STANDARDIZED COMMUNICATION AND PERIOPERATIVE STAFF SATISFACTION

by

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Abstract

Patient safety relies on effective and efficient communication among healthcare providers. Tools, such as standardized checklists, ensure information sharing in a consistent, predictable format. In the perioperative setting, where handoffs occur at several points and among various disciplines, high reliability is essential. This systematic review focused on the impact of standardized communication practices on perioperative staff satisfaction as it relates to sustainability of the new practice. The electronic databases PubMed and Google Scholar were used. Six articles met inclusion for the systematic review and of these six, four were determined to be of high quality through the application of The CASE Worksheet. The handoff tools implemented in these four studies were the electronic anesthesia information management system (AIMS), I-PASS mnemonic that described the illness, patient summary, action list, situation awareness and synthesis by receiver, Peri-op Handoff Protocol and a variation of the 'Surgical Safety Checklist' originally developed by WHO. Results of this systematic review suggest that these standardized communication methods are effective in improving perioperative staff satisfaction. Further research may prove helpful to determine if one handoff tool design is superior to the others. While future research could be performed to provide a larger sample size, the limited data gathered from this systematic review shows promising results. Implementing a standardized approach to perioperative communication and patient handoff has been shown in these studies to be beneficial in terms of staff satisfaction. Furthermore, it would be valuable to examine the indirect impact these communication tools have on patient care. Healthcare providers have the responsibility and opportunity to improve patient care through the adoption of standardized communication processes.

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Standardized Communication and Perioperative Staff Satisfaction

Background/Statement of the Problem

Communication during handoffs and transfer of care is a key element of patient safety; however, many healthcare providers report having no systematic way of transferring patient care (Nagpal et al., 2013). Lack of consistency can lead to omissions in handover report, frustrations between providers and suboptimal patient care. The Joint Commission (TJC, 2007) recognized the importance and value of standardized handoffs and in 2006 they included this initiative as a new National Patient Safety Goal (NPSG, 2006). Despite this recognized need for more uniform communication between clinicians, many perioperative care providers, including surgeons, anesthesia team members and perioperative nurses, report having no systematic way of transferring patient care (Nagpal et al., 2013). This lack of consistency can easily lead to omissions in handover report, placing the oncoming provider at a disadvantage in attempting to provide comprehensive quality care and also leaving them with an overall feeling of dissatisfaction with the interaction.

Many clinicians report feeling rushed during the transition of care, resulting in a sense of information overload and unnecessary anxiety (Nagpal et al., 2013). Not only does communication breakdown result in poor-quality handoffs between providers, but it can also cause preventable medical errors, increased morbidity and mortality and subsequent increases in healthcare costs (Agarwala et al., 2015). In fact, according to reports published by TJC, nearly 70% of the thousands of reportable adverse events between 1995 and 2005 stemmed from inadequate communication (2007). While human error can never be completely eradicated, it can be moderated through the implementation of safety mechanisms. Standardized handoffs and improved transfer of

information are among these safety mechanisms that contribute to high reliability in healthcare settings. The purpose of this project was to conduct a systematic review to determine what impact the implementation of a standardized handoff tool has on perioperative staff satisfaction regarding handoffs and communication in the perioperative area.

Next, the review of the literature will be presented.

Literature Review

PubMed, Google Scholar, and annual reports from the World Health Organization (WHO) and TJC databases were used to compile a thorough and comprehensive background related to this topic. The following search terms were used to investigate relevant background literature regarding standardized handoffs:

- provider communication;
- standardized handoffs;
- perioperative report;
- handoff tools;
- postoperative communication;
- satisfaction with standardized handoffs.

No date limitations were set for the literature review.

Provider Communication

In healthcare, it is important for one caregiver to relay all pertinent patient information to the oncoming provider assuming care, whether it is in the form of verbal report, written notes or face-to-face interactions (Agarwala et al., 2015). Nagpal et al. (2010) conducted a systematic review to investigate the current state and limitations of information transfer and communication (ITC) among interprofessionals working as a team in the operating room (OR). These authors explored communication patterns between OR nurses, surgeons and members of the anesthesia team. Findings within this systematic review had a recurring theme: separate disciplines and providers had differing expectations when asked to describe ITC. Similarly, a study conducted by Nestel and Kidd (2006) determined that many providers relied heavily on assumptions. Often,

surgeons assumed that their equipment would be available and when it was not ready they made up for the delay by cutting corners and potentially compromising surgical safety (Nestel & Kidd). Additionally, results from the systematic review by Nagpal et al. (2010) found provider communication to be largely informal during the handoff of patient care in the post anesthesia care unit (PACU). Even more importantly, the transfer of patient information did not always lead to the transfer of patient responsibility. Furthermore, while communication failures can occur throughout all phases of the perioperative setting, information lost in one phase of care will inevitably compromise safety in a subsequent phase (Nagpal et al.).

Provider communication may take many different forms depending on the providers leading the interaction, patient characteristics and the setting in which the transfer is occurring (Agarwala et al., 2015). From an anesthetic viewpoint, airway management is of the utmost importance, with hemodynamic stability, fluid management, and intravenous and intra-arterial access following thereafter. When anesthesia providers are relaying pertinent patient information to other members of the anesthesia team, they often focus on American Society of Anesthesiologists (ASA) physical classifications, airway assessments and other anesthesia related details (2014). In contrast, when transferring patient care to members outside of the anesthesia team, they are more likely to omit these topics (Anwari, 2002). While all of this information may be important to relay throughout the perioperative process, members of the surgical team and recovery room nurses may place priorities on different information. For example, surgeons are likely to hold the type and duration of the procedure in highest regard, as this is their focus and area of primary responsibility. Additionally, while it is valuable to

communicate all of the aforementioned data to PACU nurses, adequate analgesia, anti-emetic medications and antibiotic administration and administration times are areas of specific postoperative nursing focus (Nagpal et al.).

Standardized Handoffs

A 'handoff' is the term used to describe the transfer of patient information and responsibility from one clinician to another (Agarwala et al., 2015). A standardized handoff is a way for healthcare providers to transfer patient information in a uniform and consistent manner using a structured format predetermined by the institution (Williams et al., 2007). Standardized handoffs should include interactive communication, limited disruptions, opportunities to review any relevant history and a process for information verification (American Congress of Obstetricians and Gynecologists [ACOG], 2012). Standardization is needed during the handoff period in order to ensure all essential information is communicated, regardless of which providers are transferring and receiving care (Agarwala et al., 2015). Two thirds of all sentinel events occur because of breakdowns in communication, and, more specifically, more than half of these breakdowns occur at the time of patient handoff (Caruso et al., 2015).

Handoff Tools

Standardized communication, in the form of checklists, has been introduced in other high-stakes disciplines like aviation and the nuclear power industry (WHO, 2009). For example, aviators use checklists for almost all segments of the flight, including preflight, taxi, takeoff, and landing. Depending on the subspecialty using the checklist, whether it is airframe manufacturers, officials of regulatory agencies, or airline companies, the type of checklist varies. Some take the form of mechanical checklists,

while others rely on vocal checklists highlighting items written on a paper card (Schamel, 2012). Similarly, the International Atomic Energy Agency (IAEA) has set standards related to nuclear power plant maintenance, inspection, and safety regulations. Written checklists are used to assess power plant compliance with such standards in order to protect health, life and property in the development of nuclear energy (IAEA, 2002). While both of these professions are vastly different from the healthcare setting, communication breakdown in any one of these specialties is likely to have life-threatening consequences.

Commonly, handoff checklists include pertinent information such as patient medical and surgical histories, allergies, height and weight, relevant laboratory values, intravenous or intra-arterial access sites, medications administered and the surgery being performed. Other information that has been included in various studies may include special instructions, postoperative plan and expectations, information to be relayed to family members and significant events or concerns (Petrovic et al., 2014).

A structured checklist implemented in the Safe Surgery Saves Lives campaign conducted by the WHO (2009) is used prior to anesthesia induction, before surgical incision and before the patient leaves the operating room. This 19-item checklist has been shown to reduce patient mortality and complications by more than 35% (Agarwala et al., 2015). This particular tool, titled the *Surgical Safety Checklist*, prompts providers to answer many safety concerns such as: Is the pulse oximeter on the patient and functioning? Is the patient a difficult airway or aspiration risk? And, has the patient's name, procedure, and where the incision will be made been recognized and

acknowledged by all staff involved? This handoff tool aims to decrease errors and adverse events and increase teamwork and communication (WHO, 2009).

Variations to handoff tools in the form of a checklist can also be found; some institutions choose to standardize provider communication using prompted discussion. One quality improvement project that took place at Massachusetts General Hospital, Boston, implemented an electronic anesthesia information management system (AIMS). This initiative aimed to prompt discussion during the transfer of care, rather than provide an exhaustive list of data (Agarwala et al., 2015). It was developed by and designed from the clinical experience of practicing anesthesiologists within that institution. This electronic tool required the primary anesthesia provider to document when a transfer of patient responsibility occurred, which was performed by pressing a single button. After clicking this specific button, an additional window would pop-up to display prepopulated information regarding the patient and procedure, serving as a useful resource to relay report to the oncoming caregiver. Additionally, the outgoing provider was expected to check off individual boxes to indicate which information was communicated. To make this tool more user friendly, not all boxes were required to be checked for the handoff to be completed (Agarwala et al.). This allowed for standardization while providing caregivers an opportunity to maintain the highly valued elements of flexibility and autonomy.

Briefings are another tool used to actively involve all members of the intraoperative team and promote a sense of shared responsibility between all parties. The briefing is a short recap of the patient and procedure being performed, an assessment of any threats and risks and a way to engage everyone present while eliminating as many

distractions as possible (Marks et al., 2014). Briefings typically take place after anesthesia induction and before the beginning of the surgical procedure, but are also encouraged at subsequent handoffs or when additional team members arrive (DeFontes & Surbida, 2004).

Benefits of Standardized Handoffs

The Institute of Medicine (IOM) recognized that healthcare in the United States needs substantial improvement and perhaps as many as 98,000 patients die in hospitals each year because of preventable medical errors (IOM, 2000). In a 2000 report published by the IOM, titled *To Err is Human,* communication failure was named one of the leading causes of patient safety errors. (IOM, 2000). Handoffs that use a specific format on a consistent basis for all providers ensure predictability, reliability, comprehensiveness and above all, standardization (Caruso et al., 2015).

A systematic research review described in *Annals of Surgery* (Nagpal et al., 2010) was performed to examine the impact that standardized communication tools had on information transfer and patient safety surrounding the perioperative area. A total of 38 studies were included in the review. Results showed that improved team communication when using standardized handoffs led to increased staff satisfaction and empowerment. Over time it also translated into decreased hospital length of stays, less operating room delays and a reduction in morbidity and mortality for many patients (Nagpal et al., 2013). One finding from this study revealed that substandard communication between physicians and nurses was a direct predictor of medication errors. Improved patient outcomes and decreased hospital admissions directly translate into significant healthcare

savings. Additionally, improved staff satisfaction often results in improved staff retention and engagement in practice (DeFontes & Surbida, 2004).

There are countless benefits of implementing a standardized communication tool in fact, simple introductions of each team member by name and role has shown to have a significant impact (Bohmer et al., 2011). Closed-loop communication and being able to address individuals directly fosters teamwork and facilitates a mutual understanding (WHO, 2009). Medical literature and other industries that standardize their communication, such as aviation and Formula 1 racing, have found that using a set criterion to conduct a handoff has actually increased efficiency without increasing the duration of report (Caruso et al., 2015). In the busy healthcare environment, maximizing efficiency is a major selling point to many busy practitioners, especially surgeons and anesthesia providers.

