemented by the project leaders. Due to the nature of pathologies requiring ENT surgery, there were multiple cases added on throughout the week. Additional NICE tool screening was completed up until Wednesday prior to the week of surgery. Cases added on after that timeline were excluded from this project as they would be considered more of an urgent or emergent procedure. There were no duplicate patients between the pre-implementation and implementation data collection groups. NICE tool results were input into a password-protected Excel database, which included Patient Medical Record Number (MRN), patient age, attending surgeon, surgical procedure, ASA Sore, surgery severity level, recommended preoptimization tests, and rationale for testing. This password protected document was forwarded to the CRNA for review, and then was sent to the ENT service for review and placement of preoptimization test orders by the APPs.

Measures and Data Collection Plan

The primary outcome measured was the rate of same-day anesthesia-led cancellations of elective ENT surgery due to inadequate preoptimization. This rate involved comparing the total number of anesthesia-led same-day ENT cancelled cases to the total number of cancelled ENT cases for a given day. Measuring this outcome permitted evaluation of a risk stratification tool and the effect of preoptimization on the rate of surgical cancellations. It was established in prior sections that patients over the age of 40 may not receive the appropriate preoperative assessment, evaluation, and diagnostic evaluation prior to their procedures. This leads to cases being cancelled in order for these necessary evaluations to be completed. By using surgical cancellations as the primary outcome, this project’s question was answered.
The reliability in measuring this outcome variable is largely dependent on consistent application and use of the NICE tool. The NICE tool includes two quantifiers that largely impact preoperative considerations: ASA score and surgical severity level. ASA scores are assigned based on severity of a patient’s systemic disease processes on an ordinal scale, ranking in severity from 1-4 on the tool (Appendix D). Surgical severity is also measured on an ordinal scale in terms of increasing severity based on procedure site, incision site, estimated risk of procedure, and estimated duration of procedure (Appendix D). It is essential that those implementing the tool properly assign an ASA score to ensure that the patient scores are accurate. Similarly, grading the severity of a surgical procedure is imperative for valid, reliable risk stratification. In order to ensure correct implementation, tool implementation was limited to the three project leaders. Reliability in terms of utilizing the NICE tool was maintained by only having the three project leaders implement the tool and audit; all three project leaders reviewed the tool together to discuss examples of all ASA and surgical severity scoring. Furthermore, the three project leaders collected all data for the first week of project implementation together for all patients in order to increase inter-rater reliability of the scores using the same criteria moving forward with implementation.

The validity of the outcome measure was dependent on the project leaders’ accurate determination of the cause of the surgical cancellation for each case. To strengthen validity, only cases that were cancelled due to an anesthesia-led decision for further preoperative testing were considered. Each case was scored as 0 = no cancellation, or 1 = cancellation. As project leaders compared preoptimization-related cancellations that are relative to anesthesia decision-making between pre- and post-implementation, all other cancellations were excluded.

Data collection for the primary outcome was collected in a pre- and post-implementation fashion. Pre-implementation data was data collected during a five-week period from the EHR for eligible patients that were not preoperatively risk stratified with this systematic procedure. Five weeks were selected for pre-implementation data because the month of December had several days with no scheduled procedures due to holidays; this was done in order to ensure proportional surgical days for pre- and post-implementation data collection. Abstracted data for the project included: 1) patient age, 2) sex, 3) date of
surgical procedure, 4) type of elective surgical procedure, 5) assigned ASA score, 6) severity of surgery, 7) patient MRN for chart auditing purposes, and 8) if there was an anesthesia-related cancellation (0 = no, no cancellation, 1 = yes, cancellation). On the OR daily schedule in the EHR, there was a subsection that highlighted if a case was cancelled. This feature was utilized to help determine if eligible participants fell into the cancellation category. If eligible patient cases were cancelled, the project leaders investigated if it was determined to be an anesthesia-led cancellation decision.

Post-implementation data abstraction was conducted using data from the completed NICE tool during the four-week implementation phase of the project. Data abstracted for NICE tool implementation included: 1) patient MRN for chart auditing purposes, 2) age, 3) sex, 4) type of surgical procedure, 5) date of surgical procedure, 6) assigned ASA score, 7) severity of surgery, 8) if further evaluation was recommended by the NICE tool (0 = no further recommendation, 1 = yes, more testing recommended), and if the recommended orders were placed (0 = no, orders were not placed, 1 = yes, orders were placed but not completed, 2 = placed orders were completed by the patient).

The project leaders at this site had access to the EPIC EHR and utilized this platform to accurately collect data for the participants. After the scheduled day of surgery had passed, project leaders completed the audit portion of the project tool by conducting a chart review for each patient to determine if any of the NICE tool recommendations were ordered before surgery, if the testing was performed, and if there was an anesthesia-led surgical cancellation. This data was manually entered into the password-protected Excel database.

Data Management Plan

Data was abstracted by patient chart audits in EPIC to complete the “audit” portion of the tool based on the provided MRN specific to each patient. In addition to the audit questions (Appendix D), a codebook was created with variables for patient age, procedure, surgeon, ASA score, sex, and surgery date. Data was managed on an Excel spreadsheet (i.e., database), and was password-encrypted; only project leaders and the project faculty site leader had access to all data. The project leaders input the
collected data into the database; MRN was kept on the database in order for project leaders to re-access the correct patient’s chart for the audit portion of the tool. This data was input and cleaned by all three project leaders in preparation for analysis in SPSS. This password protected excel database was stored on the University of Pennsylvania School of Nursing drive, in a specific folder that only project leaders had access to. This will also be used for long-term data storage and will be destroyed in May of 2022.

Analysis

Data from the created Excel database was imported into SPSS for data analysis. For the purpose of the analysis, an associated code book was developed. Data levels of measurement for all responses in the audit tool that measure the primary outcome (the rate of surgical cancellation) were measured at a nominal level, with “YES =1” or “NO = 0” as the only categorical options. This included the independent variable, which was the implementation of NICE tool intervention (YES =1 or NO=0); The dependent variable, a same-day surgical cancellation, was also measured on this nominal level (0 = no cancellation, or 1 = yes cancellation).

The Pearson’s Chi-Square Test for Association was therefore the most appropriate statistical analysis test to answer the project question, as it can determine if there is an association between two categorical variables and the strength of the association. In the absence of controlled trial methods, this was the optimal approach to address the project question. This project met the assumptions for this test because both the independent and dependent variables were categorical and nominal in nature, and there was independence of groups between pre- and post-implementation. The data records were screened by project leaders to ensure that no participant was present in both the pre- and post-implementation groups. If there was an association between the implementation of the NICE tool and the incidence of surgical case anesthesia cancellations, then the null hypothesis of no association could be rejected and the strength of the association would be evaluable; if there was no association between the variables, then this project
failed to reject the null hypothesis. If the primary analysis with Chi-Square had cell frequencies less than five in regard to case cancellations, the alternative test, Fisher’s Exact Test, would be utilized.

