

# The World Health Organisation Surgical Safety Checklist

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# THE WORLD HEALTH ORGANISATION SURGICAL SAFETY CHECKLIST

## INTRODUCTION

Surgical management remains an essential component of health care in the globe. The ageing and growing population is increasing world-wide, resulting in an increasing incidence of cardiovascular disease, malignancies, and traumatic injuries. As a result, the need of surgical intervention on the public health systems will continue to escalate. At least more than 230 million major surgical procedures are performed globally each year, with mortality rates reported to be between 1% and 4%<sup>1</sup>.

Almost 50% of post-surgical morbidity and mortality events have been identified as preventable in various studies. Unfortunately these adverse events results in major human suffering, and puts strain on insufficient and dwindling health resources. In 2007 the Safe Surgery Saves Lives initiative was put together by the World Alliance for Patient Safety as part of the World Health Organisation's efforts to decrease the number of surgical deaths across the world<sup>2</sup>. The resulting document was a World Health Organisation Surgical Safety Checklist (SSCL). The WHO has demonstrated that the use of their SSCL is associated with a reduction in morbidity and mortality in the peri-operative period<sup>3, 4</sup>.

## HISTORY OF THE WHO SURGICAL SAFETY CHECKLIST

The WHO Safe Surgery Saves Lives Checklist is a document that was produced by an international group of experts who were gathered in 2007 by the WHO, lead by Prof Atul Gawande, with the objective of improving the safety of patients undergoing surgical procedures in all corners of the globe. Inputs were received from anaesthetists, surgeons, operating theatre nurses, patients, biomedical engineers, safety experts and other professionals for the development of this essential tool. 19 items were carefully chosen by the four working groups of the second Global Patient Safety Challenge. The progress of the checklist was guided by three principles; simplicity, wide applicability, and measurability.

## DEVELOPMENT OF THE WHO SURGICAL SAFETY CHECKLIST

### **The content and format of the checklist.**

The WHO Safe Surgery Saves Lives team started by amassing a background document of safety practices with known benefits to surgical patients<sup>5</sup>. Then a group of experts was convened to evaluate this document, and to add additional elements to be considered for this checklist. This group included participants from low, middle and high-income countries from around the world. Selected topics were then changed into potential checklist items that only would require a vocal confirmation by the theatre personnel and that allowed an easy corrective action if they had been overlooked. The emphasis was to look at items that would cause harm if omitted. Carefully worded, simple and clear sentences to maintain professionalism in theatre were used, a lesson learned from the aviation industry<sup>6</sup>.

## **The timing of elements.**

In aviation, checklists are designed around operational work-flow patterns, such as before takeoff or before landing. This allows the crew to confirm that critical steps have been completed, and while the identification of their omission is still remediable<sup>5</sup>. During the development of the surgical safety checklist, three phases in the work – flow pattern were identified: the first phase being before induction of anaesthesia, second phase being before skin incision, and third phase being before the patient leaves the operating theatre. The 19 items identified by the team were arranged to follow the normal flow of events in any theatre. Human beings err, and checklists allow for these errors to be identified and corrected before they cause harm<sup>7</sup>.

## **Trial and feedback**

The draft checklist was subjected to a trial. It was clear that some of the steps that seemed straight-forward were not as simple as thought. There were multiple problems with logistics and timing. Through multiple trials, the clinical teams elucidated all the actions and the language that was confusing. Once the checklist was refined and in operation in one setting, it was trialled it was tested in variable other settings<sup>5</sup>. Following multiple successful trials, the checklist was then subjected into wider practice.

## **Formal testing and evaluation of the checklist.**

The surgical safety checklist was piloted in eight hospitals in eight cities. These cities represented a wide variety of economic circumstances and diverse populations. Unfortunately the introduction of the safety surgical checklist faced significant opposition and scepticism; therefore for the checklist to be accepted, its positive impact on patient care and outcome was considered essential. The evaluation of the surgical safety checklist showed a decline in mortality and complications to patients who had undergone non-cardiac surgery in a pilot study done by Haynes AB et al<sup>3</sup>.