Healthcare clinicians are impacted by their patient care roles both professionally and personally. When caregivers choose to embrace change and adopt improved communication methods, they inevitably develop invaluable nontechnical skills as well (Nagpal et al., 2010). Standardized handoff tools have the ability to enhance communication by organizing data in an objective, concise, systematic fashion thereby sharpening professional and personal skills (Nagpal et al.). Well-developed communication skills are transferrable to all healthcare settings, as well as within daily personal interactions (WHO, 2009).

Challenges of Standardized Handoffs

Challenges with standardized handoffs stem from a variety of factors. These challenges range from deciding on what type of tool to adopt, what elements to include,

what information to omit and how to foster a commitment to change practice by all involved caregivers (Nagpal et al., 2010). Most handoff tools are subject to the perception of the healthcare professional being asked to use them (Agarwala et al., 2015). Some tools, when first reviewed or practiced, may seem too difficult to use, require too many steps or take too long to complete (Caruso et al., 2015). Other means of standardized communication may appear too rigid and non-customizable to each individual patient interaction. Consequently, it is not uncommon for providers to be unwilling to embrace the change in practice with an open mind and they may be unlikely to adopt the proposed tools into their routine. The WHO described a relatively new term called checklist fatigue, which is likely to occur when practitioners who are required to use too many checklists start to view certain items as extraneous and unimportant (2009).

Two of the biggest obstacles that are often faced when introducing a standardized handoff tool are the cultural barriers within the institution and the adoption of new technology that may be required (Nagpal et al., 2013). The culture of an institution or department is affected by many influences. Its' leadership, the structure of the team, the perception of different roles and individual attitudes toward safety concerns all contribute to the norms and values of the group. Within the perioperative world, teams are often formed in a hierarchal manner and reluctance to communicate within the team is not uncommon (WHO, 2009). Surgery, anesthesia and nursing professions are all accustomed to thinking and working independently, making it difficult to transition to thinking of these disciplines as a single unit (Lingard et al., 2008). Furthermore, standardization, in general, within the healthcare field is often viewed as a means to undermine professional autonomy. All of these factors can result in strong opposition by

many providers when expected to embrace recommended changes, no matter the cost, or undisputed benefits (WHO, 2009).

The Perioperative Area Defined

The perioperative area generally encompasses pre, intra, and post-operative patient care areas. Perioperative staff refers to nursing or medical healthcare workers who participate in direct patient care in these areas. Additionally by common definition, perioperative staff may also include preoperative care unit nurses or intensive care unit nurses who assume care of patients coming directly from the OR, but for the purposes of this systematic review, articles relating to these specific populations will be omitted. The majority of postoperative care takes place in the PACU, with the exception being some intensive care level patients who may be transferred directly from the OR to the intensive care unit (ICU) (Catchpole et al., 2007). For the purposes of this systematic review, only intraoperative and PACU handoffs will be included and only those professionals who are immediately involved in the transfer of patient care responsibilities will be discussed.

Preoperative Communication

Preoperative (preop) communication relates to any healthcare provider handoff that takes place between the preoperative area and the OR. The preop setting is where patients are prepared for surgery, last minute lab tests are performed and final documentation is completed. The preop holding area is often the first direct contact patients have with perioperative staff and the nurses' primary responsibilities are to provide information and emotional support to patients and their families and ensure that all preoperative data and documentation has been thoroughly completed (Vera, 2012).

Communication breakdown between the preop nurses and the OR personnel could lead to major oversights, legal disputes and potential patient harm. For instance, if communication fails related to a positive pregnancy test result that was obtained in the preoperative holding area, there is a potential for a patient to be medicated inappropriately with benzodiazepines or other medications toxic to a fetus (Nagelhout & Plaus, 2014). Additionally, once a patient is medicated, he/she is no longer deemed appropriate to consent for surgery. Omissions in handoff report regarding completed anesthesia and surgical consent forms could result in OR delays, surgical cancellations or healthcare provider negligence (American Association of Nurse Anesthetists [AANA], 2013). Clear and comprehensive communication in the preoperative setting is essential to set the stage for effective communication in the remaining perioperative areas.

Intraoperative Communication

In the operating room, handoffs occur in the midst of many other competing demands and distractions, such as surgeon and OR technician discussions, loud noises of hammers, saws or other instrumentation and the repetitive beeping of different hemodynamic monitors and machines (Nagelhout & Plaus, 2014). These distractions place this information transfer event at a higher-risk for error (Agarwala et al., 2015). Between October 2012-January 2013, a prospective observational assessment was conducted at Massachusetts General Hospital, Boston, as a quality improvement initiative to expose potential areas for improvement surrounding the process of handoffs in the intraoperative arena (Agarwala et al.). Agarwala et al. recognized a need for a more uniform approach to guide providers through a comprehensive handoff during what often is an already stressful and distracting environment within the OR suite. They

hypothesized that the use of a standardized handoff tool would not only improve provider satisfaction with report, but also improve memory recall and information retention.

The authors introduced an electronic checklist to be incorporated into the electronic medical record that would be used to communicate essential patient information between outgoing and oncoming anesthesia providers when the primary provider would be away from the operating room for at least 40 minutes, or when ending a shift. Examples of pertinent information included on the checklist were past medical history, allergies and administration of specific medications. The goal of this checklist was to structure the information and to be used as a framework to guide report. After observing a total of 69 handoffs, 39 of which voluntarily used the study checklist, a post-handoff survey was conducted. This post-handoff survey was administered to the oncoming providers 15 minutes after assuming patient responsibility. The assessment asked subjective questions about the clarity of the handoff report, whether the interaction felt rushed and overall provider satisfaction with the interaction. Objective questions were also asked related to specific patient information in order to determine overall information retention by the oncoming provider. Limitations of this study were identified as the limited sample size and non-randomized observational design. However, to avoid bias, observers conducting the handoff assessments were blinded to the providers' use of the voluntary checklist. The results of the study suggested that the use of the checklist was associated with improved communication for items such as potential areas of concern and postoperative plan of care. Specifically, a larger percentage of providers, 97% who used the checklist compared to only 63% who did not, were able to accurately

recall critical patient information regarding paralytic administration after the handoff occurred (Agarwala et al.).

Another safety checklist was introduced and trialed in the following three venues: the Department of Traumatology and Orthopedics; the Department of Anaesthesiology and Intensive Care; and The Institute for Research in Operative Medicine of the University of Witten/Herdecke (Bohmer et al., 2011). The aim of the study was to assess compliance with safety standards perioperatively and to determine the degree of interprofessional teamwork and cooperation. These assessments were made before and after the implementation of a safety checklist and the results were compared (Bohmer et al.). The safety checklist was introduced and performed by staff working directly within the operating room. It included basic safety features such as the patient identity, intended surgical site and indications for preoperative antibiotic use prior to the first surgical incision. Twelve weeks after implementing the checklist, an attitude survey was conducted in order to measure staff perceptions related to the change in practice. A total of 71 staff members from the departments of anaesthesiology and traumatology were polled.

Staff members were not only more cognizant of the names and roles of each intraoperative team member, which helped to improve communication and eliminate hierarchal disparities, but surgeons reported increased knowledge of patient risk factors, more confidence that all surgical instruments were removed from the surgical field and an overall increase in job satisfaction. The implementation of the checklist allowed for a more proactive approach to care and increased efficiency of the OR team. This resulted in staff reports of decreased stress levels because the competing demands of economic

constraints and patient safety were minimized. Furthermore, when asking staff from the Department of Traumatology if they were informed when high-risk patients were undergoing surgery and where particular attention was required in these cases, result polled before and after checklist implementation showed an average increase from 3.89 to 4.67, respectively on a five- point scale. Similarly, when asking the Department of Anaesthesiology members if the operative site was marked or where specifically the surgical site was, results showed an increase from 3.78 to 4.20 when using the safety checklist. The results of this study suggested that early recognition of patient comorbidities and risk factors can decrease the occurrence of postoperative complications, unexpected healthcare costs and further contribute to heightened staff satisfaction (Bohmer et al.).

The prior study was carried out over two years following the checklist initiation. In a follow up article titled, "Long-term Effects of a Perioperative Safety Checklist from the Viewpoint of Personnel", the authors (Bohmer et al., 2012) sought to evaluate the quality and cooperation of operating room staff long after the surgical safety checklist was implemented. These results were then compared with the original 12-week evaluation. Again, in the form of a questionnaire, staff satisfaction and knowledge of the patient and procedure were measured using a five-point Likert scale. Questions were asked in statement style, such as "I am certain that the patient's written consent was obtained prior to surgery". The respondents were asked to rate the statement using a numerical scale. Seventy-six physicians and 23 anaesthetic nurses were polled. Overall, it was the orthopedic surgeons who responded most positively to the use of the checklist, both immediately, and after two years. In contrast, anesthesiologists and anesthesia

nurses were less enthusiastic and positive about the impact of the checklist and its effects. These differences may have been related to different specialties placing a higher priority on different parts of the checklist or perhaps the different specialties regard the importance of communication and teamwork to varying standards. Time management and uncertainty about obtained informed consent were two specific areas of concern for anesthesia nurses, even after implementing the checklist. Prior to the checklist implementation, time management was given a mean score of 3.47 on a 5-point scale by anesthesia nurses. According to the 5-point Likert scale, a score of one represents "never", and five represents "always". When surveyed again at three, 18, and 24 months, scores increased to 3.58, 4.11, and 4.00, respectively. This increase in scoring signifies that overall, the anesthesia nurses actually felt more rushed as time went by. While study findings over the two-year period were not as dramatic as the 12-week results, the findings still supported that teamwork and interdisciplinary communication were of value in the intraoperative setting (Bohmer et al.).

Postoperative Communication

During the transfer of the patient from the OR to the PACU, there is a physical handoff of the patient, monitors, intravenous lines and other equipment as well as the verbal transfer of patient responsibility (Caruso et al., 2015). Within this busy setting, there is an increased risk for patient clinical instability and communication breakdowns. When there are a variety of procedures being performed, it is even more essential that accurate information be translated to the oncoming PACU nurse, especially when this nurse is caring for multiple patients simultaneously (Petrovic et al., 2014). Furthermore, the surgeons, surgical residents and anesthesia personnel are not always as readily

available in the PACU as they are intraoperatively (Nagelhout & Plaus, 2014). This change of team composition further necessitates the need for thorough handoff report because once the transfer of care occurs additional questions and clarifications from one profession to another may not be made as easily (Caruso et al.).

Satisfaction with Handoffs

All of the studies that will be reviewed in this section assessed satisfaction on behalf of the outgoing provider, oncoming provider or both. Several studies conducted pre and post handoff tool surveys and compared the results as a means to measure improvement. Many of the studies, including the one conducted by Caruso et al. (2015), allowed the reports to be submitted anonymously by having the respondents use a unique identification code on their surveys. Protecting the identity of respondents eliminated any bias and allowed participants to freely express opinions with the interaction.