Patient data in the pre- and post-implementation groups was described by characteristic data. Descriptive analysis included frequencies and mean average as appropriate. Other secondary process-oriented project data such as post-implementation completion of the NICE tool, cases requiring further preoptimization, and recommended order placement completion was summarized using frequencies and mean averages as well. Balancing measures included monitoring compliance with completing preoperative diagnostic recommendations. Additionally, collected data was utilized to create a Run Chart to help visualize the effect of the preoperative NICE tool implementation on same-day surgical cancellations.

Pre- and post-implementation data were compared with regards to the frequency of anesthesia-led same-day surgical cancellations. If the rate of surgical cancellations related to anesthesia-led preoptimization decreases was found post-implementation, project implementation will be deemed successful.

Ethical Considerations

Submission to the IRB in January 2021 prior to historical data collection and implementation deemed this project approved as a Quality Improvement (QI) project. Chart auditing was a foundational element to historical data collection, patient screening for inclusion during the implementation, and post implementation data collection. Patient identifying information was securely stored on a password protected Microsoft Excel file strictly between the project leaders. When forwarding the recommendations to the faculty site CRNA leader, the document remained password protected to view the document. Communication between the team through text and email was void of any specific patient identifiers.

Results
**Project Setting and Participant Group**

The participant group in this project were patients ages 40 years or older who underwent elective ENT procedures at the project site. Patients involved in the project were between the ages of 40-94. The average age in the pre-implementation group was 62.2 years old (see Table 2), and the average age in the post-implementation age was 63.7 year (see Table 2). Participants were 59% male patients and 41% female patients (see Table 2). The most frequent ASA score applied was 2 in both pre- and post-implementation periods (see Figure 4), while the most frequent surgical severity level was intermediate in both the pre- and post-implementation periods (see Figure 5). There were five anesthesia-led cancellations from the historical pre-implementation data. After implementation of a preoperative risk stratification there were a total of eight anesthesia-led cancellations; the run chart in Figure 6 highlights the relative increase in anesthesia-led cancellations between the pre- and post-implementation periods. The pre-implementation same-day anesthesia-led cancellation rate was 4.67% and the post-implementation same-day anesthesia-led cancellation rate was 8.4%.

**PICOT Question Answered**

This QI project ultimately found that applying a preoperative risk stratification screening tool did not decrease anesthesia-led cancellations, but instead there was a relative increase in anesthesia-led cancellations. A Pearson Chi-Square analysis was conducted to assess for an association between NICE tool implementation and same-day anesthesia-led surgical cancellations from a sample of ENT patients pre-implementation (n=107) and post-implementation (n=109) for a total of 216 cases. All expected cell frequencies were five or greater, therefore the Pearson Chi-Square analysis was appropriately used. It was determined that there was no statistically significant association between implementation of the NICE tool and same-day anesthesia-led case cancellations ($\chi^2(1) = 1.144$, p = 0.285). When analysis was run including only the post-implementation cases where NICE tool recommendations were completed
correctly, there was no statistically significant association between implementation of the NICE tool and same-day anesthesia led cancellations ($\chi^2(1) = 2.682, p = 0.102$).

**Additional Results**

One critical finding in data analysis included that, in the post-implementation phase, the recommended tests were only correctly ordered for 58.8% of patients. This means that recommended orders from the NICE tool were only correctly placed for 64 out of the 109 post-implementation patients.

An additional finding that was identified during the post-implementation data collection phase found that providers ordered preoperative testing that was not indicated according to the NICE tool for those specific patients in 11% of post-implementation patients. These patients received more preoperative testing than originally recommended by the NICE tool based on ASA level and surgical severity.

**Project Adaptations**

Prior to implementation, the project leaders had to make adjustments to the participant group by changing surgical specialty. The ENT service has a more robust patient population which led to a larger study group. The initial plan to implement the NICE tool in the preoperative clinic for breast surgery patients did not prove to be feasible because the majority of the patients were screened via telehealth due to the COVID-19 pandemic and few patients were brought to the clinic for an in-person assessment that would have included the use of the NICE tool. Additionally, the preoperative clinic began evaluating patients with little communication to the project leaders and without formal education about how to use the NICE tool, which also led to the change in the participant group to ENT patients.

Originally, the project leaders hoped to measure anesthesia-led surgical delays as a primary outcome as well. They planned on evaluating the daily “SnapBoard” option in EPIC to assess delays as an additional primary outcome measure for this project. This feature shows when cases were originally scheduled, if they were delayed, and by how much time. However, SnapBoard only shows the length of the start delay and does not list a reason. It is also considered a surgical delay if the reason that a case
started after its scheduled start time is because the previous case in the same room ran over their scheduled time. Ultimately, this was not an effective way to assess the true cause of the delay. The anesthesia team previously had access to a weekly list of specifically anesthesia-led delays related to the need for further preoperative evaluation. However, the EPIC system recently changed how case delays are evaluated and created a new system with the goal to have all of the information more streamlined and accessible. Because this is a newer system, the majority of the anesthesia team did not have education on how to access the delay list on the new system leading to inaccessibility. Due to this, the project leaders ultimately decided to focus solely on anesthesia-led same-day surgical case cancellations as the primary outcome, as this data was readily accessible within the time duration for the first cycle of this QI project.

The ENT service agreed to be a part of this QI project with the condition that the project leaders’ recommendations derived from the NICE tool would be screened and approved by the project faculty lead expert CRNA. Then, the approved recommendations were forwarded to the ENT service, as seen in the process flow chart in Figure 3. A copy of the NICE tool document was sent to the ENT service for reference regarding the algorithm providing the recommendations. In an attempt to simplify the process for the ENT service, rationale was provided with the recommendations such as ASA class, certain medications a patient was prescribed such as anticoagulation medications, or the extent of a patient’s comorbidities. Also, to ease facilitation of the application of the NICE tool recommendations for the ENT service, patient identifiers were provided, such as patient initials, age, date of surgery, surgeon, and procedure.

Discussion

Summary

Key Findings

The question for this quality improvement project was: in the older adult surgical population ages forty and older undergoing elective Otolaryngology procedures (P), how does the use of a standardized
preoperative risk assessment screening tool (I) compared to standard preoperative care without a risk screening tool (C) influence the rate of same-day surgical case cancellations due to improper preoptimization (O) in the preoperative period (T)? The primary outcome measure was the rate of same-day anesthesia-led surgical cancellations and the association between the implementation of a screening tool and anesthesia-led surgical cancellations in the pre- and post-implementation periods. Data analysis determined that the rate of surgical cancellations increased in the post-implementation period from 4.67% to 8.4%; however, Pearson Chi Square analysis indicated that there was not a statistically significant relationship between the implementation of the NICE tool and same-day anesthesia-led surgical cancellations (p= 0.285) (see Figure 7).