## **Local modification of the checklist.**

The Safe Surgery Saves Lives team encouraged health-care workers and hospital administrators to modify the checklist so that it best fits their local practice and work-flow. Elimination of any of the safety steps was discouraged. The team urged for a rapid-cycle trial of the modified checklist to ensure balance and functionality. The process of developing the WHO Surgical Safety Checklists summarised in figure 1 below, and this is a useful tool in implementing any new program.

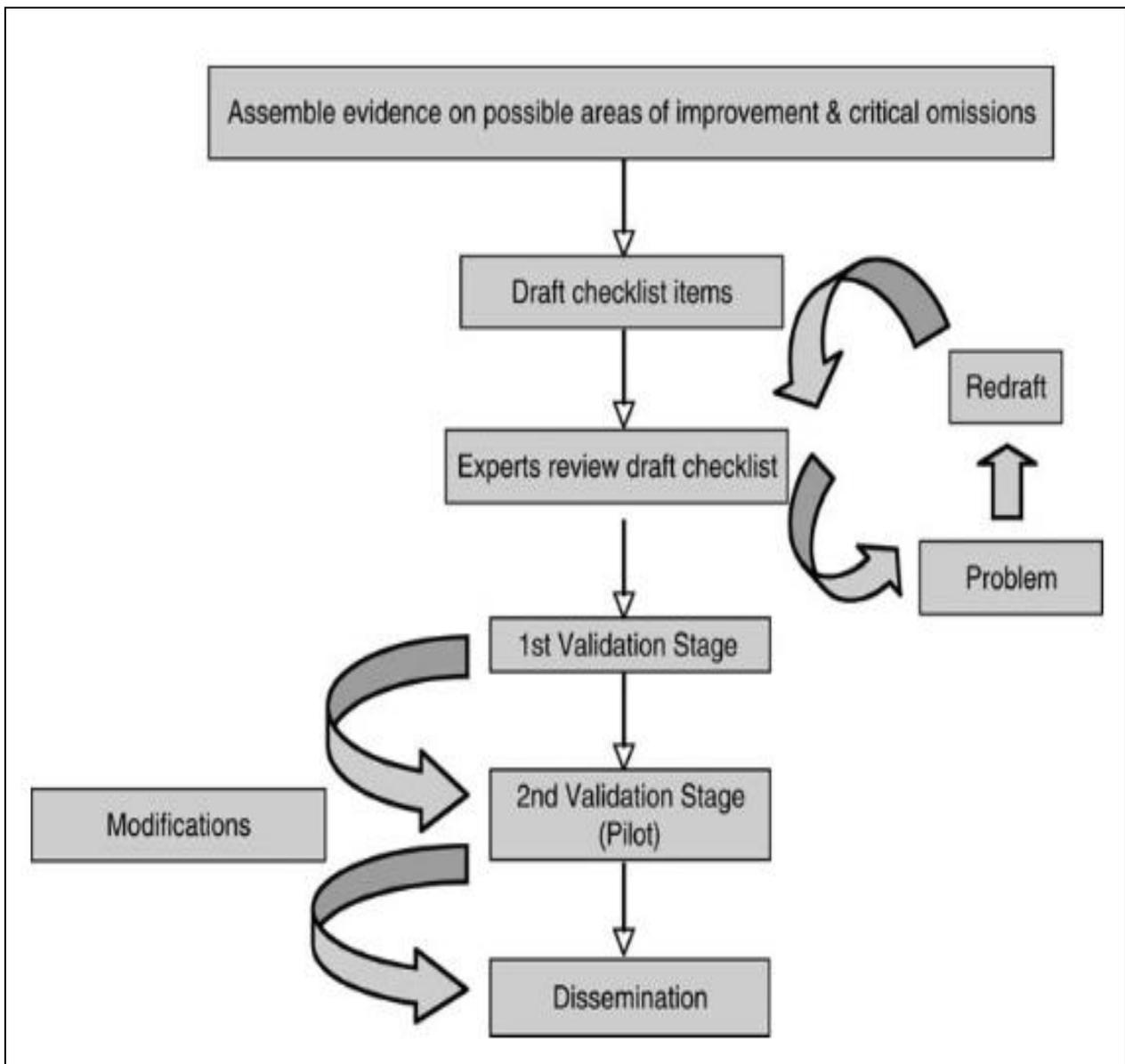


Figure 1 Development of WHO Surgical Safety Checklist<sup>5</sup>.