In a prospective observational study that took place at Massachusetts General Hospital, Boston (Agarwala et al., 2015), a post-handoff assessment tool was used to gauge the recipients' satisfaction with the interaction. The assessment tool that was implemented contained both subjective and objective information, which sought to assess satisfaction and perceptions if the handoff was rushed, as well as the amount of information retained regarding fluid and medication administration and timing. After implementing the checklist 28% more anesthesiologists (n =13) were able to successfully recall specific information about muscle relaxant administration. Additionally, discussion of potential areas of concern and postoperative plans increased from approximately one half to more than 90% when using the tool. Subjects' reports of improved information retention led to increased provider confidence and improved

interpersonal relationships. Reinforcing or improving the confidence of busy and often stressed clinicians is likely to translate into happier, more satisfied staff. Likewise, improved work relationships are likely to facilitate more open communication, teamwork, and over time may have the potential to lead to fewer hierarchal barriers between disciplines (WHO, 2009). By using the checklist, incoming anesthesiologists were introduced to the operative team more frequently, 3% (n =0.9) before checklist implementation as compared to 51% (n =19.8) after. Clinicians who were found to be still using the checklist long after the study ended provided further evidence to suggest increased provider satisfaction with the standardized handoff tool and a clear perceived benefit from its use (Agarwala et al.). In fact, 66.2% of respondents (n =88) stated they used the checklist in at least two-thirds of their handoffs. Of these respondents, 97.7% (n=86) felt the checklist was somewhat or very helpful.

Similar to the aforementioned study, Nagpal et al. (2013) conducted a prospective interventional study to examine handover conducted in the PACU in an acute care teaching hospital in London. A trained researcher who was implementing a new assessment tool examined handoffs and assessed providers' participation, communication, task sequence and inclusion of pertinent medical information, such as antibiotic, pain, and intravenous fluid plans, anesthetic course and complications and the patient's current condition and vital signs. After standardization, there was a noticeable improvement in the comprehensiveness of handoff report. A clearer transfer of patient responsibility lead to less information omissions and task errors, which translated into improved quality of care. The results of the study found that overall nurses' satisfaction was greatly improved in terms of leadership, communication, coordination, cooperation,

and situational awareness. Scores in each of these categories were rated a three out of five before the handover protocol was initiated. Scores increased to a four in all categories, with the exception being communication, which increased to a five. After the protocol was implemented, 58% (n=23.2) of handovers were awarded a perfect 5/5 score for overall PACU nurse satisfaction, whereas only 8% (n=4) met this score prior to the protocol implementation. Increased scores represented an improvement to communication and teamwork and a reduction in information omissions and task errors (Nagpal et al.).

Next, the framework used to guide this systematic review will be presented.

Theoretical Frameworks

In the evolving healthcare arena, there is an ever-growing need for safety improvements and risk reduction. In order to keep clinicians abreast of any and all relevant data, studies must be compiled in a systematic, reproducible manner. Systematic reviews and meta-analyses are regarded as the highest level of research in healthcare. Reporting the findings of systematic reviews requires that the authors provide complete transparency of all elements of the investigation. This ensures that readers have been provided with full disclosure to judge the merits of the study based on its strengths and weaknesses (Liberati et al., 2009).

In 2005, a group of 29 clinicians, authors, methodologists and medical editors joined together for a three-day meeting in order to create a standardized tool that could be used to guide the development of systematic reviews. This group of developers guided their work through the use of the Quality Of Reporting of Meta-analysis Statement, more commonly referred to the QUOROM Statement. Quality of Reporting of Meta-analysis Statement was a 1999 publication that could be used to guide authors when analyzing randomized trials and reporting their findings into a meta-analysis (Moher et al., 2009). The result of this meeting yielded a critical appraisal tool known as The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA), which was finalized and published in 2009. Preferred Reporting Items for Systematic Reviews and Meta-Analyses includes a 27-item checklist, illustrated in Table 1 on the next page and a four-phase flow diagram that can be used to minimize bias, provide reliable findings, and allow accurate conclusions to be drawn from the systematic collection of studies. Major sections within the PRISMA checklist consist of the title of the article to

Table 1.

PRISMA Checklist

Table 1. **Checklist of Items to Include When Reporting a Systematic Review (With or Without Meta-Analysis)**

Section/Topic	Item #	Checklist Item	Reported on Page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome-level assessment (see Item 12).	
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group and (b) effect estimates and confidence intervals, ideally with a forest plot.	
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., health care providers, users, and policy makers).	
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review level (e.g., incomplete retrieval of identified research, reporting bias).	
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	

(Moher et al., 2009).

be included along with its abstract, introduction, methods, results, discussion, and funding. Embedded in each of these sections is detailed information to be summarized

and reported, along with rationales and supporting evidence as to why each item should be included.

The flow diagram, illustrated in Figure 1 below, provides authors with a way to narrow down search results in a consistent and reproducible fashion.

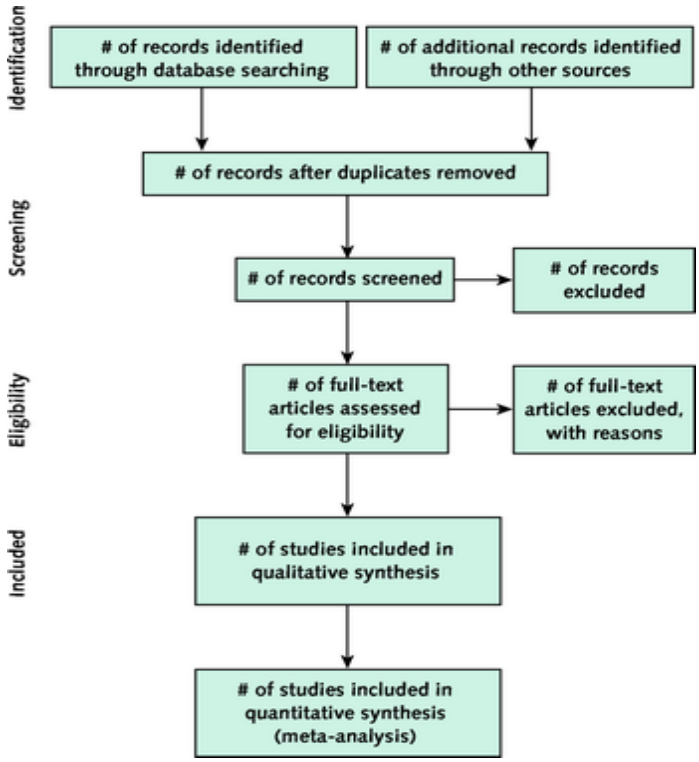

Figure 1. PRISMA Flow Diagram (Moher et al., 2009)

Initially, all articles found during the search are counted and assessed for their relevancy to the topic being analyzed. Then, in accordance with the PRISMA diagram, any duplicates are removed and the remaining records are then screened for eligibility. If a record is to be excluded, there must be substantial objective reasons as to why it does not meet inclusion criteria. After following the diagram, any researcher who follows this step-by-step process should end up with very similar results, further proving that the

remaining articles to be included within the systematic review are unbiased and transparent.

PRISMA is adhered to by many other authors and is highly regarded within the research community. For that reason, PRISMA was chosen as the framework to be used when conducting the data search for this systematic review and will be referred to throughout the article screening process.

While many studies may seem reliable and valid at first glance, it is important to critically analyze in order to assess the overall quality. The Critical Appraisal for Summaries of Evidence (CASE) worksheet is a tool used by healthcare providers to assess the quality of evidence and to recognize patterns among the overall quality of all tools being used (Foster & Shurtz, 2013). The CASE worksheet, illustrated in Table 2 on the next page, consists of 10 questions, asking about the transparency and appropriateness of the examined reports.

Table 2.

CASE Worksheet

Critical Appraisal for Summaries of Evidence (CASE) Worksheet *Numbers in evaluation correspond with those assigned to articles in study key chart	
Questions	**Evaluation**
Summary Topic	
1. Is the summary specific in scope and application?	Yes- Not completely- No-
Summary Methods	
2. Is the authorship of the summary transparent?	Yes- Not completely- No-
3. Are the reviewer(s)/editor(s) of the summary transparent?	Yes- Not completely- No-
4. Are the research methods transparent and comprehensive?	Yes- Not completely- No-
5. Is the evidence grading system transparent and translatable?	Yes- Not completely- No-
Summary Content	
6. Are the recommendations clear?	Yes- Not completely- No-
7. Are the recommendations appropriately cited?	Yes- Not completely- No-
8. Are the recommendations current?	Yes- Not completely- No-
9. Is the summary unbiased?	Yes- Not completely- No-
Summary Application	
10. Can this summary be applied to your population?	Yes- Not completely- No-

(Foster & Shurtz, 2013)

These 10 questions encompass specificity, authorship, reviewers, methods, grading, clarity, citations, currency, bias, and relevancy of each study (Foster & Shurtz, 2013). The researcher must answer these questions as either “yes”, “no”, or “not completely”. The CASE worksheet has been trialed many times by its creators and revised to eliminate any inter-rater ambiguity. Traditionally, the CASE worksheet is

utilized to assess the quality of point-of-care tools and treatment modalities that directly impact patient outcomes.

Next, the methodology of the systematic review will be described.

Method

Purpose of the Study

The purpose of this paper was to conduct a systematic review to determine what impact the implementation of a standardized handoff tool has on perioperative staff satisfaction regarding handoffs and communication in the perioperative area. When staff are engaged and committed to an improvement, incorporating that improvement as standard practice is more likely, lending itself to long-term enhancements in patient safety in the perioperative arena

Definition of Terms

For purposes of this review, perioperative staff included intraoperative and PACU staff only. These staff members are immediately involved in the transfer of patient care responsibilities surrounding the immediate operative period.

Staff satisfaction related to the use of the standardized tool was identified as important to measure as it relates to the sustainability of the new practice. For the purposes of this systematic review, any objective measurement of staff satisfaction is acceptable for inclusion.

Eligibility Criteria

Inclusion criteria. Studies included in this systematic review were required to meet the following criteria, in addition to a focus on implementation of standardized handoffs:

- involved members of the perioperative team, including operating room (OR) nurses; post-anesthesia care unit (PACU) nurses; surgeons; surgical residents; anesthesiologists; certified registered nurse anesthetists (CRNAs); student registered nurse anesthetists (SRNAs); anesthesia assistants;

- occurred in any of the following perioperative settings: inpatient hospitals; outpatient ORs; free-standing surgical suites;
- no limitation on type of surgical procedure or severity of illness;
- quantitatively measured staff satisfaction;
- any study design including meta-analysis;
- available in English language.

Exclusion Criteria. Studies excluded from this systematic review included:

- not focused on perioperative care;
- centered around patient satisfaction;
- staff satisfaction discussed but not objectively measured;
- Only available in languages other than English.

There were no exclusions based on the date of study conduction or publication.

Data Sources and Search Strategy

The database searched was PubMed. Additional searches were conducted using Google Scholar as well as hand-searching reference lists for additional citations. The only limitation for data inclusion was the availability of articles in the English language. No limitations regarding article publication dates were imposed. The following search terms were combined in numerous ways and used to identify all relevant literature:

- surgical, perioperative, intraoperative, anesthesia, provider;
- handover, handoff, communication tool;
- improve, reporting, satisfaction.

All articles meeting the search criteria were scanned for their relevance to the topic. All search results were applied to the PRISMA flow diagram in order to be

assessed for eligibility in a systematic and unbiased manner. A comprehensive record of search terms and results were logged throughout the process, and then carefully scrutinized, to remove any duplicates, as illustrated in *Figure 2*.