It is important to consider multiple factors when analyzing this outcome data. Outcome analysis may be limited due to the relatively short implementation period for the tool. Similarly, it is possible that the patient presented to the ENT office for their preoperative assessment prior to the project leader’s chart auditing and already had orders placed; ideally, charts would be audited further in advance of the surgical date, but the relatively short turn-around time from scheduling procedures to the day of surgery for ENT patient population is a major limitation.

Furthermore, the NICE tool recommendations were correctly and completely followed in only 46.8% (n=51/109). Chi Square analysis was run a second time to include only the post-implementation cases where the NICE tool recommendations were completed correctly, and again no statistically significant association was found between implementation of the NICE tool and same-day anesthesia-led surgical cancellations (p=0.102) (see Figure 8). However, it would be interesting to conduct further cycles of this project where the groups of pre-implementation cases and the post-implementation cases with correctly ordered and completed recommendations were more comparable in size. As stated previously the NICE tool recommendations were only correctly and completely followed for 46.8% of the post-implementation group. Future work should be done to successfully implement the NICE tool and
complete recommendations in order to best determine if there is a significant relationship between tool implementation and anesthesia-led surgical case cancellations.

This greatly affects analysis in that the tool was only truly utilized on a smaller participant group. This warrants further data auditing and analysis, as well as a discussion with ENT regarding potential barriers that impeded ordering the NICE tool recommendations. Additionally, education regarding the tool’s utilization and how the recommendations are created may be beneficial in order to increase compliance with the suggested recommendations from the NICE tool.

An additional finding of this project included that providers were at times ordering more preoperative testing than indicated from the NICE tool for patients. 11% of post-implementation patients received more preoperative testing than originally recommended by the NICE tool based on ASA level and surgical severity. This warrants a discussion with the ENT service regarding their current rationale and culture for preoperative test ordering, and reconciling this with the current adapted NICE tool. It is important to understand the ENT provider rationale behind this extraneous testing in order to determine future continued use of the NICE tool for this service. Depending on the outcome of this discussion, tool adaptations may be beneficial to better meet the needs of the ENT surgical population. Another possibility is that additional education regarding determining individualized “necessary” testing for patients related to their comorbidities and surgical severity may lead to surgeons ordering fewer, more impactful preoperative testing. This would ultimately decrease the amount of invasive testing a patient would undergo and also decrease procedural costs associated with unnecessary testing (Nickel et al., 2019).

Strengths

A strength of this project was that the ENT service was eager to engage and implement a project that would improve their patient preoperative assessments. This buy-in was key to ensuring that recommendations from the tool would be followed and ordered prior to the day of surgery. Without their support, the QI project would have failed to be implemented. Another strength was the high volume of
ENT patients available to meet eligibility criteria to be included in this QI project. Few patients had to be excluded due to not meeting the age criteria. There was a surplus of cases during the initial screening for surgical cases, and there were always multiple add-on cases to be screened each week. Submission of the NICE tool recommendations was prompt with streamlined information to the faculty lead CRNA for review prior to providing the information to the ENT service.

Furthermore, the project leaders’ ability to remotely access the EHR permitted easy facilitation of chart auditing for patients, as well as timely chart auditing. Once patients were identified as meeting the inclusion criteria, the NICE tool was applied using the algorithm. Adding to the feasibility of implementation, the three project leaders were the sole auditors implementing the tool, auditing charts, and making recommendations for the ENT service; not only did this streamline the data collection process, but it also ensured reliable consistent application of the tool.

**Weaknesses and Limitations**

A limitation of the project was a lack of a preset timeline for auditing between the auditors and the ENT service. A distinct timeline was defined by project leaders specifying when chart auditing would be completed for NICE tool application, the deadline for add-on cases to be included before recommendations, and when recommendations would be forwarded. However, a timeline was not specifically discussed for when the faculty lead CRNA would have time to review the recommendations and send the recommendations to the ENT service. Audits were performed one week prior to the date of the scheduled procedure, but it may have been more beneficial for these audits to have been performed earlier. This would have allowed more time for review of recommendations by the CRNA, more time for the ENT service to review the approved recommendations and order appropriate testing, and for the patient to comply with further testing if recommended. Similarly, a longer implementation period may have been ideal in order to determine a more representative cancellation rate.
Due to the nature of ENT surgery, certain pathologies and procedures are considered to be more time-sensitive regarding scheduling surgery, leading to cases being scheduled quickly after their initial ENT office visit. This led to some cases being excluded from implementation simply due to inadequate time available to apply the NICE tool and for recommended orders to be followed. For the same reason of time-sensitive pathologies, emergent surgery add-ons were not uncommon and would alter the scheduled surgery cases that were screened for the NICE tool, such that the scheduled procedures were often “cancelled” and rescheduled for a different day.

Despite the ENT service being eager to have their patient population included in this project, there was only two weeks between the ENT service’s official engagement in this project and the start of the NICE tool implementation. Perhaps the rapid pace of this project hindered its success because the ENT service had limited time to completely buy in to the extent of the commitment of the project. Allowing more time between project acceptance and implementation may have allowed for a more seamless project transition with increased communication and clarification opportunities which could have led to a more congruent work environment.

**Process Facilitators and Barriers**

The project faculty lead CRNA was instrumental in the development and success for this QI project. Not only was the lead CRNA a key stakeholder in this project, but she also facilitated the recruitment of the ENT service for this project. She acted as a primary communication liaison between the project leaders and the ENT service, assisted with data collection strategies, screened NICE tool recommendations, and provided mentorship and guidance when project barriers were encountered.

One barrier identified by the ENT service prior to agreeing to participate in this project was that there was a lack of a certified anesthesia provider’s involvement. ENT recommended an official anesthesia provider be utilized to screen and validate the project leaders’ recommendations from the NICE tool prior to dissemination to the ENT service. This barrier was overcome when the faculty lead
CRNA agreed to review NICE tool recommendations for appropriateness prior to forwarding them to the ENT service to be ordered. Additionally, project leaders attempted to organize the patient demographics, recommendations, and rationale for each recommended preoperative test in the most consistent streamlined way possible to limit the time and confusion burden to the ENT service. This ensured that all recommendations given to the ENT service were appropriate and necessary for the ENT patient from an anesthesia provider standpoint.

Another project barrier included difficulty in obtaining data related to anesthesia-led delays in the EHR. Anesthesia-led delay data was initially sought by the project leaders as another primary outcome measurement for this project. However, due to a project site policy and Information Technology (IT) systems change, project leaders and the faculty lead CRNA did not have access to anesthesia-led delay data within the implementation and analysis periods for the project. This barrier was not able to be overcome and the project leaders determined that the project outcome would necessarily be anesthesia-related cancellation data only.

