University of California, Los Angeles, surgical time-out process: evolution, challenges, and future perspective

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Since the development of the WHO Safe Surgery Saves Lives initiative and Surgical Safety Checklist, numerous hospitals across the globe have adopted the use of a surgical checklist. The UCLA Health System developed its first extended Surgical Safety Checklist in 2008. Authors of the present paper describe how the time-out checklist used before skin incision was implemented and how it progressed to its current form. Compliance with the most recent version of the checklist has been closely monitored via documentation and observance audits. In addition, the surgical team's appreciation of the current time-out has been assessed. Cultural, practice, and human resource challenges are discussed, as are potential future avenues for innovations in the emerging field of the surgical checklist in neurosurgery.

(<http://thejns.org/doi/abs/10.3171/2012.8.FOCUS12255>)

KEY WORDS • checklist • neurosurgery • time-out • compliance • safety • quality

CHECKLISTS have been used in many industries to improve efficiency, accuracy, and safety. The first pilot's checklist was developed in the early 1930s as aircraft technology became more complex and the number of steps required by pilots for safe takeoff and landing increased. In the late 1990s Berenholtz and colleagues³ tested a safety checklist in the surgical intensive care unit at Johns Hopkins Hospital. They developed a 5-item checklist that was used before inserting central lines from January 1998 through December 2002. After 1 year of requiring completion of the checklist before all central line insertions, associated infections had dropped from 11% to 0% in the intensive care unit. Using statistical projections, the authors estimated that 43 infections were prevented, 8 lives were spared, and almost \$2 million in additional costs per year were saved. The success of the central line insertion checklist spread quickly, and today a similar checklist is used in most patient care settings across the nation.^{12,33,36} At about the same time, Calland and colleagues⁴ performed a randomized controlled trial of procedural checklists to determine their capacity to increase the frequency of safety-critical behaviors during laparoscopic cholecystectomies. Cases were randomized from April 2001 to July 2002. Their study represents the first use of operative checklists in the US. No differences in patient outcome, case

duration, and technical proficiency were noted between surgeons proceeding with a preprocedural briefing and checklist versus those proceeding in their standard fashion. Importantly, however, the study did show that surgical safety checklists increased the frequency of favorable team behavior such as team communication.⁴

Other health care checklists quickly followed in large hospitals and smaller practice settings across the globe.^{2,8,13,15,17,19} A nursing pain management checklist was developed to ensure that a patient's pain level was assessed at least once every 4 hours.⁸ Following implementation of the checklist, untreated pain complaints decreased from 41% to 3%. A checklist for patients on ventilators was created to ensure the head of the patient's bed was raised to 30°, H₂ inhibitors were initiated, and frequent oral care was provided.² After using the checklist, a 25% decrease in ventilator-associated pneumonia and 21 fewer deaths than in the prior year were noted.

The WHO was attentive to the safety and quality concerns in the massively growing number of surgeries performed annually around the world. In the US alone, studies suggested that almost half of all surgical complications in which patients were left disabled or dead were potentially preventable.^{7,34} Reports of operations mistakenly performed on the wrong extremity, or even on the wrong patient altogether, had surfaced.^{6,14,21,28,32} Inadequately maintained medical equipment setting fire to patients, incorrect use of instruments due to improper staff training, miscommunication between medical teams, and preventable complications presented issues that needed immediate action.

Abbreviations used in this paper: SCIP = Surgical Care Improvement Project; UCLA = University of California, Los Angeles.

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In January 2007, WHO officials and a panel of expert surgeons, anesthesiologists, nurses, and even patients from around the globe met at the WHO Geneva headquarters to discuss potential solutions. Shortly thereafter, the WHO Surgical Safety Checklist was created.^{24,46} In 2009, the results of a multisite pilot study assessing the efficacy of the WHO surgical checklist was published in the *New England Journal of Medicine*. The authors observed a 4% decrease in surgery-related complications and a 0.7% reduction in in-hospital deaths.¹⁶ The proposed checklist was designed to be easy to use and applicable in many settings. Numerous hospitals, both small and large scale, have implemented the WHO checklist and continue to observe its positive impact.^{38,39,42,43} To date, few groups have reported their experience with a surgical checklist specifically for neurosurgery.^{9,18,22,25}

Implementing the First Surgical Safety Checklist at UCLA

As of July 1, 2004, the UCLA Health System adopted the Universal Protocol created by The Joint Commission Board to address the continuing occurrence of wrong-site, wrong-procedure, and wrong-person surgery.^{30,35} The Universal Protocol includes preprocedure verification, site marking, and time-out.³⁵ It was expanded to a series of requirements under The Joint Commission's 2003 and 2004 National Patient Safety Goals. The UCLA Health System had instituted measures to meet all related regulatory requirements before introducing its extended time-out.