## ELEMENTS OF THE WHO SURGICAL CHECKLIST

The checklist covers the peri-operative period, and it separates the operation into three phases. Each phase corresponds to a specific sequence in the normal flow of a procedure:

### **Before induction of anaesthesia (sign in)**

This phase at the very least requires the availability of the anaesthetist & nursing personnel. Ideally all members of the theatre team including the surgeon should be present during this phase. It consists of seven items;

- The patient confirms his or her name, the procedure, the site of the procedure, and that he has signed the consent.
- The team confirms the site if marked or not applicable.
- The anaesthetist confirms theatre preparation for the procedure.
- Team members confirm any awareness of whether the patient has any known allergy or not.
- The anaesthetist again confirms examination of the airway and preparedness for difficult airway or prevention of aspiration risk if possible.
- Ideally the surgeon should be able to estimate expected blood loss, and if appropriate access and fluids are available.

<b>SIGN IN</b>	
<input type="checkbox"/>	<b>PATIENT HAS CONFIRMED</b> <ul style="list-style-type: none"> <li>• IDENTITY</li> <li>• SITE</li> <li>• PROCEDURE</li> <li>• CONSENT</li> </ul>
<input type="checkbox"/>	<b>SITE MARKED/NOT APPLICABLE</b>
<input type="checkbox"/>	<b>ANAESTHESIA SAFETY CHECK COMPLETED</b>
<input type="checkbox"/>	<b>PULSE OXIMETER ON PATIENT AND FUNCTIONING</b>
<b>DOES PATIENT HAVE A:</b>	
<b>KNOWN ALLERGY?</b>	
<input type="checkbox"/>	NO
<input type="checkbox"/>	YES
<b>DIFFICULT AIRWAY/ASPIRATION RISK?</b>	
<input type="checkbox"/>	NO
<input type="checkbox"/>	YES, AND EQUIPMENT/ASSISTANCE AVAILABLE
<b>RISK OF &gt;500ML BLOOD LOSS (7ML/KG IN CHILDREN)?</b>	
<input type="checkbox"/>	NO
<input type="checkbox"/>	YES, AND ADEQUATE INTRAVENOUS ACCESS AND FLUIDS PLANNED

Figure 2 [Surgical Safety Checklist (2009 first edition)]<sup>2</sup>

## After induction and before surgical incision (time out)

This phase involves oral confirmation of the next seven items of the checklist, prior to the surgical skin incision. The entire theatre team including; the nursing personnel, the surgeon, and the anaesthetist is involved.

- The team members confirm that they have introduced themselves and their role.
- The patient's identity, surgical site and procedure is confirmed by the team.
- Anticipated critical events are reviewed by both surgical and anaesthetic teams.
- The nursing team confirms sterility, equipment availability and other concerns.
- The team confirms that prophylactic antibiotics have been given if indicated.
- The team also confirms that all necessary imaging results for the patient are displayed in the theatre.