**Implications for Practice**

The intended outcome for this project is to reduce and eventually eliminate same-day elective surgery anesthesia-led cancellations for the ENT service at the project site due to incomplete or insufficient preoperative health evaluation of patients. The implementation of a preoperative screening tool for patients 40 and older undergoing elective ENT procedures allows for at-risk patients to be identified and screened for appropriate diagnostic testing to be performed in advance of surgery. Performing these tests during the preoperative period allows for time to best mitigate the avoidable risks of surgical procedures that are associated with age, comorbidities, and surgical severity. Recognizing these preoperative testing needs early allows adequate time for patients to be optimized prior to surgery, especially because testing abnormalities are shown to correlate poorly with a patient’s perioperative risk (Nickel et al., 2019). Furthermore, the use of a screening tool can help to avoid unnecessary testing.
which can be invasive for patients and costly-- the estimated overall cost of unnecessary preoperative testing in the United States is $3-18 billion annually (Nickel et al., 2019). It is therefore in the best interest for the patient, the surgical team, the anesthesia team, and the hospital as a whole to only order and obtain necessary testing. This has been done with success within the British Healthcare system, where formalized staff educational training and the NICE tool were implemented in an ENT practice; results showed that unnecessary testing and procedural costs were reduced through the use of a preoperative screening tool (Leung et al., 2015).

Next steps for this QI project involve a discussion with the ENT service regarding the key findings, strengths, weaknesses, and barriers previously discussed. Additionally, a discussion regarding suggested improvements for a more cohesive implementation would be beneficial if further cycles of the project are to be conducted, especially as implementation of the NICE tool may evolve to other surgical services. Furthermore, the project site is continuing to work on developing a preoperative clinic for all patients undergoing scheduled procedures. Ideally, the NICE tool will be implemented as part of the process flow for all patients seen at the clinic. Blitz et al. (2016) highlighted that an anesthesia-led preoperative clinic has a positive effect on postoperative outcomes for patients that are determined to be high-risk due to their ASA score. Implementation of an evidence-based screening tool in the setting of a preoperative clinic will allow for patients and the surgery teams to inherit the benefits of preoptimization.

While the results of this QI project are inherently not generalizable given the nature of this project, it is important to consider that the NICE tool itself is not limited to one surgical service, and could, therefore, feasibly be implemented for other services at this hospital given the results and feedback of this QI project. From this project, other hospitals may search to find a preoperative screening tool that fits their own site needs given the proven importance of a thorough preoperative patient assessment prior to surgical intervention.
The literature and this QI project highlight the benefits of implementing a preoperative screening tool with little risk. Literature indicates that there is significant evidence supporting the use of a standardized preoperative screening tool because it can reduce unnecessary patient testing and decrease procedural costs, without increasing the risk of perioperative morbidity and mortality (Nickel et al., 2019). Primarily, the major costs of implementation of a preoperative screening tool include sufficient time and education. It is important that, when possible, a patient is scheduled well in advance of their surgery so that they may be assessed preoperatively with the screening tool. This allows adequate time for the patient to obtain all recommended testing, the surgical and anesthesia team to review the results, procedural plans to be adjusted to the needs of that specific patient, and therefore the patient benefiting from the preoptimization.

A preoperative screening tool, such as the NICE tool, must be administered with precision and accuracy to ensure that all patient recommendations are appropriate; therefore, education regarding its proper utilization is imperative for continued QI cycles of this project. Education for APPs on the ENT service is essential for the success of the NICE tool in their surgical service. The education should include assigning an ASA score to a patient based on a preoperative chart review, medication reconciliation, physical assessment, as well as understanding the surgical procedures done at the hospital and the varying surgical severity levels. This education would require sufficient training time and some financial compensation to the APPs but is a crucial need for the benefit of the patients at this project site.

Furthermore, a financial consideration for continued use of the NICE tool at this project site involves licensing fees for continued use. The project leaders obtained permission from the NICE organization for the use of the preoperative screening NICE tool due to the nature of this QI project. If the project site decides that they would like to continue to implement this tool in their preoperative practice, the payment of a licensing fee will be required.
While the use of the NICE tool will require staff education and financial costs including licensing agreement, these costs are potentially outweighed by the overall and lasting benefit to the patients. Although data analysis may not have indicated a statistically significant association between the use of a risk stratification tool and case cancellations, the relationship may still be clinically significant and relevant. When patient safety is prioritized with adequate preoptimization, a proper personalized anesthetic and surgical plan can be created to provide individualized care. After a preoperative screening tool is applied, when the date of surgery arrives, patients can seamlessly enter the OR without concern for missing data points that may be essential to providing the safest, most individualized, and effective perioperative anesthesia care.

Opportunities for Sustainability

In order to ensure that the NICE tool implementation project is sustainable, the project leaders first plan to meet with the ENT team to discuss the barriers encountered during implementation. By doing so, certain project adaptations can be performed to make future implementation more successful. Although data analysis may not have indicated that there was a significant association between the use of the NICE tool and same-day cancellations, future use of the NICE tool should still be considered because it is clinically relevant. A structured preoperative tool more specific to the ENT patient population may be beneficial, so it is essential that project leaders meet with the service to discuss the project, its implementation, outcomes, and future implementation opportunities.

The project leaders also hope to educate the APPs, who have recently been hired onto the ENT service for preoperative patient screening, about the purpose of the NICE tool and the results of this QI project. The project leaders will provide education by email with written instructions on application of the tool, as well as through scheduled interactive Blue Jeans educational sessions. The education materials will include information regarding determining surgical severity, how to appropriately apply an ASA score, and examples of how to apply the tool. By educating the ENT APPs, the NICE tool can be
implemented at all preoperative visits for ENT patients in order to properly preoptimize patients prior to their surgical procedures. Using properly trained staff has been correlated with successful tool implementation and a reduction in extraneous testing (Campbell et al., 2018). Engaging the APPs allows for this screening tool to continue to be utilized by the ENT service for future patients. In doing so, this project will become seamlessly integrated into the preoperative assessment for patients under this service and ensure its long-term sustainability. Ideally, the future use of the NICE tool may be adapted for use in other surgical services also at the project site in order to preoptimize all patients undergoing anesthesia.