Prior to 2008 a formal extended time-out did not exist in the UCLA Health System operating rooms. Although the hospitals and clinics had established system-wide policies and practice requirements to ensure readiness and safety before surgery, there was no standardized list of items that all team members would verify together before incision. Only the patient identity, operative site, and procedure to be performed were confirmed by an operating room nurse, an anesthesia provider, and a member of the surgical team. The surgeon would discuss the operative plan with the assistant residents and/or fellow. The anesthesia provider and surgeon would discuss management concerns. While these verifications and discussions occurred consistently before all surgical procedures, they did so at varying times and often without all team members present. Consequently, not all team members were aware of all the critical components. Communication between team members was fragmented, and readiness in the event of unplanned difficulty was not consistently optimized.

Realizing the opportunities for patient care improvement, UCLA followed the lead of other hospitals worldwide and developed the first extended Surgical Safety Checklist. While the extended Surgical Safety Checklist included verification before induction of anesthesia, time-out before skin incision, and debriefing before the patient leaves the room, in this paper we focus only on the time-out portion of the checklist. Modeling the WHO Surgical Safety Checklist,^{24,46} the UCLA checklist required the surgical team to stop all activity to time-out just before incision or start of the procedure. During the time-out, the entire surgical team would gather together to review critical components

outlined on the checklist. The checklist was a final check of the patient's identity, procedure to be performed, and operative site and laterality. The checklist required that this verification be cross-referenced with the patient's signed consent, at least 2 physical identification sources including the patient arm band, and at least 2 patient identifiers (full name, date of birth, and medical record number). Like the WHO checklist, the UCLA checklist included a review of the patient's drug allergies, their need for blood products, and the availability of any required implants, devices, or equipment. The surgeon was required to review anticipated critical events, nonroutine steps, case duration, and anticipated blood loss with the entire team. Nurses were to discuss equipment readiness, and anesthesia providers were to review any anesthesia-specific concerns with the entire team. The time-out checklist was printed on brightly colored plastic cards that were placed in every operating room and procedure room. Nurses, technicians, anesthesia providers, surgeons, residents, fellows, and medical students were all trained on the time-out process that would occur before the start of any invasive procedure.

The concept of performing an official common pause and the introduction of a checklist represented major changes in culture and practice.¹⁰ Initially, the UCLA Health System found it challenging to integrate and apply the WHO-recommended practices before every invasive procedure. While the policies were successful at other institutions, the belief that UCLA would have similar benefits was not shared by all surgical team members. At the beginning, even in specialties in which compliance with the time-out was high, 3 observations were common: 1) not all team members actively participated, 2) some elements were rushed and not given enough discussion, and 3) the checklist itself was not referred to and some elements of the list were skipped or forgotten. Despite initial challenges and difficulties, active daily and weekly management of the change helped to ease the culture shock. Direct observation and feedback, operating room huddles, and reviewing the process of time and its importance during departmental meetings are a few examples of the reinforcement measures taken. Progressively, the time-out became a forum for discussing the operative plan as a cohesive team, allowing each person to understand the concerns of the other. Although critical elements and anticipated events were discussed between the attending surgeon and assisting resident and between the attending surgeon and anesthesiologist, inclusion of this discussion in the time-out with the entire operative team present was viewed as a significant improvement.³⁹ Indeed, team workflow is particularly important during the critical steps, planned or unplanned, of an elective surgery and even more so in urgent surgeries.⁴⁵ It is exactly in these situations that it is important for each team member to know exactly what to do. Surgeons, anesthesia providers, and nurses really began to appreciate the opportunity to clarify key elements and ask questions. Certain services embraced the practice enthusiastically and wanted to add supplemental components to further enhance the process.