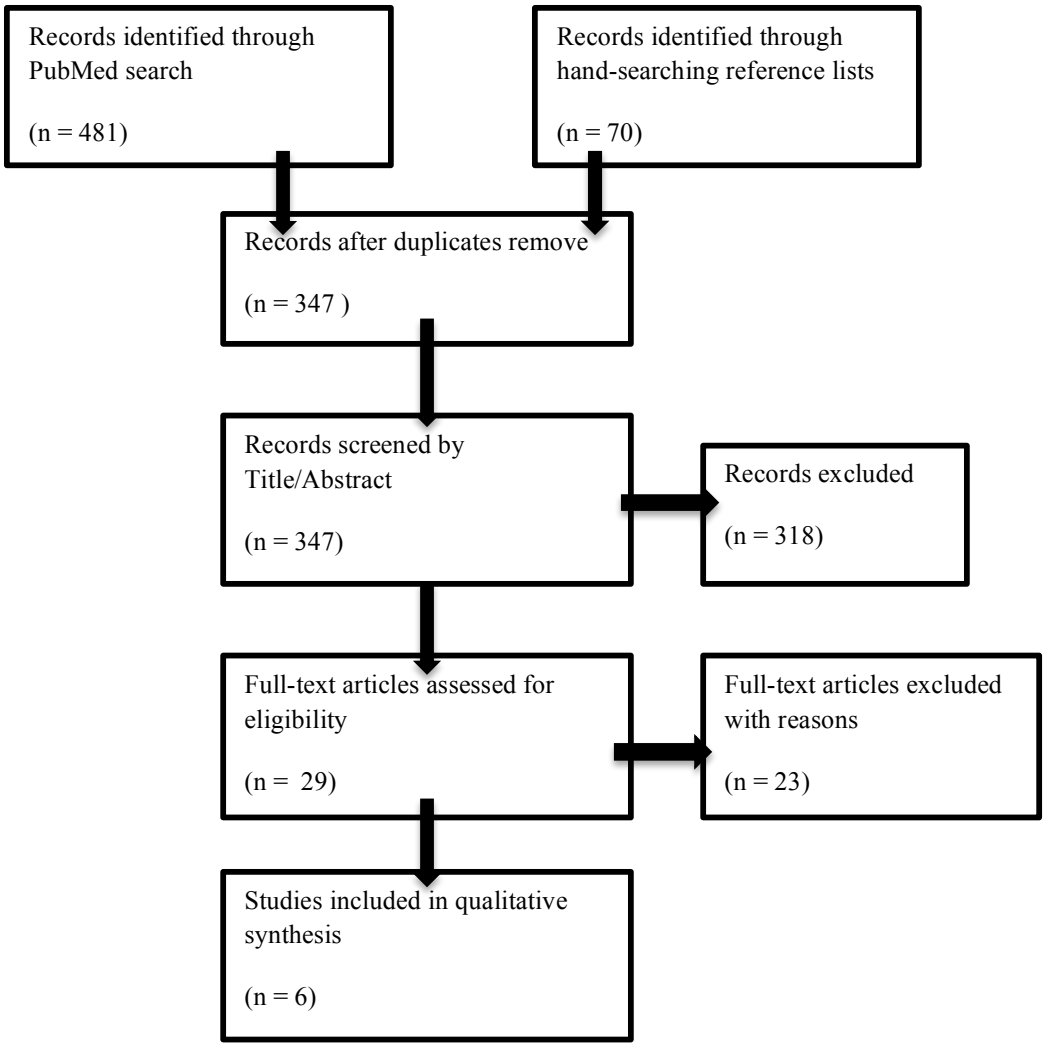

Figure 2. Flow Diagram of Article Screening Process through the utilization of PRISMA Flow Diagram.

Data Collection

In order to evaluate each report in a systematic manner, a data collection tool was adapted from PRISMA and tailored to this study (*Table 3*).

Table 3.

Data Extraction Table #1.

Study # Authors	Study Design, Methods & Goals	Population & Setting	Communication Tool	Satisfaction Measurement

This data extraction table was modified to meet the focus of this systematic review, but includes many of the same criteria as included in PRISMA, such as study design, population, setting and means of measurement. A number was assigned to each article as shown in Appendix A. This number is also listed in the first column of the data extraction tables (Appendix B & C) and may be used to abbreviate and refer to particular reports throughout the systematic review.

A second data collection table was also created (Table 4) and is illustrated on the next page. Some similarities exist between the data collected in both tables, such as the author, designated number and handoff tool being examined. The second data collection table was designed to depict the overall results and satisfaction outcomes in order for conclusions to be drawn. These findings will be described at great length in the data extraction table #2 (Appendix C).

Table 4

Data Extraction Table #2.

Study # Authors	Communication Tool	Statistical Analysis Measures	Results	Limitations	Conclusions

Results of each study are provided in narrative form, as well as tabulation form, in order to provide a more comprehensive view of the literature.

Critical Appraisal and Quality Assessment

The CASE Worksheet, as depicted earlier in *Table 2*, was used to critically analyze each article. The 10 questions included in the worksheet were applied to each study and answered accordingly as met: yes, no, or not completely. The appraisal of each study can be found in Appendix D. Through this application it was possible to assess the quality of each study in terms of transparency, clarity and bias, as well as other characteristics examined.

Cross Study Analysis/Descriptive Data Extraction

Conclusions were made from the patterns and data compiled. Through the comparison across all reports, the following questions can be answered:

- When standardized handoffs were implemented, was staff satisfaction improved?
- Were the studies that resulted in improved satisfaction appraised to be of high quality?
- Which types of handoff tools were implemented in these studies?

The aim, from this point, was to see if any conclusions could be drawn as to a particular style of handoff tool that was shown to be superior to the others. However, in order to

provide unbiased results, it is imperative to keep in mind the information derived from The CASE Worksheet and the determined quality of each study. Appendix E illustrates the cross study appraisal using The CASE Worksheet. Appendix F illustrates the cross study analysis flowchart.

Next, the results of the six articles used for this systematic review will be detailed in terms of study methods, communication tool and satisfaction measures.

Results

Six studies met the inclusion criteria for this systematic review. All six studies sought to assess the impact of a standardized communication tool on perioperative staff satisfaction. The table found in Appendix A is a key that lists each study and assigns a numerical value (1-6) according to the publication (most recent-oldest). The Data Extraction Table #1, which is located in Appendix B, describes the background information of each study whereas Data Extraction Table #2, found in Appendix C, describes the results and conclusions of each study. Appendix D provides information about how each individual study was appraised using The CASE Worksheet. Appendix E shows how all the studies compare to each other when using the CASE worksheet. Appendix F highlights the studies that resulted in improved staff satisfaction and were appraised to be of high quality. For each of the studies that had both of these positive findings, the communication tools that were implemented are provided.

In the prospective cohort study conducted by Agarwala et al. (2015) (Appendix B-1) a total of 69 handoffs were evaluated. Thirty handoffs took place without the direction of a checklist and 39 handoffs used guidance from the AIMS checklist voluntarily. The AIMS checklist was incorporated into the electronic medical record already used in practice at this facility and was designed to prompt discussion about essential patient information between the outgoing and oncoming anesthesia providers during permanent transfer of care intraoperatively. All handoffs included in this study were observed, but the use of the checklist was neither encouraged nor discouraged by observers. Objective measures of staff satisfaction were scored using a 5-point Likert scale survey completed 15 minutes after the transfer of care occurred. Survey scores

before AIMS implementation and 10 months after initiation were also compared to further assess satisfaction.

Results are illustrated in Appendix C-1. In brief, providers, most notably CRNAs, reported feeling less rushed when using the checklist. All providers reported improved satisfaction with the quality of end-of-shift communication. When comparing the results before checklist implementation and 10 months after it was introduced, respondents who felt the checklist was useful reported higher satisfaction regarding the quality of communication ($p<0.001$) as well as improved identification with perioperative concerns ($p=0.003$).

The study conducted by Argarwala et al. (2015) was appraised using The Case Worksheet (Appendix D-1). This study was specific, transparent and comprehensive. The recommendations were clear, current, appropriately cited and unbiased, which allows for results to be applied to the target population of this systematic review.

Caruso et al. (2015) (Appendix B-2) also conducted a prospective cohort study of 86 handoffs where PACU nurse satisfaction was examined. The communication tool implemented was referred to as I-PASS. Of the 86 audits performed, a total of 22 PACU nurse satisfaction surveys were completed without using I-PASS and 14 surveys were completed with I-PASS guidance; all of which were voluntary and anonymous. A select few respondents chose to create a six-digit code on their survey so auditors could make comparisons before and after I-PASS implementation.

Limitations and detailed results are found in Appendix C-2. Satisfaction scores were calculated by adding the scores of 11 total questions, all of which were based on a

5-point Likert scale. Mean satisfaction scores increased significantly from 36 to 44 when using I-PASS (p=0.004). A total score of 51 would indicate the highest level of nurse satisfaction.

Caruso et al. (2015) was evaluated using The Case Worksheet (Appendix D-2) and scored "yes" to all 10 questions. This study was specific, transparent and comprehensive. Detailed search methods and results were described and appropriately cited. The recommendations were clear, current and unbiased. The results from Caruso et al. (2015) are applicable to the target population of this systematic review.

In a prospective cross-sectional study conducted by Petrovic et al. (2014) (Appendix B-3), 103 OR to PACU handoffs were observed. In contrast to several other studies included in this systematic review, this particular study assessed post-handoff satisfaction scores of all participants from each different specialty. The tool implemented was referred to as a perioperative handoff protocol and included discipline-specific checklists to be used by each specialty during communication exchange. While only 103 handoffs were observed, there were a total of 247 surveys completed throughout the study; 105 pre-intervention and 142 post-intervention. Participation was voluntary and averaged about four completed surveys per handoff.

Results and conclusions, as described in Appendix C-3, showed improved PACU nurse satisfaction with OR, anesthesia and surgery handoff. Surprisingly, anesthesia providers did not feel more satisfied when using the perioperative handoff protocol. In fact, satisfaction scores actually decreased from 94% before implementing the protocol to 92%. This result did not reach statistical significance however (p=1.00). One possible

explanation for the decline in satisfaction may be that anesthesia providers, who were used to giving the majority of report, now had to allow the surgical team to give handoff first. Additionally, prior to study implementation, surgery providers did not participate in postop handoff so conclusions cannot be drawn about improvements in surgery providers' satisfaction.

Petrovic et al. (2014) scored 10/10 "yes" on The Case Worksheet (Appendix D-3). This study was specific, transparent and comprehensive. The recommendations were clear, appropriately cited and unbiased. Findings from Petrovic et al. (2014) can be considered current and relatable to this systematic review.

Nagpal et al. (2013) (Appendix B-4) instituted a Postoperative Handover Proforma to standardize postop communication. This observational study compared satisfaction scores completed by PACU nurses before proforma implementation and after. A total of 90 handoffs were observed. Authors provided information regarding the patient population, but there were no details given regarding the participants involved. Authors did mention that the surgical, anesthetic and recovery team involved in the study was a consistent group of people who could be described as being supportive of research.

Results of this study, as described in Appendix C-4, show an improvement in PACU nurse satisfaction scores when using the communication tool. Fifty-eight percent of handovers were awarded a perfect 5/5 score by PACU nurses, compared to only 8% before protocol implementation. Unfortunately, it is hard to apply these results to current practice because there was very limited information provided regarding participant

characteristics, checklist development and the way in which satisfaction was addressed on the PACU surveys.