Conclusions

This project focused on a patient population involving adults of 40 years and older who were subjected to the increasing number of elective procedures with increasing age, but according to the literature review, were likely to lack appropriate preoperative evaluation and, therefore, were at increased risk for complications due to linear increased mortality risk with increased age (Smetana, 2020). The ENT service at the urban academically affiliated hospital project site had a large caseload. The NICE tool was implemented for these patients as a preoperative screening tool to identify diagnostic testing needed to properly evaluate the patients in advance of their surgical date. Historical and post-implementation data were collected to identify anesthesia-led cancellations to determine if implementation of a preoperative screening tool such as the NICE tool contributed to a reduction in anesthesia-led cancellations. The post-implementation data did not indicate that implementation of the NICE tool was successful in reducing anesthesia-led cancellations. Both the literature review and the desire for the ENT service to participate in this quality initiative project emphasized the importance of including a preoperative risk assessment tool to permit safe individualized anesthesia care, which ultimately can reduce stress on the patient and healthcare system. Therefore, future projects incorporating an evidence-based preoperative screening tool, such as the NICE tool or an adaptation of the NICE tool, are warranted.
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Figures

[Figure 1] PRISMA Flow Diagram

PRISMA 2009 Flow Diagram
Collecten Bolt, Emily Herren, Alison Sweeney

Records identified through database searching (n = 256)

Records after duplicates removed (n = 226)

Records screened (n = 90)

Records excluded (n = 136)

Full-text articles assessed for eligibility (n = 12)

Studies included in qualitative synthesis (n = 9)

Studies included in quantitative synthesis (meta-analysis) (n = 12)

Full-text articles excluded, with reasons (n = 12)
Excluded for inappropriate intervention, lack of relevance, inappropriate outcome measurement, ineffective data collection

[Figure 2] Iowa Model for EBP

Problem focused Triggers
1. Lack of thorough preoperative assessment
2. Assessment data being collected too close to case
   --> delay
3. Lack of preoptimization --> increased risk of postoperative complications

Knowledge Focused Triggers
1. Risk of perioperative mortality increases linearly with age
2. The older adult population is growing and requiring more surgical procedures.
3. The "younger" older adult population often is not preoptimized effectively

The use of a preoperative risk stratification screening tool is needed at Pennsylvania Hospital to identify at-risk patients over the age of forty requiring a more thorough work-up prior their surgical procedure.

Form A Team:
Anesthesia team,
Surgeons & staff,
Perioperative Staff

Analysis and review of research:
Systematic search conducted
Literature appraised
+ effect

Sufficient Research?
YES

Pilot Change in practice
1. Engage patients and staff,
2. Consider resources, constraints,
   and approval
3. Develop localized protocol
4. Create an Evaluation plan
5. Collect baseline data
6. Develop an Implementation Plan
7. Prepare clinicians and materials
8. Promote adoption
9. Collect and report post-pilot data
10. Desired Outcome
11. Identify at-risk patients requiring more in-depth preoptimization to decrease Surgical delays or cancellations

Integrate & Sustain Change
1. Implement standardized risk stratification tool
2. Identify and engage key personnel
3. Hardwire change
4. Monitor key indicators through QI
5. Reinforce as needed

Monitor & Analyze
1. Data
2. Environment
3. Cost
4. Staff
5. Participants

Disseminate Results
[Figure 3] Process Flow Chart
[Figure 4] ASA Data Abstraction
[Figure 5] Surgical Severity Data Abstraction

[Bar chart showing surgical severity data with categories: Minor, Intermediate, Major. The chart indicates the number of cases for each category as follows: Minor: 0, Intermediate: 74, Major: 45.]
* 11/30-12/31 were audited due to a lack of scheduled ENT cases on December holidays. This ensured that pre-and post-implementation total dates were more comparable.
[Figure 7] Frequencies of Cancellations with and without NICE Tool in ENT Surgical Cases
[Figure 8] Frequencies of ENT Case Cancellations in Post-Implementation Phase with NICE tool Recommendation Uptake

Bar Chart (adjusted to only include post-implementation cases with recommendations followed)

NICE Tool Implemented

- No
- Yes

Number of Cases

Cancellations

Non-cancelled Cases

Cancelled Cases
### Table 1: Table of Evidence

<table>
<thead>
<tr>
<th>Citation</th>
<th>Intervention Assessed</th>
<th>Primary Outcome</th>
<th>Age</th>
<th>Setting</th>
<th>Design</th>
<th>Level of Evidence</th>
<th>Findings</th>
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</thead>
<tbody>
<tr>
<td>Abete et al., 2016.</td>
<td>Comprehensive Geriatric Assessment (CGA)</td>
<td>30-day mortality</td>
<td>65 yr +</td>
<td>5 surgical units in Italian academic hospital (n=177)</td>
<td>Prospective, observational study</td>
<td>IIIb</td>
<td>(+)</td>
</tr>
<tr>
<td>Blitz et al., 2016.</td>
<td>In-person preoperative assessment</td>
<td>In-hospital mortality</td>
<td>18 yr +</td>
<td>One urban academic medical center (n= 64,418)</td>
<td>Retrospective review</td>
<td>IIIA</td>
<td>(+)</td>
</tr>
<tr>
<td>Choi et al., 2015.</td>
<td>Multidimensional Frailty Score (MFS)</td>
<td>One-year mortality</td>
<td>65 yr +</td>
<td>Seoul National University Bundang Hospital (n= 281)</td>
<td>Retrospective cohort study</td>
<td>IIIb</td>
<td>(+)</td>
</tr>
<tr>
<td>Doan et al., 2017.</td>
<td>Cardiology Consult for Noncardiac surgery</td>
<td>Postoperative CV events</td>
<td>18 yr +</td>
<td>Tertiary care teaching hospital (n= 1880)</td>
<td>Nonrandomized observational study</td>
<td>IIIA</td>
<td>(+)</td>
</tr>
<tr>
<td>Glueck et al., 2020.</td>
<td>Risk Assessment &amp; Prediction Tool</td>
<td>Discharge Disposition</td>
<td>50 yr +</td>
<td>Multihospital university health system (n=432)</td>
<td>Prospective Cohort Study</td>
<td>IIIA</td>
<td>(+)</td>
</tr>
<tr>
<td>Kim et al., 2020.</td>
<td>Timed Up and Go (TUG) assessment</td>
<td>6 w Post-op complications</td>
<td>18+</td>
<td>Tertiary Care Hospital (n=103)</td>
<td>Prospective Cohort Study</td>
<td>IIIA</td>
<td>(+)</td>
</tr>
<tr>
<td>Meza et al., 2019.</td>
<td>Clinical Frailty Scale (CFS), Fried Phenotype (FF), Frailty Index (FI)</td>
<td>Mortality comorbidity in 90 days post-op</td>
<td>65 yr +</td>
<td>3 Hospitals in Ottawa, Canada (n= 645)</td>
<td>Prospective Cohort Study</td>
<td>Iib</td>
<td>(+)</td>
</tr>
<tr>
<td>Moonesinghe et al., 2015.</td>
<td>P-POSSUM, Surgical Risk Scale</td>
<td>Mortality, morbidity, 30 day outcomes</td>
<td>18 yr +</td>
<td>MEDLINE, Embase, Web of Science,27 papers, 34 tools</td>
<td>Systematic review</td>
<td>Ib</td>
<td>(+)</td>
</tr>
<tr>
<td>Mrdutt, M., et al., 2019.</td>
<td>Modified Hopkins Frailty Score</td>
<td>Morbidity/mortality, increased LOS, ED visits</td>
<td>18 yr +</td>
<td>Large healthcare system with 4 hospitals (n= 4,032)</td>
<td>Prospective cohort</td>
<td>Iia</td>
<td>(+)</td>
</tr>
<tr>
<td>Repenen, et al., 2017.</td>
<td>Patient reported data vs ASA scores</td>
<td>Morbidity and mortality 30 days post-op</td>
<td>18 yr +</td>
<td>(n = 322)</td>
<td>Prospective cohort</td>
<td>Iib</td>
<td>(+)</td>
</tr>
<tr>
<td>Samuelson et al., 2019.</td>
<td>Comprehensive Geriatric Assessment (CGA)</td>
<td>Postoperative complications and CGA @ 1, 3, and 12 months</td>
<td>75 yr +</td>
<td>Tertiary Hospital N= 39</td>
<td>Prospective Cohort Study</td>
<td>Iib</td>
<td>(+/-)</td>
</tr>
</tbody>
</table>
### Table 2: Patient Characteristic Data