<b>TIME OUT</b>	
<input type="checkbox"/>	<b>CONFIRM ALL TEAM MEMBERS HAVE INTRODUCED THEMSELVES BY NAME AND ROLE</b>
<input type="checkbox"/>	<b>SURGEON, ANAESTHESIA PROFESSIONAL AND NURSE VERBALLY CONFIRM</b> <ul style="list-style-type: none"><li>• PATIENT</li><li>• SITE</li><li>• PROCEDURE</li></ul>
<b>ANTICIPATED CRITICAL EVENTS</b>	
<input type="checkbox"/>	<b>SURGEON REVIEWS: WHAT ARE THE CRITICAL OR UNEXPECTED STEPS, OPERATIVE DURATION, ANTICIPATED BLOOD LOSS?</b>
<input type="checkbox"/>	<b>ANAESTHESIA TEAM REVIEWS: ARE THERE ANY PATIENT-SPECIFIC CONCERNS?</b>
<input type="checkbox"/>	<b>NURSING TEAM REVIEWS: HAS STERILITY (INCLUDING INDICATOR RESULTS) BEEN CONFIRMED? ARE THERE EQUIPMENT ISSUES OR ANY CONCERNS?</b>
<b>HAS ANTIBIOTIC PROPHYLAXIS BEEN GIVEN WITHIN THE LAST 60 MINUTES?</b>	
<input type="checkbox"/>	YES
<input type="checkbox"/>	NOT APPLICABLE
<b>IS ESSENTIAL IMAGING DISPLAYED?</b>	
<input type="checkbox"/>	YES
<input type="checkbox"/>	NOT APPLICABLE

Figure 3 [Surgical Safety Checklist (2009 first edition)]<sup>2</sup>

## **During or immediately after wound closure (sign out)**

The nursing personnel, anaesthetist or surgeon can initiate this phase. It should be completed before the surgeon leaves the operating room. This phase involves the last five elements of the checklist. The aim is to make sure that all instruments and swabs are accounted for and to facilitate the transfer of important information to the recovery room or intensive care unit.

- The team confirms the name of the surgical procedure.
- The scrub sister confirms that the needles, swabs, and instrument counting is complete (or not applicable).
- The nursing team confirms that the specimen (if any) is correctly labelled, including with the patient's name.
- The team confirms whether there are any issues with the equipment to be addressed.
- Finally all team members review aloud the key post-operative concerns.

<b>SIGN OUT</b>	
<b>NURSE VERBALLY CONFIRMS WITH THE TEAM:</b>	
<input type="checkbox"/>	<b>THE NAME OF THE PROCEDURE RECORDED</b>
<input type="checkbox"/>	<b>THAT INSTRUMENT, SPONGE AND NEEDLE COUNTS ARE CORRECT (OR NOT APPLICABLE)</b>
<input type="checkbox"/>	<b>HOW THE SPECIMEN IS LABELLED (INCLUDING PATIENT NAME)</b>
<input type="checkbox"/>	<b>WHETHER THERE ARE ANY EQUIPMENT PROBLEMS TO BE ADDRESSED</b>
<input type="checkbox"/>	<b>SURGEON, ANAESTHESIA PROFESSIONAL AND NURSE REVIEW THE KEY CONCERNS FOR RECOVERY AND MANAGEMENT OF THIS PATIENT</b>