When performing a critical appraisal on the study by Nagpal et al. (2013) (Appendix D-4) several shortcomings were identified. This study only scored a yes in two of the 10 categories. The authorship, as well as the reviewers, was not completely transparent, which makes it difficult to determine any potential biases that may exist. Furthermore, the research methods and evidence grading system were not clearly described so relating this study to future research or mimicking the study methods is not feasible. Authors did not provide any specific information related to the questions used to measure staff satisfaction or which specific team members were evaluated. Due to these omissions, as well as having inappropriately cited recommendations, this study is not completely applicable to the target population identified for this systematic review.

Bohmer et al. (2011) (Appendix B-6) conducted an experimental study of 71 intraoperative staff members using a variation of the 'Surgical Safety Checklist', originally developed by WHO. An attitude survey was disseminated to all participants prior to implementing the checklist. Items on the attitude survey included, but were not limited to the following: knowledge of certain patient characteristics, whether or not essential paperwork was completed, names and roles of members of the intraoperative team and other intraoperative concerns. Once the checklist had been in effect for 12 weeks, participants completed the attitude survey again, but this time two additional questions were added, one of which was said to relate directly to staff satisfaction, but specific wording was not provided. Pre- and post-checklist scores were compared and results are described in Appendix C-6. Most important to note about this study is that

satisfaction was not directly assessed prior to implementing the checklist so there was no baseline for comparisons to be made.

In appraising Bohmer et al. (2011) (Appendix D-6), it was determined that the grading system was unclear and recommendations were not properly cited. Due to these flaws, it was not completely possible to determine if the study was unbiased. Authors described an increase in job satisfaction when using the communication tool, however this was hard to evaluate without having provided a baseline satisfaction score. This study only received "yes" on 4/10 questions; specificity, transparency of authorship and reviewers and currency of recommendations. Results from Bohmer et al. (2011) cannot be applied to the target population of this systematic review.

The original study conducted by Bohmer et al., (2011) was continued over two years. Long-term effects of implementing the Surgical Safety Checklist are detailed in the follow-up publication by Bohmer et al., (2012) and can be found in Appendix B-5. Results taken at the 12-week interval were used as a baseline for long-term comparisons to be made; a significant limitation of the original study. Results are described at length in Appendix C-5. At 12 weeks, 18 months and 24 months, satisfaction results were 3.31 ± 1.22, 3.58 ± 1.1, and 3.59 ± 1.14, respectively. While there is a clear improvement in staff satisfaction over time, these scores are not further divided by specialty so it is difficult to draw detailed conclusions.

Unlike the original short-term study by Bohmer et al. (2011), the follow-up study by Bohmer et al. (2012) was more positively appraised by The Case Worksheet (Appendix D-5) with 7/10 "yes" scores. Although an improvement from the original

study, the research methods in the follow-up study were not completely transparent. The grading system, however, was much more clearly described and translatable. Again, without fully knowing the research methods used, it is unclear whether this study had any biases and therefore, is not completely applicable to the target population.

Appendix E combines results from Appendix D1-D6 to show a cross-study comparison. Studies 1, 2 and 3, Argarwala et al. (2015), Caruso et al. (2014) and Petrovic et al. (2014), respectively, all received the best possible scores, suggestive that these studies may be considered the highest quality of all the studies included in this systematic review. Study 5, Bohmer et al. (2011), was determined be of good quality, but may not be completely applicable to the target population because it failed to describe the satisfaction measurements clearly. Study 6, Bohmer et al. (2011), lacked quality and cannot be applied to the target population. Authors did not provide enough transparent and reliable information for any results to be considered. Lastly, the appraisal of study 4, Nagpal et al. (2013), revealed lack of transparency, currency and valid citations. While this study received the lowest quality score by The CASE Worksheet, it is relatable to the target population and may be used to make generalizations about standardized communication.

After reviewing and appraising all six studies, the Cross-Study Critical Analysis Flowchart (Appendix F) was completed. First, studies that resulted in improved satisfaction are listed. All six studies showed improved satisfaction of all participant groups, with the exception being Petrovic et al. (2014), which demonstrated mixed results. Despite the decreased satisfaction scores by anesthesia providers, PACU nurse satisfaction was significantly increased; which supported the decision to include the study

in the flowchart. Next, high quality studies, determined via the critical appraisal, are identified; studies by Nagpal et al. (2013) and Bohmer et al. (2011) were excluded. Finally, of the remaining four studies, the communication tool that was trialed is listed for each. The handoff tools implemented in the high quality studies that had positive results were the electronic anesthesia information management system (AIMS), I-PASS mnemonic that described the illness, patient summary, action list, situation awareness and synthesis by receiver, Peri-op Handoff Protocol and a variation of the 'Surgical Safety Checklist' originally developed by WHO. Results of this systematic review suggest that these four standardized communication methods are effective in improving perioperative staff satisfaction.

Next, summary and conclusions will be discussed.

Summary and Conclusions

A systematic review was performed to determine what impact the implementation of a standardized handoff tool has on perioperative staff satisfaction regarding handoffs and communication in the perioperative area. The goal was to determine if perioperative staff felt more satisfied when using a systematic method to communicate patient, surgical and anesthetic factors. An extensive literature search and review was performed to highlight the importance of concise communication in the perioperative arena. Different handoff tools used in the clinical setting were described and the benefits and challenges of standardizing communication were discussed. There was an abundance of literature focused on standardizing communication in the perioperative setting, which suggests the importance of mainstreaming this practice. Surprisingly, however, the search was limited when measuring the impact that standardized communication had directly on staff satisfaction.

Communication during handoffs and transfer of care is a key element of patient safety. Lack of consistency can lead to omissions in report, frustrations between providers and suboptimal patient care. The Joint Commission (TJC, 2007) recognized the importance and value of standardized handoffs and in 2006 they included this initiative as a new National Patient Safety Goal. Despite this recognized need for more uniform communication between clinicians, many perioperative care providers, including surgeons, anesthesia team members and perioperative nurses, report having no systematic way of transferring patient care (Nagpal et al., 2013). The purpose of this project was to identify if perioperative staff felt more satisfied with their practice when using a communication tool to guide them in handing off patient care responsibilities.

After performing an extensive literature search, six studies were selected for this systematic review based on the identified inclusion and exclusion criteria. The PRISMA checklist and flow diagram were used throughout the literature search and screening process to minimize bias, provide reliable and replicable findings and allow accurate conclusions to be drawn from the systematic collection of studies. Data extraction tables were adapted from PRISMA and tailored to this study. Additionally, The CASE Worksheet was used to critically analyze the studies both individually as well as against one another. The quality of each study was assessed in terms of transparency, clarity and bias.

All six of the studies resulted in improved staff satisfaction when implementing a standardized method of communication. Interestingly, however, Petrovic et al. (2014), demonstrated mixed results when examining satisfaction scores by specialty. The PACU nurses reported improved satisfaction regarding handoffs by anesthesia, OR personnel and members of the surgical team. The study by Nagpal et al. (2013) demonstrated a significant improvement in satisfaction scores when instituting a standardized communication tool. This study instituted a Postoperative Handover Proforma, which included predetermined patient, anesthesia and surgical data. Satisfaction scores were compared before Proforma implementation and after. Fifty eight percent of handovers were awarded a perfect 5/5 score by PACU nurses, compared to only 8% before protocol implementation. Unfortunately, it is hard to apply these results to current practice because there was very limited information provided regarding participant characteristics, communication tool development and the way in which satisfaction was addressed on the PACU surveys. As a result, this study was appraised with low scores by The CASE

Worksheet, receiving a yes in only two of the 10 categories (Appendix D-4). Similarly, results by Bohmer et al. (2011) reported increased job satisfaction when using a communication tool, but accurate conclusions could not be made because there was no baseline information provided to demonstrate such improvement.

Limitations to this systematic review include the small sample size of only six studies and the incomplete data provided by two of the six reports. Many of the six studies implemented different communication tools, but all of them objectively measured staff satisfaction using self-reports graded on a 5-point Likert scale. It could be argued that generalized conclusions about perioperative staff satisfaction cannot be drawn because some studies only measured PACU nurse satisfaction.

While more research could be performed to provide a larger sample size, the limited data gathered from this systematic review shows promising results. Implementing a standardized approach to perioperative communication and patient handoff has been shown in these limited number of studies to be beneficial in terms of staff satisfaction.

Next, recommendations and implications for advanced nursing practice will be discussed.

Recommendations and Implications for Advanced Nursing Practice

The transition of patient care from one provider to another has been identified as a critical event that can result in preventable medical errors, increased morbidity and mortality and subsequent increases in healthcare costs (Argarwala et al., 2015). As healthcare services become more advanced and the average life expectancy continues to rise, patient management is becoming more complex. Additional comorbidities often translate into patients receiving more medications and treatments. Challenging patient care is further confounded by the demands to keep healthcare costs low and increase efficiency and productivity. As healthcare providers on the front lines are being pulled in several different directions, the risk of making errors increases. Providers have less time to communicate more information. Many clinicians report feeling rushed during the transfer of care, resulting in information overload and unnecessary anxiety (Nagpal et al., 2013).

A simple solution to prevent breakdowns in communication is to have a standardized way to transfer patient information. As examined in the six different studies included in this systematic review, standardized handoffs can take place between many different disciplines. Communication tools can be used by same discipline providers, such as an out-going anesthesia provider transferring care to the oncoming anesthesia provider at a change of shift. These tools can also be applied to interdisciplinary exchanges, such as a surgeon communicating to a PACU nurse during a postoperative handoff. The idea of systematic communication gives providers a guide so that all pertinent information is relayed. Communication tools organize data into an objective, concise and systematic manner so omissions are prevented.

One of the biggest obstacles that is often faced when introducing a standardized handoff tool to a new setting is the cultural barriers that exist within the institution. Leadership, team structure and individual attitudes can influence the culture of a department. The perioperative culture, specifically, may be more resistant to change because surgery, anesthesia and nursing professionals are all accustomed to thinking and working independently. Staff need to be educated about the benefits of adopting guided communication tools. One way to break down these barriers could be in the form of policy implementation. If an institution developed a policy mandating standardized handoffs all disciplines would have to undergo a change in practice together. Further develop of policy at the national level emphasizing the critical importance of communication in health care is indicated.

As seen in many of the studies examined in this systematic review, communication tools foster teamwork, increase efficiency and improve staff satisfaction. Many of these studies even resulted in decreased duration of report when implementing a communication tool. Improved efficiency and less omissions in report can lead to safer and more comprehensive patient care, less operating room delays, less medication errors and significant healthcare savings. Furthermore, increased staff satisfaction may improve staff retention and department morale. There are countless reasons as to why leadership should adopt standardized communication practices. While healthcare administrators may have to initially invest in this practice by providing staff education and adopting new technology, the return on investment would be undeniable. In fact, many handoff tools can be adapted to any current practice whether it be in the form of a poster or electronic checklist, such as the electronic anesthesia information management system (AIMS)

described by Agarwala et al., (2015). The majority of healthcare institutions already use electronic medical records, which could further ease the transition and expedite the process.