<table>
<thead>
<tr>
<th>ASA Scores</th>
<th>ASA Pre Count (N=107)</th>
<th>%</th>
<th>ASA Post Count (N=109)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>0.90%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>52</td>
<td>48.60%</td>
<td>57</td>
<td>52.30%</td>
</tr>
<tr>
<td>3</td>
<td>49</td>
<td>45.80%</td>
<td>51</td>
<td>46.80%</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>4.70%</td>
<td>1</td>
<td>0.90%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ages</th>
<th>Pre Count</th>
<th>%</th>
<th>Post Count</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-49</td>
<td>18</td>
<td>16.80%</td>
<td>15</td>
<td>13.80%</td>
</tr>
<tr>
<td>50-59</td>
<td>24</td>
<td>22.40%</td>
<td>27</td>
<td>24.80%</td>
</tr>
<tr>
<td>60-69</td>
<td>39</td>
<td>36.40%</td>
<td>33</td>
<td>30.30%</td>
</tr>
<tr>
<td>70-79</td>
<td>15</td>
<td>14.00%</td>
<td>24</td>
<td>22.00%</td>
</tr>
<tr>
<td>80-89</td>
<td>11</td>
<td>10.30%</td>
<td>8</td>
<td>7.30%</td>
</tr>
<tr>
<td>90-99</td>
<td>0</td>
<td>0.00%</td>
<td>2</td>
<td>1.80%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th>Pre Count</th>
<th>%</th>
<th>Post Count</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>64</td>
<td>60.70%</td>
<td>63</td>
<td>57.80%</td>
</tr>
<tr>
<td>Female</td>
<td>43</td>
<td>40.20%</td>
<td>46</td>
<td>31.60%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Surgical Severity</th>
<th>Pre Count</th>
<th>%</th>
<th>Post Count</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Intermediate</td>
<td>62</td>
<td>57.9</td>
<td>74</td>
<td>67.9</td>
</tr>
<tr>
<td>Major</td>
<td>45</td>
<td>42.1</td>
<td>34</td>
<td>31.2</td>
</tr>
</tbody>
</table>
Appendix A

DNP Team and Project Implementation Form

University of Pennsylvania
School of Nursing
Doctor of Nursing Practice Program

DNP Team and Project Implementation Form
This form is to be completed by the student(s), institutional/organization project member(s), and school of nursing project lead and submitted for approval to the DNP Program Director.

Student Names: Colleen Bole, Emily Herron, Allison Sweeney

Project Title: The Impact of a Preoperative Screening Tool for Adults Over the Age of 46 on Surgical Delays: A Quality Improvement Project at Pennsylvania Hospital

School of Nursing DNP Project Faculty Lead: Dr. Angelarosa DiDonato

Institutional/Organization DNP Project Member(s): Dr. Angelarosa DiDonato, Dr. Maya Clarke

I hereby accept the following proposed project pending IRB approval (completed by student(s)).

Project Site: Pennsylvania Hospital (PAH)
Project Purpose:
The purpose of this project is to decrease same-day surgical delays and cancellations due to improper preoptimization by implementing a risk stratification tool from the National Institute for Health and Care Excellence (NICE).

Project Activities:
- Pilot implementation of the adapted preoperative NICE risk stratification tool in the preoperative clinic at Pennsylvania Hospital.
- Patient Chart Audits pre- and post- implementation for data abstraction
- Data abstraction and cleaning using Microsoft Excel
- Data analysis via SPSS

Participants (Describe target group; approximate # in project):
Target group consists of adults over the age of 40 undergoing non-cardiac, non-neurological elective surgical procedures at Pennsylvania Hospital.
Approximate number in project is 50-100 subjects.

Site(s) Support (Resources):
Site Support Resources include SHAC, PAH PACU Nurse Manager, Dr. Maya Clarke at the preoperative clinic, and Dr. Angelarosa DiDonato as our faculty and clinical site lead.

Data Management Plan:
Data will be abstracted from the EPIC EHR at Pennsylvania Hospital for pre- and post-implementation; it will be input into a password-protected Excel database and a codebook will be created.

Anticipated Start Date: 3/1/2021

Anticipated End Date: 4/30/2021
I hereby consent to serve on the DNP Project Committee

We understand that this site’s participation will only take place during the project’s active IRB approval period. All project activities must cease if IRB approval expires or is suspended. We understand that any activities involving Personal Private Information of Protected Health Information may require compliance with HIPAA laws and the University of Pennsylvania’s policy. Our organization agrees to the terms and conditions stated above. If we have any concerns related to this project, we will contact the project team. For concerns regarding IRB policy or human subject welfare, we may also contact the UPENN IRB.

As a doctoral student member of this team, I agree to conduct the project to the best of my abilities with professionalism.

Student Signature: [signature]

Student Signature: [signature]

Student Signature: [signature]

As an institutional/organization member of this project team, I agree to read and review all drafts of the project within a timely turnaround (approximately 2 weeks).

Team Member Signature: [signature]

Contact Information (email and phone number):
cbole@nursing.upenn.edu, (408) 821-8463

Team Member Signature: [signature]

Contact Information (email and phone number):
emherron@nursing.upenn.edu, (609) 457-9505

Team Member Signature: [signature]

Contact Information (email and phone number):
aswee@nursing.upenn.edu, (610) 529-1264
As the School of Nursing DNP Project faculty lead, I agree to meet with the student(s) and consult throughout the project.

Faculty Lead Signature:  

Contact information (email and phone number):

angelaro@nursing.upenn.edu  267-535-1124

APPROVED BY DIRECTOR, DOCTOR OF NURSING PRACTICE PROGRAM:

Director Signature:  

Date Approved:
Appendix B
Project Charter
Preoperative Surgical Tool to Prevent Surgical Cancellations

**AIM**

To decrease the rate of same-day surgical case cancellations due to improper preoperative screening and diagnostic testing based on surgical severity and patient-specific comorbidities in patients over the age of 40 undergoing non-cardiac non-neurological elective procedures.