Evolution of the Time-Out Process

As the time-out practice became commonplace

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across the organization, improvements to the process and additions to the checklist were underway. Indeed, the WHO encouraged modifications to fit with local practices. While UCLA's initial checklist included verification of numerous components, there was little emphasis on the importance of the concept of the pause. Truly stopping all activity to time-out and discuss concerns was to be an ongoing theme—not just an exercise for the beginning of the case. Thorough communication was emphasized, and team members were assured that everyone in the room had equal power to stop activity and voice concern if a safety issue arose. To stress each team member's responsibility of voicing concerns, a safety statement by the team leader was instituted. The safety statement was worded to stress that each member should feel at ease to voice questions or concerns at anytime during the procedure: "If anyone has any concerns now or at any point during the procedure, please voice them immediately."

In addition to the safety statement, team member introductions, inspired by the WHO checklist, were also incorporated. The surgeon was to state, "My name is John Smith and I am the attending surgeon"; and then the nurse, "My name is Jane Doe and I am the circulating nurse"; and so forth to include every single person in the room. Nursing students and medical students were also asked to introduce themselves and expected to voice any questions or concerns. Having team members introduce themselves by name and role would help to instill comfort and confidence to speak up in the operating room. It would also help create a team spirit and allow people who may have just met to be formally introduced to one another. These early additions to the checklist, which encouraged personalized interaction between members of the procedural team, were quickly incorporated into daily practice.

Previously in the UCLA Department of Neurosurgery, the surgeon or designee (that is, the resident or fellow) could conduct the time-out. Recently, however, it became policy for the attending surgeon to conduct the time-out in person. It is the attending surgeon's responsibility to set the tone for open communication and team spirit. He or she ensures that all team members, including the attending anesthesiologist, all neurosurgical and anesthesia residents and fellows, circulating nurses, operating room technicians, neuromonitoring technicians, and all other participants, are present and actively engaged in the time-out process. The time-out leader asks, "Can we do a time-out now?" This is the key phrase that lets all team members know that they must not only stop what they are doing but also gather around the patient so that everyone can be easily seen and heard. If some members persist in their activity, the time-out will not proceed beyond the introduction of all members gathered together. Note that the Department of Neurosurgery added a supplemental list of items to verify after completing the hospital's standardized checklist. Two important elements added to the extended time-out are reviews of critical imaging and use of lasers. Although not pertinent to all surgeries, these additions were found to be so valuable that they were later added to the Health System's standardized checklist.

In July 2011, the UCLA Health System released its

most current version of the time-out checklist for use across the system (Fig. 1). This latest version included the 2 elements added by the Department of Neurosurgery, as well as all preincision SCIP measures. Since implementing this version of the checklist, compliance has been closely monitored via documentation and observance audits. In addition, the surgical team's appreciation of the most current version of the time-out was assessed, giving important feedback on culture change and avenues for improvement.

Compliance With the Time-Out Process and Preincision Guidelines

As mentioned previously, before 2008 no standardized surgical safety checklist was used in the UCLA Health System. After introducing the first extended version of the time-out, compliance with the time-out process and preincision guidelines was assessed specifically for the Department of Neurosurgery. The first quarter showed 77% compliance based on the documentation audit (Fig. 2). Within 6 months of applying the time-out procedure, compliance reached 96%. After implementing the most recent version of the time-out process in July 2011, a documentation audit showed 100% compliance during 3 of the 4 quarters. Note that compliance was also assessed by someone watching the time-out process. A completed time-out implied that the checklist card was used, that all elements were reviewed, and that the entire team was present. An incomplete time-out implied that the checklist card was not used during the time-out, at least 1 element was skipped, or at least 1 team member was missing. The completion audit revealed that although the time-out process was performed in almost all cases in the last year, complete observance of the time-out process was noted in only 53%–62% of cases across the UCLA Health System. Importantly, this audit was performed across all surgical specialties performing procedures in the main operating rooms of both the Ronald Reagan UCLA Medical Center and the Santa Monica UCLA Medical Center and Orthopaedic Hospital. The next step is identifying why complete observance was not achieved in all cases. Is the standardized time-out perceived as inappropriate for some specialties or procedures? Are there any new cultural issues that must be addressed?