Undeniably, the findings from this systematic review highlight the benefits of implementing standardized communication tools in the perioperative setting. In addition, further research may prove helpful to determine if one handoff tool design is superior to the others. Results may differ dramatically when using electronic checklists built into the pre-existing patient record versus a bulletin board flowchart hanging in the department. Additionally, assessing long-term outcomes when these tools are used may uncover areas for improvement. It would be valuable to note any increases in staff retention rates or decreases in the length of time taken to give handoff and if such improvements are sustainable. Furthermore, and perhaps most valuable, would be to examine the indirect impact these communication tools have on patients. If communication breakdowns are prevented and a concise transfer of care takes place with each interaction, it is possible that fewer errors would occur. Incorrect timing of medication administration, omissions in pertinent patient history, misinterpretation of future plan of care or countless other errors could possibly be prevented through the implementation of standardized handoffs. Healthcare providers have the responsibility and opportunity to improve patient care through the adoption of standardized communication processes.

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Appendix A

Study Number Key

Study #	Citation
1	Agarwala, A. V., Firth, P. G., Albrecht, M. A., Warren, L., & Musch, G. (2015, January). An electronic checklist improves transfer and retention of critical information at intraoperative handoff of care. *Anesthesia & Analgesia*, *120*(1), 96-104. http://dx.doi.org/10.1213/ANE.0000000000000506
2	Caruso, T. J., Marquez, J. L., Wu, D. S., Shaffer, J. A., Balise, R. R., Groom, M., ... Sharek, P. J. (2015, January). Implementation of a standardized postanesthesia care handoff increases information transfer without increasing handoff duration. *The Joint Commission Journal on Quality and Patient Safety*, *41*, 35-42. Retrieved from http://www.ncbi.nlm.nih.gov
3	Petrovic, M. A., Aboumatar, H., Scholl, A. T., Krenzischek, D. A., Camp, M. S., Senger, C. M., ... Martinez, E. A. (2014, September). The perioperative handoff protocol: evaluating impacts on handoff defects and provider satisfaction in adult perianesthesia care units. *Journal of Clinical Anesthesia*, *27*, 111-119. http://dx.doi.org/10.1016/j.jclinane.2014.09.00
4	Nagpal, K., Abboudi, M., Manchanda, C., Vats, A., Sevdalis, N., Bicknell, C., ... Moorthy, K. (2013). Improving postoperative handover: a prospective observational study. *The American Journal of Surgery*, *206*, 494-501. http://dx.doi.org/10.1016/j.amjsurg.2013.03.005.
5	Bohmer, A. B., Kindermann, P., Schwanke, U., Bellendir, M., Tinschmann, T., Schmidt, C., ... Gerbershagen, M. U. (2012, October 15). Long-term effects of a perioperative safety checklist from the viewpoint of personnel. *Acta Anaesthesiologica Scandinavica*, *57*, 150-157. http://dx.doi.org/10.1111/aas.12020
6	Bohmer, A. B., Wappler, F., Tinschman, T., Kindermann, P., Rixen, D., Bellendir, M., ... Gerbershagen, M. U. (2011, October 14). The implementation of a perioperative checklist increases patients' perioperative safety and staff satisfaction. *Acta Anesthesiologica Scandinavica*, *56*, 332-338. http://dx.doi.org/10.1111/j.1399-6576.2011.02590.x

Appendix B-1

Data Extraction #1

1. Agarwala, A. V., Firth, P. G., Albrecht, M. A., Warren, L., & Musch, G. (2015, January). An electronic checklist improves transfer and retention of critical information at intraoperative handoff of care. *Anesthesia & Analgesia*, *120*(1), 96-104. http://dx.doi.org/10.1213/ANE.0000000000000506

Study Design, Methods & Goals	Population & Setting	Communication Tool	Satisfaction Measurement
Voluntary, prospective observational assessment. Two surveys were disseminated to all anesthesia providers before and after the study took place, as well as one study conducted after an observed transfer of care. The aim of this study was to improve the quality of intraoperative handoff between anesthesiologists through the implementation of a structured checklist.	All anesthesia providers involved in permanent intraop transfer of care between October 2012 and January 2013 at Massachusetts General Hospital, Boston, MA. A total of 69 handoffs were included in the results; 30 performed without the use of the checklist and 39 with checklist guidance.	Electronic anesthesia information management system (AIMS). A simple, structured checklist, which required the outgoing or oncoming provider to check a button indicating information was relayed. AIMS was used as a guide to prompt discussion about essential patient information. It was not to be used as an exhaustive list of data. The tool was developed by practicing clinical anesthesiologists based on collective experience and general consensus.	A post-handoff assessment survey was completed by the oncoming provider 15 minutes after transfer of care occurred. This survey contained 3 subjective and 4 objective questions. The subjective questions assessed the providers' level of satisfaction regarding the clarity and conciseness of the info relayed, whether or not intra- and postop concerns were discussed and if the oncoming provider felt rushed. Questions were answered using a 5-point Likert-type scale. The four objective questions were used to assess how well the oncoming provider could recall specific information that was communicated during the transfer. Additionally, a survey was distributed via email before checklist implementation, which included the same three subjective questions so comparisons could be made. 10 months after initiating the study, a repeat survey was distributed via email, which asked how often the checklist was used and how useful the participant thought it was.

Appendix B-2

Data Extraction #1

2. Caruso, T. J., Marquez, J. L., Wu, D. S., Shaffer, J. A., Balise, R. R., Groom, M., ... Sharek, P. J. (2015, January). Implementation of a standardized postanesthesia care handoff increases information transfer without increasing handoff duration. *The Joint Commission Journal on Quality and Patient Safety*, *41*, 35-42. Retrieved from http://www.ncbi.nlm.nih.gov

Study Design, Methods & Goals	Population & Setting	Communication Tool	Satisfaction Measurement
Prospective cohort study was conducted in which an anesthesia provider, a member of the surgical team and an OR nurse gave patient handoff to a PACU nurse. The study was conducted in two phases; pre-implementation of I-PASS and post-implementation. While the primary goal of this study was to improve information transfer, it also assessed satisfaction related to the transfer of info. A secondary goal of this study was to determine the overall PACU nurse satisfaction with respect to the handoff and provider presence at the time of the handoff.	A total of 86 audits were completed at an academic pediatric hospital in Northern California between October 2012-May 2013. Of these 86 cases, 22 PACU nurse satisfaction surveys were submitted during the pre-implementation phase and 14 after the post-implementation phase.	I-PASS mnemonic was used to guide communication. Items included were illness severity (I), patient summary (P), action list (A), situation awareness (S), and synthesis by receiver (S).	On a voluntary basis, PACU nurses completed an anonymous satisfaction survey consisting of 11 questions, scored on a Likert scale. A few of the questions asked were the following: “I was satisfied with the PACU handoff”, “the anesthesia provider report was satisfactory”, and “handoff start and end were clear”.

Appendix B-3

Data Extraction #1

3. Petrovic, M. A., Aboumatar, H., Scholl, A. T., Krenzischek, D. A., Camp, M. S., Senger, C. M., ... Martinez, E. A. (2014, September). The perioperative handoff protocol: evaluating impacts on handoff defects and provider satisfaction in adult perianesthesia care units. *Journal of Clinical Anesthesia*, *27*, 111-119. http://dx.doi.org/10.1016/j.jclinane.2014.09.00

Study Design, Methods & Goals	Population & Setting	Communication Tool	Satisfaction Measurement
Prospective pre and post, unblinded study. Voluntary and anonymous participation. The aim of this study was to determine if implementing a periop handoff protocol would reduce the number of communication errors and improve multidisciplinary communication thereby leading to greater provider satisfaction without increasing the transition time.	Handoffs taking place between May 2009- March 2010 in the PACU at a large tertiary care center. Providers involved in the study included PACU nurses, surgical staff and anesthesia providers. 103 handoffs were observed; 53 pre-intervention and 50 post-intervention. Of each handoff, providers from each specialty were able to complete a survey.	Peri-op Hand Off Protocol. Discipline-specific checklists were provided to guide information exchange during the communication. Anesthesia checklist included the patient's medical and surgical histories, allergies, baseline vital signs and lab values, intraoperative procedures, invasive monitoring, venous access, and medications. Surgical checklist items included drains/tubes, surgical findings and special instructions, as well as other recommendations. Nursing checklist further described skin inspection, family info, special equipment and any additional events or concerns.	A 9-question satisfaction survey was completed by all involved practitioners after the handoff took place. Scores were evaluated using a 5-point Likert scale. Three of the nine questions asked specifically about satisfaction with OR to PACU handoff and satisfaction related to report from the surgery provider or anesthesia provider.

Appendix B-4

Data Extraction #1

4. Nagpal, K., Abboudi, M., Manchanda, C., Vats, A., Sevdalis, N., Bicknell, C., ... Moorthy, K. (2013). Improving postoperative handover: a prospective observational study. *The American Journal of Surgery*, *206*, 494-501. http://dx.doi.org/10.1016/j.amjsurg.2013.03.005.

Study Design, Methods & Goals	Population & Setting	Communication Tool	Satisfaction Measurement
Prospective observation study conducted under direct observation. A trained researcher observed handovers before and after the implementation of a postoperative handover proforma. The aim of this study was to improve postop handover by implementing this protocol, which involved a handover proforma and standardized the handover process.	Handover was observed before and after instituting the protocol in the PACU of an acute teaching hospital in London. A total of 90 handovers were observed; 50 before and 40 after protocol implementation. The types of cases included in this study were limited to major vascular procedures (n=41) and major gastrointestinal procedures (n=49). Those involved in transfer of care included consistent members of the surgical, anesthetic and recovery team. No other specific information was described	Postoperative Handover Proforma, which included predetermined patient, anesthesia and surgical data. Details related to the proforma development were not described. Included in this handover standardization process was a phase of task completion. All patient-specific and equipment tasks were to be completed before the transfer of info could occur in order to eliminate any distractions during the communication process.	PACU nurses rated their overall satisfaction with the handover on a 5-point Likert scale. No information was provided about the specific wording of the question.

Appendix B-5

Data Extraction #1

5. Bohmer, A. B., Kindermann, P., Schwanke, U., Bellendir, M., Tinschmann, T., Schmidt, C., ... Gerbershagen, M. U. (2012, October 15). Long-term effects of a perioperative safety checklist from the viewpoint of personnel. *Acta Anaesthesiologica Scandinavica*, *57*, 150-157. http://dx.doi.org/10.1111/aas.12020

Study Design, Methods & Goals	Population & Setting	Communication Tool	Satisfaction Measurement
Anonymous, experimental study. This study was carried out as a continuation of a previously conducted study (#6) by the same authors in order to evaluate long-term effects of the 'Surgical Safety Checklist'. The goal of this study was to evaluate the perioperative safety standards and interprofessional cooperation of personnel two years after implementing the checklist. The results obtained after two years would then be compared with the results gathered only three months after the checklist implementation.	A total of 99 employees from the Department of Traumatology and Orthopedics, the Department of Anaesthesiology and Intensive Care and the Institute for Research in Operative Medicine of the University of Witten/Herdecke were surveyed. Specifically, 76 physicians and 23 nurse anesthetists were sampled.	A variation of the 'Surgical Safety Checklist', which was originally developed by WHO, was implemented in this study and carried out as a continuation of study #6. Again, this checklist involved three separate sections to be completed by all members of the OR team. The first was to be answered prior to anesthesia induction, the second was conducted prior to skin incision, and the third checklist completed prior to suturing.	An anonymous 19 item questionnaire was disseminated to participants, which asked safety questions pertinent in the perioperative area. It was referred to as an 'attitude survey' because it evaluated each particpants' attitude regarding certain activities. Questions were answered on a numerical scale from 1 (negative evaluation) to 5 (positive evaluation). This attitude survey was repeated 3, 18 and 24 months after implementing the checklist. The three repeat surveys that were completed contained a total of 21 questions. Only one of these questions related specifically to job satisfaction.