Figure 4 [Surgical Safety Checklist (2009 first edition)]<sup>2</sup>

## The complete WHO Surgical Safety Checklist

 <b>World Health Organization</b>			<b>SURGICAL SAFETY CHECKLIST (FIRST EDITION)</b>		
Before induction of anaesthesia		Before skin incision		Before patient leaves operating room	
<b>SIGN IN</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> PATIENT HAS CONFIRMED                             <ul style="list-style-type: none"> <li>• IDENTITY</li> <li>• SITE</li> <li>• PROCEDURE</li> <li>• CONSENT</li> </ul> </li> <li><input type="checkbox"/> SITE MARKED/NOT APPLICABLE</li> <li><input type="checkbox"/> ANAESTHESIA SAFETY CHECK COMPLETED</li> <li><input type="checkbox"/> PULSE OXIMETER ON PATIENT AND FUNCTIONING</li> </ul> <p>DOES PATIENT HAVE A:</p> <p>KNOWN ALLERGY?</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> NO</li> <li><input type="checkbox"/> YES</li> </ul> <p>DIFFICULT AIRWAY/ASPIRATION RISK?</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> NO</li> <li><input type="checkbox"/> YES, AND EQUIPMENT/ASSISTANCE AVAILABLE</li> </ul> <p>RISK OF &gt;500ML BLOOD LOSS (7ML/KG IN CHILDREN)?</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> NO</li> <li><input type="checkbox"/> YES, AND ADEQUATE INTRAVENOUS ACCESS AND FLUIDS PLANNED</li> </ul>		<b>TIME OUT</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> CONFIRM ALL TEAM MEMBERS HAVE INTRODUCED THEMSELVES BY NAME AND ROLE</li> <li><input type="checkbox"/> SURGEON, ANAESTHESIA PROFESSIONAL AND NURSE VERBALLY CONFIRM                             <ul style="list-style-type: none"> <li>• PATIENT</li> <li>• SITE</li> <li>• PROCEDURE</li> </ul> </li> </ul> <p>ANTICIPATED CRITICAL EVENTS</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> SURGEON REVIEWS: WHAT ARE THE CRITICAL OR UNEXPECTED STEPS, OPERATIVE DURATION, ANTICIPATED BLOOD LOSS?</li> <li><input type="checkbox"/> ANAESTHESIA TEAM REVIEWS: ARE THERE ANY PATIENT-SPECIFIC CONCERNS?</li> <li><input type="checkbox"/> NURSING TEAM REVIEWS: HAS STERILITY (INCLUDING INDICATOR RESULTS) BEEN CONFIRMED? ARE THERE EQUIPMENT ISSUES OR ANY CONCERNS?</li> </ul> <p>HAS ANTIBIOTIC PROPHYLAXIS BEEN GIVEN WITHIN THE LAST 60 MINUTES?</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> YES</li> <li><input type="checkbox"/> NOT APPLICABLE</li> </ul> <p>IS ESSENTIAL IMAGING DISPLAYED?</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> YES</li> <li><input type="checkbox"/> NOT APPLICABLE</li> </ul>		<b>SIGN OUT</b> <p>NURSE VERBALLY CONFIRMS WITH THE TEAM:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> THE NAME OF THE PROCEDURE RECORDED</li> <li><input type="checkbox"/> THAT INSTRUMENT, SPONGE AND NEEDLE COUNTS ARE CORRECT (OR NOT APPLICABLE)</li> <li><input type="checkbox"/> HOW THE SPECIMEN IS LABELLED (INCLUDING PATIENT NAME)</li> <li><input type="checkbox"/> WHETHER THERE ARE ANY EQUIPMENT PROBLEMS TO BE ADDRESSED</li> </ul> <hr/> <ul style="list-style-type: none"> <li><input type="checkbox"/> SURGEON, ANAESTHESIA PROFESSIONAL AND NURSE REVIEW THE KEY CONCERNS FOR RECOVERY AND MANAGEMENT OF THIS PATIENT</li> </ul>	

THIS CHECKLIST IS NOT INTENDED TO BE COMPREHENSIVE. ADDITIONS AND MODIFICATIONS TO FIT LOCAL PRACTICE ARE ENCOURAGED.

Figure 5 [Surgical Safety Checklist (2009 first edition)]<sup>2</sup>

### BARRIERS TO IMPLEMENTATION OF THE CHECKLIST

The surgical safety checklist continues to be received with mixed emotions in different hospitals. There are still countries that have not adopted this checklist<sup>8</sup>. There are several barriers to implementation of the checklist.

#### Anxiety of unfamiliarity of the checklist

In certain cultures and theatres it may be very unfamiliar for members of the team to begin by introducing themselves to each other. It may even be more difficult to go through each other's elements of the checklist, resulting in anxious moments in theatre. This actually is an opportunity for members of the team to communicate better, to discuss anticipated challenges with the procedure they are about to start, and assess' availability of resources for the procedure<sup>9</sup>.

## **Hierarchy of staff in institutions**

Hierarchy clearly exist in many theatres, and this can be one of the barriers of implementing a checklist, as for an example, a nurse leading the checklist compared to the checklist being led by the anaesthetist or surgeon. There's definitely more compliance to conclusion of the checklist when it's led by a confident nurse, or when the surgeons and anaesthetists are supportive<sup>9</sup>.