The addition of checklist items covering SCIP measures in the most recent version of the time-out process was an initiative to improve UCLA's compliance with SCIP measures. Originally developed by the Centers for Medicare & Medicaid Services and the Centers for Disease Control and Prevention, the SCIP national partnership endeavored to improve the quality and safety of surgical care by reducing postoperative complications.^{1,11,37} The introduction of preincision SCIP measures to the time-out process was intended to improve UCLA's compliance with these nationally mandated process measures (Fig. 3). Between 2008 and June 2011, administration of the correct prophylactic antibiotic per institutional guidelines varied from 75% to 98%. After performing the current version of the time-out process, this rate reached 100% and was maintained for the entire year. Admin-

SURGICAL SAFETY TIMEOUT

In Room, Prior to Incision (or before procedure start)

- **TEAM MEMBER INTRODUCTION**
Verbalization of Name & Role
- **CONFIRMATION OF**
Patient Identity
Operative Site
Procedure
Blood Status
Allergy Status
Isolation Status
- **ANTICIPATED CRITICAL EVENTS**
PROCEDURALIST/SURGEON
Review Critical Steps
Review Procedure Duration & Anticipated Blood Loss
Confirm Critical Imaging Available & Reviewed
SCIP ➡ Address Prophylactic Antibiotic
- ANESTHESIA PROVIDER
State ASA
Address Patient-Specific Concerns
SCIP ➡ Address Beta-Blocker & Temperature Management
- REGISTERED NURSE
Confirm Implant(s) Available
Address Equipment Issues
SCIP ➡ Address Hair Removal & DVT Prophylaxis
- **TEAM MEMBER ATTESTATION**
"All issues have been addressed."
- **SAFETY ANNOUNCEMENT BY TEAM LEADER**
"If anyone has any concerns now or at any point during this surgery/procedure, please voice them IMMEDIATELY."
- **LASER** requires additional timeout prior to use
- **Supplemental procedure-specific timeout** required if applicable

SCIP REQUIRED ANTIBIOTICS

SURGICAL PROCEDURE	REQUIRED ANTIBIOTIC	PENICILLIN ALLERGY
COLON/BOWEL SURGERY	Cefoxitin OR Ertapenem OR Unasyn	Flagyl & Gentamicin OR Flagyl & Ciprofloxacin OR Clindamycin & Gentamicin OR Clindamycin & Ciprofloxacin
PEG PLACEMENT/ REVISION	Cefazolin OR Cefoxitin	Clindamycin & Gentamicin OR Clindamycin & Ciprofloxacin
SPINE SURGERY ORTHO/PODIATRY NEUROSURGERY CABG, Pacemaker, AICD, other CARDIAC & VASCULAR SURGERY	Cefazolin OR Vancomycin*	Clindamycin OR Vancomycin
HYSTERECTOMY PUBOVAGINAL SLING	Cefoxitin OR Cefazolin	Flagyl & Gentamicin OR Flagyl & Ciprofloxacin OR Clindamycin & Gentamicin OR Clindamycin & Ciprofloxacin
HEAD & NECK	Cefazolin	Vancomycin* OR Clindamycin +/- Gentamicin
PROSTATE BIOPSY	Cefoxitin	Ciprofloxacin OR Flagyl & Gentamicin OR Clindamycin & Gentamicin
PENILE PROSTHESIS	Cefazolin & Gentamicin	Clindamycin & Gentamicin

*VANCOMYCIN requires documentation of reason for use before surgery start.
ORAL antibiotics are only acceptable for Prostate Biopsy & Pubovaginal Sling.

Fig. 1. The current extended Surgical Safety Time-Out checklist used in the UCLA Health System operating rooms. AICD = automatic implantable cardioverter defibrillator; ASA = aspirin; CABG = coronary artery bypass graft; DVT = deep venous thrombosis; PEG = percutaneous endoscopic gastrostomy.

istration of a beta-blocker in the perioperative period for appropriate patients ranged from 75% to 97% after instituting the first time-out but reached 100% and was maintained for the entire year after applying the current time-out. Compliance with intraoperative deep vein thrombosis prophylaxis (compression devices applied before incision) varied from 81% to 98% between 2008 and June 2011 but reached 100% since July 2011. Intraoperative temperature management (application of forced air warming if the body temperature was below 36°C) ranged from 98% to 100% after implementation of the initial time-out. Since enforcing the current time-out, the rate reached 100% and was maintained. Appropriate hair removal methods (clippers only, no razors) were met in 91%–100% of cases prior to June 2011. Thereafter, com-

pliance reached 100% and was maintained. Thus, there was across-the-board improvement in compliance with SCIP guidelines after their incorporation into the checklist format of the time-out process.