Appendix B-6

Data Extraction #1

6. Bohmer, A. B., Wappler, F., Tinschman, T., Kindermann, P., Rixen, D., Bellendir, M., ... Gerbershagen, M. U. (2011, October 14). The implementation of a perioperative checklist increases patients' perioperative safety and staff satisfaction. *Acta Anesthesiologica Scandinavica*, *56*, 332-338. http://dx.doi.org/10.1111/j.1399-6576.2011.02590.x

Study Design, Methods & Goals	Population & Setting	Communication Tool	Satisfaction Measurement
Experimental study, participants were to remain anonymous. This study aimed to discover whether working with safety checklists has a direct influence on the job satisfaction of the participating staff.	Participants consisted of 71 staff members who directly worked in the OR from the Department of Traumatology and Orthopedics, the Department of Anaesthesiology and Intensive Care and the Institute for Research in Operative Medicine of the University of Witten/Herdecke. Subjects included were of different specialties, including trauma surgeons, anesthesia providers, and surgical nurses.	A variation of the 'Surgical Safety Checklist', which was originally developed by WHO, was implemented in this study. This checklist involved three separate sections to be completed by all members of the OR team. The first was to be answered prior to anesthesia induction, the second was conducted prior to skin incision, and the third checklist completed prior to suturing.	An anonymous 19 item questionnaire was disseminated to participants, which asked safety questions pertinent in the perioperative area. It was referred to as an 'attitude survey' because it evaluated each particpants' attitude regarding certain activities. Questions were answered on a numerical scale from 1 (negative evaluation) to 5 (positive evaluation). This attitude survey was repeated 12 weeks after implementing the checklist, but this time contained two additional questions relating to patient safety and work satisfaction.

Appendix C-1

Data Extraction #2

1. Agarwala, A. V., Firth, P. G., Albrecht, M. A., Warren, L., & Musch, G. (2015, January). An electronic checklist improves transfer and retention of critical information at intraoperative handoff of care. *Anesthesia & Analgesia*, *120*(1), 96-104. http://dx.doi.org/10.1213/ANE.0000000000000506

Communication Tool	Statistical Analysis Measures	Results	Limitations	Conclusions
Electronic anesthesia information management system (AIMS)	Two-tailed Fisher exact test X2 test Statistical analysis was performed using two different software packages.	Results showed that information was relayed more consistently and thoroughly when the checklist was used. Oncoming providers were able to recall specific medication doses and critical patient info when completing the post-handoff assessment 15 minutes after the interaction took place. With specific regards to satisfaction, results showed an improvement in the perceived quality of communication and discussions of potential areas for concern, although results did not reach statistical significance ($p>0.05$). Providers, most notably CRNAs, reported feeling less rushed when using the checklist, with these results reaching statistical significance. Interestingly, handoff durations were not significantly different when using the checklist to guide the communication (5 ± 2 vs. 4 ± 3 minutes with and without checklist, respectively).	Study had a nonrandomized design and a limited sample size. The observers and assessors were the same, which could have introduced observer bias and the possibility of a Hawthorne effect. Additionally, observations were limited to the authors' availability, which increased the likelihood that observations took place during less busy times and perhaps the participants were less rushed to begin with.	Using AIMS checklist at least 75% of the time is likely to result in a perceived improvement in communication quality.

Appendix C-2

Data Extraction #2

2. Caruso, T. J., Marquez, J. L., Wu, D. S., Shaffer, J. A., Balise, R. R., Groom, M., ... Sharek, P. J. (2015, January). Implementation of a standardized postanesthesia care handoff increases information transfer without increasing handoff duration. *The Joint Commission Journal on Quality and Patient Safety*, *41*, 35-42. Retrieved from http://www.ncbi.nlm.nih.gov

Communication Tool	Statistical Analysis Measures	Results	Limitations	Conclusions
I-PASS	Paired t-tests	Mean satisfaction scores increased significantly from 36 to 44 when using I-PASS. Findings were statistically significant (p=0.004). Specifically, OR-to-PACU handoff reached a statistical significant improvement; pre-implementation mean Likert scores were 3.3 ± 0.82 compared to post-implementation scores of 4.3 ± 0.48 (p=0.001).	Three observers may have resulted in inter-rater variability, although multiple training sessions and audits were conducted before hand to eliminate this possibility. Observations were limited to standard business hours. Additionally, the satisfaction survey was adapted from previously published literature but was not formally validated. Furthermore, nurse turnover throughout study conduction may have confounded data. Lastly, the Hawthorne effect is a possible limitation, but unlikely because auditors were present both pre and post-intervention.	Having a standardized communication process significantly improved PACU nurse satisfaction with the interaction. Additional findings showed a significant improvement in information relay to the oncoming provider. The PACU nurse receiving report had multiple opportunities to clarify info or ask questions.

Appendix C-3

Data Extraction #2

3. Petrovic, M. A., Aboumatar, H., Scholl, A. T., Krenzischek, D. A., Camp, M. S., Senger, C. M., ... Martinez, E. A. (2014, September). The perioperative handoff protocol: evaluating impacts on handoff defects and provider satisfaction in adult perianesthesia care units. *Journal of Clinical Anesthesia*, *27*, 111-119. http://dx.doi.org/10.1016/j.jclinane.2014.09.00

Communication Tool	Statistical Analysis Measures	Results	Limitations	Conclusions
Peri-op Hand Off Protocol	2 sample t-test, Mann-Whitney U-test, Fisher exact test	A total of 105 surveys were completed in the pre-intervention phase and 142 completed in the post-intervention phase. There was an average of four surveys per handoff. Results were further divided by specialty. Of the three questions related to satisfaction, the only results that reached statistical significance was that of PACU nurses who agreed or strongly agreed that anesthesia report was satisfactory; 98% compared to only 77% pre-intervention. Although not statistically significant, PACU nurse satisfaction was also improved regarding OR and surgery handoff. Interestingly, anesthesia providers actually reported a decrease in	Potential Hawthorne effect. Small sample size. The observers were not in the OR so it was difficult for them to discern if information was omitted in the PACU handoff. Hard to draw accurate conclusions when comparing pre-interventions scores from one provider to the post-intervention score that may be from a different provider. Also, the fewer number of surveys evaluated pre-intervention are less likely to be representative because of the smaller sample	PACU nurses reported increased satisfaction when using a standardized handoff protocol. In contrast, there was a decrease in satisfaction reported by anesthesia providers.

		satisfaction when using the peri-op handoff protocol; 94% beforehand vs. 92% when using the protocol.	size. Unable to assess improvements in satisfaction on behalf of surgery providers because there were no pre-intervention scores measured.	

Appendix C-4

Data Extraction #2

4. Nagpal, K., Abboudi, M., Manchanda, C., Vats, A., Sevdalis, N., Bicknell, C., ... Moorthy, K. (2013). Improving postoperative handover: a prospective observational study. *The American Journal of Surgery*, *206*, 494-501. http://dx.doi.org/10.1016/j.amjsurg.2013.03.005.

Communication Tool	Statistical Analysis Measures	Results	Limitations	Conclusions
Postop Handover Proforma	Mann-Whitney U-test	Nurse satisfaction improved significantly. Mean scores based on the Likert scale increased from 4 to 5 after implementing the new handover. 58% of handovers were awarded a perfect 5/5 score by PACU nurses, compared to only 8% before protocol implementation.	The study design was observational and a Hawthorne effect may have confounded results. Additionally, there was a small sample size of only 90 handovers and authors did not specify if participation was voluntary or required. Data collected assessed the receiving nurses' satisfaction with the interaction, but did not take into account their level of understanding of the information.	Standardization and the handover proforma significantly improved PACU nurses' satisfaction, teamwork and the perceived quality with interdisciplinary communication.

Appendix C-5

Data Extraction #2

5. Bohmer, A. B., Kindermann, P., Schwanke, U., Bellendir, M., Tinschmann, T., Schmidt, C., ... Gerbershagen, M. U. (2012, October 15). Long-term effects of a perioperative safety checklist from the viewpoint of personnel. *Acta Anaesthesiologica Scandinavica*, *57*, 150-157. http://dx.doi.org/10.1111/aas.12020

Communication Tool	Statistical Analysis Measures	Results	Limitations	Conclusions
Variation of WHO's 'Surgical Safety Checklist'	Mean values, standard deviation, Mann-Whitney U-test	Of the 99 respondents, job satisfaction scores showed continued improvement overtime. At 12 weeks, 18 months and 24 months, results were 3.31 ± 1.22, 3.58 ± 1.1, and 3.59 ± 1.14, respectively. Additionally, results demonstrated an improvement in most safety-relevant factors, but quality of teamwork and interpersonal communication did not show sustained improvement long-term.	Satisfaction scores at each time interval are provided, but are not broken down by each specialty, as all other questions are. This makes it hard to identify if a certain population contributed more than others to the improvement. The checklist was presented to staff by department leaders, which may have influenced staffs' decisions to participate and adopt changes. It is also difficult to determine if changes in scores were related directly to the use of the checklist or other factors that may have influence opinions over the two-year span.	Generally speaking, when intraop personnel used the checklist, satisfaction was improved. Long-term use of the surgical safety checklist positively influenced safety and staff knowledge of patient and surgical factors, but improvements in teamwork and communication were not sustained over time.

Appendix C-6

Data Extraction #2

6. Bohmer, A. B., Wappler, F., Tinschman, T., Kindermann, P., Rixen, D., Bellendir, M., ... Gerbershagen, M. U. (2011, October 14). The implementation of a perioperative checklist increases patients' perioperative safety and staff satisfaction. *Acta Anesthesiologica Scandinavica*, *56*, 332-338. http://dx.doi.org/10.1111/j.1399-6576.2011.02590.x

Communication Tool	Statistical Analysis Measures	Results	Limitations	Conclusions
Variation of WHO's 'Surgical Safety Checklist'	Mean values, standard deviation, students' t-test	The increase in job satisfaction when using the checklist was rated as 3.31 ± 1.22. No additional information was provided.	The checklist was presented to staff by department leaders, which may have influenced staffs' decisions to participate and adopt changes. The exact question added to the 12-week survey regarding staff satisfaction was not provided. Furthermore, no comparisons can be made because there was no direct satisfaction measurement pre-intervention.	Job satisfaction was said to have improved at the 12-week measurement. Accurate conclusions cannot be made because there was no baseline for comparison.