**PROBLEM**

Surgical patients over the age of 40 presenting for non-cardiac non-neurological elective procedures are not screened by a member of the anesthesia team in the preoperative period prior to the day of surgery at the project site. Lack of diagnostic testing in advance of surgery can lead to same-day surgical case cancellations.

**IMPORTANCE**

Preoperative risk screening tools suggestive for patient-specific diagnostic testing prior to surgical procedures allow for providers to identify gaps in preoperative care. By considering patient-specific factors such as comorbidities in combination with surgical severity, individualized preoperative diagnostic testing can be performed to best optimize patients prior to surgery. Identifying these risks in the preoperative period prior to the day of surgery gives time for testing to occur, results to be disseminated, and for a safe, patient-specific perioperative plan to be formed. If not performed prior to the day of surgery, cases may be cancelled. Same-day cancellations for elective procedures have a direct negative correlation with patient outcomes, are significantly financially costly to the hospital, cause provider and patient frustration, and may increase patient anxiety (Vogel, 2010).

**EXPECTED OUTCOMES**

There will be a decrease in same-day surgical cancellations for adults over the age of 40 undergoing elective otolaryngology (ENT) procedures due to inadequate preoperative diagnostic testing compared to the current rate of surgical case cancellations for this population.

The NICE tool will be implemented for 100% of the patients in this population undergoing surgical procedures that are participating in project implementation. Ideally, 100% of the patients who receive recommendations for further diagnostic testing will have orders placed and will obtain these results prior to the day of surgery.

**MEASURES**

**Primary Implementation Tools:** NICE Preoperative Risk Assessment tool and Audit Tool  
**Main Outcome Measure:** Number of Same-Day Surgical Cancellations  
**Process Secondary Measures:** ASA scores, Surgical Severity, Compliance with Completing Preoperative Diagnostic recommendations  
**Balancing Measures:** Compliance with Completing Preoperative Diagnostic recommendations
## RISKS/BARRIERS

A major recurring theme discovered when discussing the changes with CRNAs was a sense of exhaustion and disillusionment with multiple new projects a year. There needs to be adequate buy-in from the anesthesia staff and a succinct sustainability plan in order to effectively implement and sustain the project. Other major challenges may include education regarding application of the tool for providers, and education for patients on the importance of ensuring that any recommended and ordered diagnostic tests are performed prior to the day of surgery. If tests are recommended but not completed, the tool will be ineffective in decreasing same-day surgical case cancellations.

## STAKEHOLDERS

Key stakeholders in the planned changes include the project site, the private anesthesia group employed at the project site, Student Registered Nurse Anesthetists that may participate in the project and future steps, and Advanced Practice Providers (APPs) that will be implementing the tool for the ENT service patients. Informal input from all participants will be collected during educational sessions and at the end of the intervention.

## SCOPE

<table>
<thead>
<tr>
<th>In Scope:</th>
<th>Out of Scope:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients age 40 and older presenting for elective ENT surgical procedures</td>
<td>Patient under the age of 40, patients who are presenting for a cardiac or neurological procedure, patients presenting for emergent surgical intervention, or patients presenting for other surgical service procedures</td>
</tr>
</tbody>
</table>

## SCHEDULE

- **Project Implementation:** 3/7/2021 - 4/2/2021
- **Initial Pre-Implementation Data Abstraction:** 2/1/2021 - 2/28/2021
- **Post-Implementation Data Abstraction:** 4/2/2021 - 4/15/2021
- **Data Analysis:** 4/1/2021 - 4/30/2021

## PROJECT TEAM

<table>
<thead>
<tr>
<th>Team Member</th>
<th>Project Role (sponsor, lead, SME, coordinator, etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colleen Bole</td>
<td>Project Leader</td>
</tr>
<tr>
<td>Emily Herron</td>
<td>Project Leader</td>
</tr>
<tr>
<td>Allison Sweeney</td>
<td>Project Leader</td>
</tr>
<tr>
<td>Dr. Angelarosa DiDonato</td>
<td>Site Lead/ University of Pennsylvania Faculty Leader</td>
</tr>
</tbody>
</table>
Appendix D

*Adapted NICE tool for Implementation*

**Tool adapted from National Institute for Health and Care Excellence (NICE):** ‘Routine Preoperative tests for elective surgery’, NICE guideline NG45 (April 2016) © National Institute for Health and Care Excellence 2016. All rights reserved.

**Purpose:** This adapted tool is to be utilized for patients over the age of 40 undergoing elective non-cardiac, non-neurological surgeries. The goal of this tool is to identify at-risk patients that are requiring further work-up and pre-optimization prior to their procedure in order to decrease perioperative complications.

**Instructions:** Please complete this tool for your patients over the age of 40 undergoing elective, non-cardiac, non-neurological surgeries.

1. Fill out the patient information section listed below. Then, read through the general recommendations section (section 1), and answer the questions posed in each section.
2. In section 2, you will assign an ASA score to the patient in question based off of the description of each score in the table.
3. Then, determine the severity of the patient’s surgical procedure: Minor, Intermediate, or Major; examples of each severity level are listed in their respective tables. Use this severity level to determine which table is appropriate for your patient.
4. Use your assigned ASA score to determine the recommendation for each diagnostic/laboratory study section (Complete Blood Count, Coagulation studies, Renal Function, EKG, and Arterial Blood Gas/ PFTs). Recommendations are color-coded, with RED meaning “not indicated routinely”, YELLOW meaning “consider based on individualized patient profile”, and GREEN meaning “yes”. Please indicate which category your patient falls into for each test (bolden type, circle, highlight, etc.).
5. Once you have determined which tests are indicated for your patient, please determine if these tests have been ordered; if they have not but are recommended by the tool, please order the required tests.
6. Then, answer the questions in the audit tool to indicate if the pre-operative screening was discussed, if the pre-optimization plan was adapted, and if optimization changes occurred. If there are changes to the plan of care and more testing is required, please indicate if this caused the surgery to be delayed or rescheduled.
Routine preoperative tests for elective surgery

1. Recommendations relevant for all types of surgery
   The recommendations in this NICE guideline were developed in relation to the following comorbidities: cardiovascular, diabetes, obesity, renal, and respiratory.

Communication

- When offering tests before surgery, give people information in line with recommendations (including those on consent and capacity) made in the NICE guideline on patient experience in adult NHS services
- Ensure that the results of any preoperative tests undertaken in primary care are included when referring people for surgical consultation.

Considering existing medicines

- Take into account any medicines people are taking when considering whether to offer any preoperative test.

Pregnancy tests

- On the day of surgery, sensitively ask all women of childbearing potential whether there is any possibility they could be pregnant.
- Make sure women who could possibly be pregnant are aware of the risks of the anesthetic and the procedure to the fetus.
- Document all discussions with women about whether or not to perform a pregnancy test.