Appreciation of the Time-Out Process by the Team

One year after implementing the most recent time-out process, members of the surgical team involved in neurosurgical procedures in the main operating theater of the Ronald Reagan UCLA Medical Center were asked to respond anonymously to a survey. This survey was intended to poll the team regarding its opinions on the time-out process. Responses were categorized as strongly agree, agree, disagree, strongly disagree. The respondents were also

Fig. 2. Bar graph showing documentation audit results in the Department of Neurosurgery since implementation of the extended time-out. The y axis measures the compliance percentage.

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Fig. 3. Graph showing compliance with preincision process measures in the Department of Neurosurgery. Q = quarter.

encouraged to note comments in a blank space reserved for this purpose. Ninety-three of the 128 members of the surgical team, including neurosurgical residents and/or fellows, neurosurgeons, anesthesia residents, anesthesiologists, operating room nurses, scrub technicians, and neuromonitoring technicians, completed the survey. Overall, 98.9% of respondents believed that performing a time-out prior to procedure start (incision) improves patient safety; 80.6% strongly agreed (Fig. 4A). The majority of respondents (97.8%) believed that team member introductions helped to promote a team spirit during the case. Although 80.6% of the respondents strongly agreed with this statement, open comments stressed the importance of clearly pronouncing names (Fig. 4B). This step may be viewed as redundant when the same team is working together regularly. However, given the resident rotations in neurosurgery and anesthesia, the frequent training of new operating room personnel, and observation by medical students, the team member introductions were believed to be essential. Although 93.5% of respondents believed that performing a time-out helped to ensure all team members were comfortable to voice safety concerns throughout the case, only 59.1% of the respondents strongly agreed (Fig. 4C). Open comments stressed that the existence of a safety statement at the end of the UCLA time-out is an important reminder that all members should voice their concerns. However, it is crucial that the attending surgeon sets the tone favoring communication during the case. The time-out is a platform for the attending to inspire respect among all members of the team and make everyone feel that they are equally part of the team. All of the respondents believed that the attending surgeon's review of anticipated critical elements was helpful to their role during the case; 88.2% strongly agreed. A total of 97.1% of respondents believed that they learn something new about the patient and/or the procedure during the time-out that helps them ensure patient safety during the case; 69.1% strongly agreed. All respondents noted that they would want a time-out to be performed prior to the start (incision) of their own surgery if they were the patient. Overall, this survey showed that the team favorably views the use of the time-out.

Challenges

Since the institution of the first extended version of the time-out process, multiple challenges have surfaced.^{10,43,44} Some have been successfully tackled, whereas others are ongoing concerns.

Cultural Change

The cultural change was a challenge during implementation of the first version of the time-out. Surgeons have historically identified themselves as individual craftsmen. Accepting that they are members of a team did require a culture change.⁴⁰ The time-out process stimulates communication among all team members and encourages members to speak up during the time-out and at any time during the procedure.²⁰ Some physicians were not used to being challenged, and some of the team members were not used to expressing their concerns. Surgeons value their clinical autonomy and were reluctant to proceed with a standardized preincision process. It was important to stress that the time-out was an accumulation of standardized prompts to stimulate discussion.^{20,27} The checklist cannot encompass every situation, and the discretion and insight of the surgeon are essential.

Practice Change

The time-out differentiated itself from the formal preprocedural process of verifying the correct patient, procedure, and site. Gathering the entire team and making sure that everyone stopped activity to concentrate on the time-out process was a practice change and, in fact, was viewed by some as an interruption of the workflow.¹⁰ Moreover, in the beginning, going through elements of the time-out took some time, since the team members were not acquainted with the process. Time spent in the operating theater is definitely costly.^{23,31} Realistically, the time-out takes approximately 3–5 minutes to complete.²⁰ However, minor problems, distraction, and equipment issues were also associated with increased time in the operating room and decreased operative performance.^{5,26} With time, the entire team embraced the fact that it was

FIG. 4. Charts showing results of the time-out appreciation survey performed in the Department of Neurosurgery.