Appendix D-1

Individual Study Critical Appraisal

1. Agarwala, A. V., Firth, P. G., Albrecht, M. A., Warren, L., & Musch, G. (2015, January). An electronic checklist improves transfer and retention of critical information at intraoperative handoff of care. *Anesthesia & Analgesia*, *120*(1), 96-104. http://dx.doi.org/10.1213/ANE.0000000000000506

Critical Appraisal for Summaries of Evidence (CASE) Worksheet *Numbers in evaluation correspond with those assigned to articles in study key chart	
Questions	**Evaluation**
Summary Topic	
1. Is the summary specific in scope and application?	Yes
Summary Methods	
2. Is the authorship of the summary transparent?	Yes
3. Are the reviewer(s)/editor(s) of the summary transparent?	Yes
4. Are the research methods transparent and comprehensive?	Yes
5. Is the evidence grading system transparent and translatable?	Yes
Summary Content	
6. Are the recommendations clear?	Yes
7. Are the recommendations appropriately cited?	Yes
8. Are the recommendations current?	Yes
9. Is the summary unbiased?	Yes
Summary Application	
10. Can this summary be applied to your population?	Yes

Appendix D-2

Individual Study Critical Appraisal

2. Caruso, T. J., Marquez, J. L., Wu, D. S., Shaffer, J. A., Balise, R. R., Groom, M., ... Sharek, P. J. (2015, January). Implementation of a standardized postanesthesia care handoff increases information transfer without increasing handoff duration. *The Joint Commission Journal on Quality and Patient Safety*, *41*, 35-42. Retrieved from http://www.ncbi.nlm.nih.gov

Critical Appraisal for Summaries of Evidence (CASE) Worksheet *Numbers in evaluation correspond with those assigned to articles in study key chart	
Questions	**Evaluation**
Summary Topic	
1. Is the summary specific in scope and application?	Yes
Summary Methods	
2. Is the authorship of the summary transparent?	Yes
3. Are the reviewer(s)/editor(s) of the summary transparent?	Yes
4. Are the research methods transparent and comprehensive?	Yes
5. Is the evidence grading system transparent and translatable?	Yes
Summary Content	
6. Are the recommendations clear?	Yes
7. Are the recommendations appropriately cited?	Yes
8. Are the recommendations current?	Yes
9. Is the summary unbiased?	Yes
Summary Application	
10. Can this summary be applied to your population?	Yes

Appendix D-3

Individual Study Critical Appraisal

3. Petrovic, M. A., Aboumatar, H., Scholl, A. T., Krenzischek, D. A., Camp, M. S., Senger, C. M., ... Martinez, E. A. (2014, September). The perioperative handoff protocol: evaluating impacts on handoff defects and provider satisfaction in adult perianesthesia care units. *Journal of Clinical Anesthesia*, *27*, 111-119. http://dx.doi.org/10.1016/j.jclinane.2014.09.00

Critical Appraisal for Summaries of Evidence (CASE) Worksheet *Numbers in evaluation correspond with those assigned to articles in study key chart	
Questions	**Evaluation**
Summary Topic	
1. Is the summary specific in scope and application?	Yes
Summary Methods	
2. Is the authorship of the summary transparent?	Yes
3. Are the reviewer(s)/editor(s) of the summary transparent?	Yes
4. Are the research methods transparent and comprehensive?	Yes
5. Is the evidence grading system transparent and translatable?	Yes
Summary Content	
6. Are the recommendations clear?	Yes
7. Are the recommendations appropriately cited?	Yes
8. Are the recommendations current?	Yes
9. Is the summary unbiased?	Yes
Summary Application	
10. Can this summary be applied to your population?	Yes

Appendix D-4

Individual Study Critical Appraisal

4. Nagpal, K., Abboudi, M., Manchanda, C., Vats, A., Sevdalis, N., Bicknell, C., ... Moorthy, K. (2013). Improving postoperative handover: a prospective observational study. *The American Journal of Surgery*, *206*, 494-501. http://dx.doi.org/10.1016/j.amjsurg.2013.03.005.

Critical Appraisal for Summaries of Evidence (CASE) Worksheet *Numbers in evaluation correspond with those assigned to articles in study key chart	
Questions	**Evaluation**
Summary Topic	
1. Is the summary specific in scope and application?	Yes
Summary Methods	
2. Is the authorship of the summary transparent?	Not completely
3. Are the reviewer(s)/editor(s) of the summary transparent?	Not completely
4. Are the research methods transparent and comprehensive?	No
5. Is the evidence grading system transparent and translatable?	No
Summary Content	
6. Are the recommendations clear?	Not completely
7. Are the recommendations appropriately cited?	No
8. Are the recommendations current?	Not completely
9. Is the summary unbiased?	Yes
Summary Application	
10. Can this summary be applied to your population?	Not completely

Appendix D-5

Individual Study Critical Appraisal

5. Bohmer, A. B., Kindermann, P., Schwanke, U., Bellendir, M., Tinschmann, T., Schmidt, C., ... Gerbershagen, M. U. (2012, October 15). Long-term effects of a perioperative safety checklist from the viewpoint of personnel. *Acta Anaesthesiologica Scandinavica*, *57*, 150-157. http://dx.doi.org/10.1111/aas.12020

Critical Appraisal for Summaries of Evidence (CASE) Worksheet *Numbers in evaluation correspond with those assigned to articles in study key chart	
Questions	**Evaluation**
Summary Topic	
1. Is the summary specific in scope and application?	Yes
Summary Methods	
2. Is the authorship of the summary transparent?	Yes
3. Are the reviewer(s)/editor(s) of the summary transparent?	Yes
4. Are the research methods transparent and comprehensive?	Not completely
5. Is the evidence grading system transparent and translatable?	Yes
Summary Content	
6. Are the recommendations clear?	Yes
7. Are the recommendations appropriately cited?	Yes
8. Are the recommendations current?	Yes
9. Is the summary unbiased?	Not completely
Summary Application	
10. Can this summary be applied to your population?	Not completely

Appendix D-6

Individual Study Critical Appraisal

6. Bohmer, A. B., Wappler, F., Tinschman, T., Kindermann, P., Rixen, D., Bellendir, M., ... Gerbershagen, M. U. (2011, October 14). The implementation of a perioperative checklist increases patients' perioperative safety and staff satisfaction. *Acta Anesthesiologica Scandinavica*, *56*, 332-338. http://dx.doi.org/10.1111/j.1399-6576.2011.02590.x

Critical Appraisal for Summaries of Evidence (CASE) Worksheet *Numbers in evaluation correspond with those assigned to articles in study key chart	
Questions	**Evaluation**
Summary Topic	
1. Is the summary specific in scope and application?	Yes
Summary Methods	
2. Is the authorship of the summary transparent?	Yes
3. Are the reviewer(s)/editor(s) of the summary transparent?	Yes
4. Are the research methods transparent and comprehensive?	No
5. Is the evidence grading system transparent and translatable?	No
Summary Content	
6. Are the recommendations clear?	Not completely
7. Are the recommendations appropriately cited?	Not completely
8. Are the recommendations current?	Yes
9. Is the summary unbiased?	Not completely
Summary Application	
10. Can this summary be applied to your population?	No

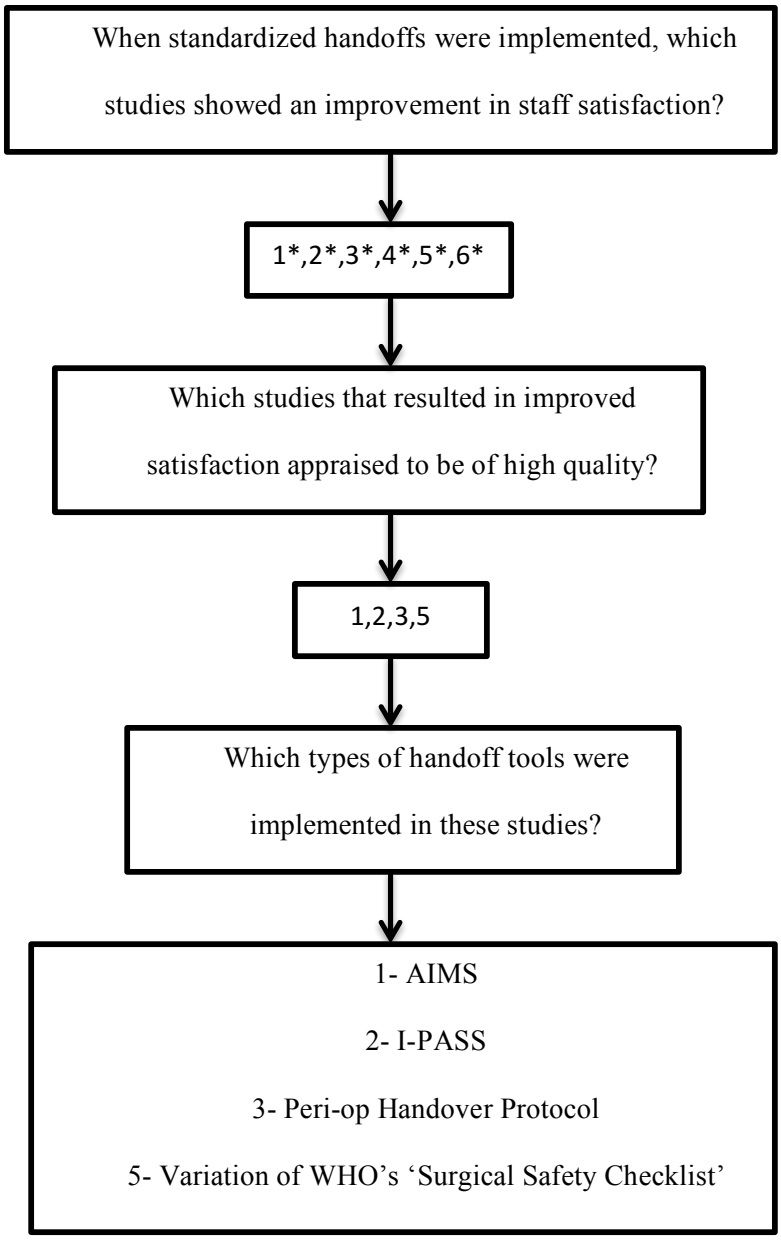
Appendix E

Cross-Study Critical Appraisal

Critical Appraisal for Summaries of Evidence (CASE) Worksheet *Numbers in evaluation correspond with those assigned to articles in study key chart	
Questions	**Evaluation**
Summary Topic	
1. Is the summary specific in scope and application?	Yes- 1, 2, 3, 4, 5, 6 Not completely- No-
Summary Methods	
2. Is the authorship of the summary transparent?	Yes- 1, 2, 3, 5, 6 Not completely- 4 No-
3. Are the reviewer(s)/editor(s) of the summary transparent?	Yes- 1, 2, 3, 5, 6 Not completely- 4 No-
4. Are the research methods transparent and comprehensive?	Yes- 1, 2. 3 Not completely- 5 No- 4, 6
5. Is the evidence grading system transparent and translatable?	Yes- 1, 2, 3, 5 Not completely- No- 4, 6
Summary Content	
6. Are the recommendations clear?	Yes- 1, 2, 3, 5 Not completely- 4, 6 No-
7. Are the recommendations appropriately cited?	Yes- 1, 2, 3, 5 Not completely- 6 No- 4
8. Are the recommendations current?	Yes- 1, 2, 3, 5, 6 Not completely- 4 No-
9. Is the summary unbiased?	Yes- 1, 2, 3, 4, Not completely- 5, 6 No-
Summary Application	
10. Can this summary be applied to your population?	Yes- 1, 2, 3 Not completely- 4, 5 No- 6

Appendix F

Cross-Study Critical Analysis Flowchart



1* Argarwala et al. (2015); 2* Caruso et al. (2015); 3* Petrovic et al. (2014); 4* Nagpal et al. (2013); 5* Bohmer et al. (2012); 6* Bohmer et al. (2011)