## **The logistics and timing of elements**

It is common in some settings for a surgeon not to be available at the sign in phase, as they may be busy assessing another patient. Sometimes surgeons will send a junior colleague to be present at the sign in, and most of the times this junior colleague have difficulties answering some of the questions like anticipated blood loss. This unfortunately does break the momentum and enthusiasm of doing the checklist. Re-confirming the patient's identity in the time-out phase can be a challenge especially trying to access the identity band under a cleaned and draped patient.

## **Duplication of elements**

Surgical wards have their own checklist before the patient leaves the ward to theatre. When the patient arrives in theatre for sign in, most of the questions like patient's identification, procedure and site might have been asked a few times. This may be seen as redundant and even irritating to the patient. This sometimes results in incomplete checklist, the teams avoiding asking the same questions over and over again. Same as when the team has to introduce themselves again and again, especially when there are ten patients booked on the list, and it's the same theatre team for all this cases. Unfortunately incomplete checklist has less impact in decreasing mortality and morbidity in surgical patient<sup>8</sup>.

## **Relevance of checklist elements**

The WHO checklist is a guiding document; modification to local settings has been encouraged. In some settings, pulse oximetry, non-invasive blood pressure monitor, and ECG monitor are standard monitors; no theatre case is done in their absence. Adding this to a checklist may be viewed as redundant, resulting in negative views about the checklist.

## **Incorrectly done checklist**

Various studies have shown a decrease in post-surgical mortality and adverse effects following implementation of the checklist<sup>10</sup>. An incomplete, hurried surgical safety checklist, done with dismissive replies and absence of other team members results not only in poor outcomes, but also compromise patient safety and team-work in theatre.

## **IMPLEMENTING THE WHO SURGICAL SAFETY CHECKLIST SUCCESSFULLY**

To achieve maximum results from the checklist, it is clear that a correct approach to its implementation is essential. There are several methods that have been tried with success like enthusiastic leadership, accountability, and training.

### **Leadership support**

For a successful implementation of the surgical checklist, a capacity to create direction, to influence and align members of the team to a common goal is essential. On-going motivation and committing the team to action remains critical for the success of the implementation. Support from senior members of the institution was considered to be the strongest independent predictor of a successful checklist implementation among 64 Veterans Health Administration facilities<sup>11</sup>.

### **Local champions**

The most important person in our theatres is the patient. The main reason for the operation is to make sure our patient's pre-operative condition is improved. Therefore patient's safety remains high in our list. For a successful implementation of the surgical checklist in an institution, this requires a few individuals who rates patient's safety high in their list, and who believes unconditionally that the surgical checklist decreases post-operative mortality and morbidity. This so-called "local champions" are key to driving implementation of the checklist and creating a positive mind set about it to other members of the institution.

### **Education and training of team members**

Practice makes perfect is a common idiom that we hear of almost everyday. Training is a simple tool that can be used to help theatre team to excel in the implementation of the surgical safety checklist. If all team members understand the importance of the checklist, how to apply it, and their roles in it's application, this will surely result in a more successful implementation of the checklist. During training, all the logistics, timing, roles, and other elements can be clarified, resulting in increased confidence in all the team members.

## **EFFECTS OF THE WHO SURGICAL SAFETY CHECKLIST ON POST OPERATIVE COMPLICATIONS**

After validation of the checklist, it was introduced to eight hospitals in eight cities of different socio-economic status and different population dynamics. A pilot study looking at effects of the introduction of the surgical checklist was done between October 2007 and September 2008. Alex B Haynes et al: prospectively gathered data on clinical processes and outcomes from 3733 consecutively enrolled patients, 16 years of age and older who were undergoing non-cardiac surgery. Then following introduction of the surgical safety checklist, data was collected on 3955 consecutively enrolled patients.