Is this patient a woman with childbearing potential? YES or NO

If yes, conduct a urine pregnancy test with patient’s consent prior to surgery.
Sickle cell disease or sickle cell trait tests

- Do not routinely offer testing for sickle cell disease or sickle cell trait before surgery.

<table>
<thead>
<tr>
<th>Does this patient have diagnosed sickle cell disease? <strong>YES or NO</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>If NO, move on to the next section.</td>
</tr>
<tr>
<td>If Yes, is there a consultation note from the specialist in the chart? <strong>YES or NO</strong></td>
</tr>
<tr>
<td>If NO, consult with the team prior to surgery.</td>
</tr>
</tbody>
</table>

HbA1c testing

- Do not routinely offer HbA1c testing before surgery to people without diagnosed diabetes.
- People with diabetes who are being referred for surgical consultation from primary care should have their most recent HbA1c test results included in their consultation information.

<table>
<thead>
<tr>
<th>Does this patient have diagnosed diabetes? <strong>YES or NO</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>If NO, move on to the next section.</td>
</tr>
<tr>
<td>If Yes, does this patient have a recent HbA1c test result within the last 3 months? <strong>YES or NO</strong></td>
</tr>
<tr>
<td>If NO, obtain a HbA1C prior to the patient’s procedure and treat as necessary.</td>
</tr>
</tbody>
</table>

Urine tests

- Do not routinely offer urine dipstick tests before surgery.
- Consider microscopy and culture of midstream urine sample before surgery if the presence of a urinary tract infection would influence the decision to operate.

Chest X-ray
- Do not routinely offer chest X-rays before surgery.

**Echocardiography**

- Do not routinely offer resting echocardiography before surgery.
- Consider resting echocardiography if the person has:
  - a heart murmur and any cardiac symptom (including breathlessness, pre-syncope, syncope or chest pain) or signs or symptoms of heart failure.
  - Before ordering the resting echocardiogram, carry out a electrocardiogram (ECG) and discuss the findings with an anesthetist.

2. Recommendations for Specific Surgery and ASA Grade: color traffic light tables

<table>
<thead>
<tr>
<th>ASA Grades (American Society of Anesthesiologists Physical Status Classification System)</th>
<th>Please circle which ASA score corresponds with your patient.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASA 1</td>
<td>A normal healthy patient</td>
</tr>
<tr>
<td>ASA 2</td>
<td>A patient with mild systemic disease</td>
</tr>
<tr>
<td>ASA 3</td>
<td>A patient with severe systemic disease</td>
</tr>
<tr>
<td>ASA 4</td>
<td>A patient with severe systemic disease that is constant</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test</th>
<th>ASA 1</th>
<th>ASA 2</th>
<th>ASA 3 or ASA 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minor Surgery</strong> (ex. Skin lesion excision, draining breast abscess)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete Blood Count (CBC)</td>
<td>Not routine</td>
<td>Not routine</td>
<td>Not routine</td>
</tr>
<tr>
<td>Coagulation Tests</td>
<td>Not routine</td>
<td>Not routine</td>
<td>Not routine</td>
</tr>
<tr>
<td>Renal Function</td>
<td>Not routine</td>
<td>Not routine</td>
<td>Consider in patients at risk for AKI</td>
</tr>
<tr>
<td>EKG</td>
<td>Not routine</td>
<td>Not routine</td>
<td>Consider if no EKG available from past 12 months</td>
</tr>
<tr>
<td>Test</td>
<td>ASA1</td>
<td>ASA 2</td>
<td>ASA 3 or ASA 4</td>
</tr>
<tr>
<td>------------------------------</td>
<td>------</td>
<td>-------</td>
<td>----------------</td>
</tr>
<tr>
<td><strong>Arterial Blood Gas/PFTs</strong></td>
<td>Not routine</td>
<td>Not routine</td>
<td>Not routine</td>
</tr>
<tr>
<td><strong>Intermediate Surgery</strong> (ex. Primary repair of an inguinal hernia, varicose vein excision in lower extremity, Tonsillectomy/adenoidectomy, knee arthroscopy)</td>
<td>Not routine</td>
<td>Not routine</td>
<td>Consider for patients with CV or renal disease, if symptoms not recently assessed</td>
</tr>
<tr>
<td><strong>Complete Blood Count (CBC)</strong></td>
<td>Not routine</td>
<td>Not routine</td>
<td>Consider in patients with chronic liver disease. Consider if patients taking anticoagulants need adjustment to their treatment plan and make individualized plans with guidance from specialists. If coagulation status is required before surgery, consider using point-of-care testing.</td>
</tr>
<tr>
<td><strong>Coagulation Tests</strong></td>
<td>Not routine</td>
<td>Not routine</td>
<td></td>
</tr>
<tr>
<td><strong>Renal Function</strong></td>
<td>Not routine</td>
<td>Consider in patients at risk for AKI</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>EKG</strong></td>
<td>Not routine</td>
<td>Consider for patients with CV, renal, or diabetes comorbidities</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Arterial Blood Gas/PFTs</strong></td>
<td>Not routine</td>
<td>Not routine</td>
<td>Consult senior anesthetist ASAP after assessment if known or suspected respiratory disease for</td>
</tr>
<tr>
<td>Test</td>
<td>ASA 1</td>
<td>ASA 2</td>
<td>ASA 3 or ASA 4</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------</td>
<td>-------------</td>
<td>----------------</td>
</tr>
<tr>
<td><strong>Major or Complex Surgery</strong></td>
<td>(ex. Total abdominal hysterectomy, endoscopic resection of prostate, lumbar discectomy, thyroidectomy, total joint replacement, thoracic surgery, colonic resection, radical neck dissection)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete Blood Count (CBC)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Coagulation Tests</td>
<td>Not routine</td>
<td>Not routine</td>
<td>Consider in patients with chronic liver disease Consider if patients taking anticoagulants need adjustment to their treatment plan and make individualized plan with guidance from specialist. If coagulation status is required before surgery, consider using point-of-care testing.</td>
</tr>
<tr>
<td>Renal Function</td>
<td>Consider in patients at risk for AKI</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>EKG</td>
<td>Consider for people over the age of 65 if there is no available EKG within the last 12 months</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Arterial Blood Gas/PFTs</td>
<td>Not routine</td>
<td>Not routine</td>
<td>Consult senior anesthetist ASAP after assessment if known or suspected respiratory disease for advice.</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>-----</td>
<td>----</td>
<td></td>
</tr>
<tr>
<td>1. Was further testing recommended for this patient?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. IF YES, was further testing ordered for this patient after implementing the NICE tool?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Audit Tool (To be filled out by project leaders ONLY)

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. NICE Tool recommendations implemented by the Nurse Practitioner?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Was all recommended testing ordered prior to the day of surgery?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Was all recommended testing completed prior to the day of surgery?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**IF OPTIMIZATION CHANGES DID NOT OCCUR:**

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Did this cause the surgery time to be delayed?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Did this cause the surgery to be rescheduled?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>