important to take a few minutes at the beginning of a procedure to prevent losing time during the case and potentially during a critical step. The evolving safety culture supported these practice changes. Leadership endorsement early in the implementation process and throughout its entire progress has been instrumental.³⁸

Standardization of the Time-Out

Using a standardized tool for all surgical procedures, whatever the duration, location, or complexity, is a challenge. A reasonable question arises: should the time-out be subspecialty-specific, surgeon-specific, and location-specific (operating room, emergency department, or clinic)? The advantage of a standardized surgical checklist is that all members of the team know exactly the contents

of the time-out, since it is the same from specialty to specialty. Given that the time-out process represents a template setting the stage for discussion prior to surgery, the team leader should be encouraged to discuss additional important elements for a specific patient or surgery during the time-out. The UCLA Health System has adopted the time-out checklist not only in the main operating rooms but also prior to invasive procedures performed in all patient care areas.

Human Resource Obstacles

Although the time-out is performed at the beginning of the procedure, staff turnover does occur during the case. Information transfers are made between nurses, scrub technicians, neuromonitoring technicians, residents, and

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anesthesiologists. Transferring information introduces the risk of failing to discuss or passing along the wrong information. Of course, maintaining the integrity of the team for as long as possible is preferred. However, this raises the following question: do all team members that will be involved in the case need to be present at the time-out? Realistically, this is not feasible. To remedy this, some have recommended creating service-specific operating room teams. Thus, even if a member of this team was not present at the initial time-out, he or she would be familiar with the cases and have knowledge of the critical elements usually discussed at the time-out. Turnover of team members is a challenge, emphasizing the need for frequent new training sessions, coaching sessions, and updates.²⁹

Future Perspectives

As the team becomes used to performing the time-out, it becomes susceptible to checklist fatigue, in which the users become too familiar with the process and may go through the elements too quickly or not as thoroughly as before. Keeping the time-out process simple with a limited number of elements helps to prevent checklist fatigue. Innovative approaches from the time-out committee are also essential to maintain the interest of team members. As noted, the time-out process sets the tone for patient safety in the operating room. Each team member must remain vigilant throughout the case and avoid complacency toward patient safety. Training and continuous updates are essential to reeducate and stimulate team members.

In the era of informatics, contemplating the use of a smart checklist is not so far away. As in other institutions, the time-out card has been converted from paper to an electronic format.³⁸ Since instituting the current version of the time-out, the neurosurgery department has been using an electronic format projected on digital screens in the operating theater. In the future, the surgeon might enter responses using a mobile tablet with screen touch technology that projects to screens. Using an interactive platform, the team would go through a series of essential elements. A specific response to an element might prompt a drop-down window to stimulate discussion on additional elements. This could prevent over-standardization and lengthening of the surgical checklist and time-out process. In addition, the data entered could be simultaneously compiled and immediately available for review.

Conclusions

Almost 4 years have passed since the introduction of the first extended Surgical Safety Checklist at UCLA. Striving to improve overall patient care, the UCLA Health System did not step back when facing culture and practice challenges. Regular evaluations and feedback have been instrumental in molding the time-out process into its current form and current level of appreciation by the team. The safety benefits of the surgical checklist rely on a structured and standardized communication protocol.⁴¹ The time-out process, including the pause, team member introductions, review of the checklist, and safety statement, is probably at the heart of the benefits in communication, collaboration, safety attitudes, and team-building experi-

ence. Surveying the surgical team has shed light on features that require improvement and/or development, such as the debriefing process. Having joined the Best Practices for Better Care national collaborative in 2012, the UCLA Health System will continue to ensure safer surgeries. In addition to documenting the use of time-out checklists and reporting compliance, it will be important to demonstrate sound understanding of the process by all team members.

Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author contributions to the study and manuscript preparation include the following. Conception and design: Martin, McLaughlin, Winograd. Acquisition of data: McLaughlin, Winograd, Dash. Analysis and interpretation of data: Martin, McLaughlin, Winograd, Van de Wiele. Drafting the article: McLaughlin. Critically revising the article: Martin, McLaughlin, Winograd, Dash, Van de Wiele. Reviewed submitted version of manuscript: all authors. Study supervision: Martin.

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Manuscript submitted July 13, 2012.

Accepted August 31, 2012.

Please include this information when citing this paper: DOI: 10.3171/2012.8.FOCUS12255.

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