They mainly looked at the rate of complications, including death during hospitalisation within the first 30 days after the operation. The rate of death was 1.5 % before the checklist was introduced and declined to 0.8% afterward (P = 0.003). Inpatient complications occurred in 11 % of patients at baseline and in 7 % after introduction of the

checklist ( $P < 0.001$ )<sup>3</sup>. Eefje N de Vries et al looked at the effect of a comprehensive surgical safety system on patient outcomes in a study published in the New England Journal of Medicine (NEMJ) in November 2010. Surgical safety checklist was implemented in six hospitals with high standards of care. Data was then prospectively collected during a base line period of three months, and then again another set of data collected in a period of three months post introduction of the checklist.

They then compared the rate of post surgical complications, while accounting for potential confounders. Similar data was collected from a control group of five hospitals of similar high standards. Results were that the total number of complications per 100 patients decreased from 27.3% to 16.7%, and in hospital mortality decreased from 1.5% to 0.8%<sup>4</sup>.

The outcomes in the five hospitals did not change. Annegret Borchard et al undertook a systematic review of the effectiveness, compliance, and critical factors for implementation of the safety checklist in surgery, which was published in the Annals of Surgery in 2012. 22 articles were selected from 84 articles, which had been selected for full text review out of 4997 citations. They deduced that the checklists are effective and economic tools that decrease post surgical morbidity and mortality, but suggested that further research relating to implementation was necessary<sup>12</sup>.

J Berghs et al embarked on a systematic review and meta-analysis of the effect of the WHO surgical safety checklist on post-operative complications which was published in the British Journal of Surgery (BJS) 2014. Only seven of the 723 identified studies met the criteria. They concluded that the evidence is highly suggestive of a decrease in post-operative complications and mortality following the introduction of the WHO surgical safety checklist, but cannot be regarded as conclusive in the absence of higher quality studies<sup>13</sup>.

Not all the data has been positive, David R Urbach et al recently examined all acute care hospitals in Ontario following implementation of the surgical safety checklist. They looked at operative mortality, rate of surgical complications, length of hospital stay, and rates of re-admission and visit to emergency unit within 30 days after discharge post a surgical procedure. They compared data collected before and after adoption of surgical safety checklist. They concluded that introduction of the surgical safety checklist in Ontario, Canada, was not associated with significant decreases in operative mortality or complications<sup>14</sup>.

## **ADDITIONAL BENEFITS OF THE WHO SURGICAL SAFETY CHECKLIST**

### **Improved communication among team members**

A number of authors have reported improved communication between members of the operating team following implementation of the surgical checklist. A B Bohmer et al in their publication published in the Acta Anaesthesiologica Scandinavica 2012, reported staff satisfaction following introduction of the surgical safety checklist<sup>15</sup>.

### **Cost savings in the institutions**

In South Africa, the department of health is paying millions of rands as a result of litigation. The surgical safety checklist has been associated with decreased post-surgical complications; this surely will decrease litigations against the state, hence massive cost savings. M E Semel et al published a paper in Health Affairs in 2010 titled "Adopting a Surgical Safety Checklist Could Save Money and Improve the Quality of Care in U.S. Hospitals"<sup>16</sup>.

### **Improved safety culture in theatre**

T Kawano et al administered a safety attitudes questionnaire three months before and three months after administration of the checklist. In their findings reported that the average scores on the safety attitude questionnaire (SAQ) had considerably improved three months after the introduction of the surgical safety checklist compared to those prior to its implementation<sup>17</sup>.

## **CONCLUSION**

Worldwide volume of surgical procedures continues to increase at an alarming rate. Surgery continues to improve the quality of life; unfortunately it also carries risk of complications. It is for us to engage in formulating new and evolving paradigms of patient care and safety. Surgical safety checklist seems to provide exactly that, decreasing postoperative mortality and morbidity. Despite its documented success there are several barriers to implementation of the surgical safety checklist like anxiety of unfamiliarity, hierarchy of staff in theatre. Education and training about checklist and supportive leadership will definitely play an important role to its implementation. More research will surely help to support, increase awareness, and to create more enthusiasm to its implementation.

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