Checklists in Healthcare

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October 16, 2009

A checklist is a list of action items arranged in a systematic manner that allows the user to record the completion of the individual items.[1] Checklists have been used successfully in aviation and industry, and healthcare has learned from this success. In aviation, checklists are used for pre-flight checks as well as for emergency situations, trouble-shooting, and problem solving. The goals of checklists used in healthcare are primarily error reduction and adherence to best practices in clinical care.

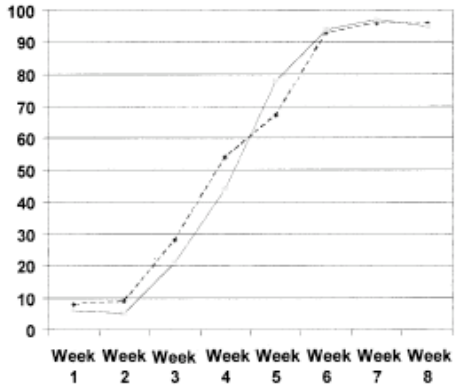
Several examples of the effective use of checklists have been published in recent years. Pronovost and his colleagues studied the checklist as a tool for the healthcare team to better understand the daily goals of patient care in the Johns Hopkins Hospital surgical intensive care unit (ICU).[2] The daily goals checklist (Figure 1) was shown to increase the nurses' and house staff's understanding of the patient care plan from 10% to 95% over the span of 8 weeks (Figure 2) and reduce length of stay (LOS) by 50%, from 2.2 days to 1.1 days.[2]

Figure 1. Daily Goals Checklist[2]

- ☐ What needs to be done for the patient to be discharged from the ICU?
- ☐ What is this patient's greatest safety risk? How can we reduce that risk?
- ☐ Pain management and sedation
- ☐ Cardiac - volume status
- ☐ Pulmonary - ventilator (plateau pressure, elevate head of bed)
- ☐ Mobilization
- ☐ Infectious disease - cultures, antibiotic levels
- ☐ Nutrition
- ☐ Medications - can any be discontinued?
- ☐ Tests and procedures
- ☐ Review scheduled labs and x-rays
- ☐ Consultations
- ☐ Communication with primary service
- ☐ Family communication
- ☐ Can any catheters or tubes be removed?
- ☐ Is this patient receiving DVT or peptic ulcer prophylaxis?

ICU, intensive care unit; DVT, deep venous thrombosis

Figure 2. Percent of residents (dotted line) and nurses (solid line) per week understanding patient care goals.[2]



In a similar study at Hartford Hospital ICU, the use of a Daily Goals checklist decreased ICU mortality from 11.4% to 8.3%, decreased LOS to 1.5 days, and decreased the need for mechanical ventilation by 1 day.[3] The use of a Daily Goal Communication Sheet in a pediatric ICU study significantly reduced the number of defects in gastric ulcer prophylaxis from 10% to 3% ($p=0.02$).[4] Thus, a checklist format communication tool, once implemented, was effective in improving outcomes and reducing defects.

Another study that described the effective use of checklists included a checklist tool as one of five interventions to reduce catheter-related bloodstream infections (CRBSI) in a 16-bed surgical ICU.[5] Those interventions were:

1. A web-based training module for placement of vascular access devices and lectures from epidemiologists and infection-control experts to reinforce the evidence-based guidelines and protocols.
2. Creation of a central venous catheter (CVC) insertion cart that contained all of the supplies needed to place a sterile CVC.
3. Use of daily goals to ask whether the catheter should be removed.
4. Implementation of a simple checklist tool for CVC insertion to be completed by the bedside nurse. (Figure 3).
5. Empowerment of the bedside nurse to stop the CVC insertion if the protocol wasn't being followed.

Figure 3. Catheter-related Bloodstream Infection Checklist[5]

Catheter-related Bloodstream Infection
Care Team Checklist

Purpose: To work as a team to decrease patient harm from catheter-related bloodstream infections
When: During all central venous or central arterial line insertions or rewires
By whom: Bedside nurse

1. Today's date: _____ /_____ / _____
   month day year

2. Procedure: New line Rewire

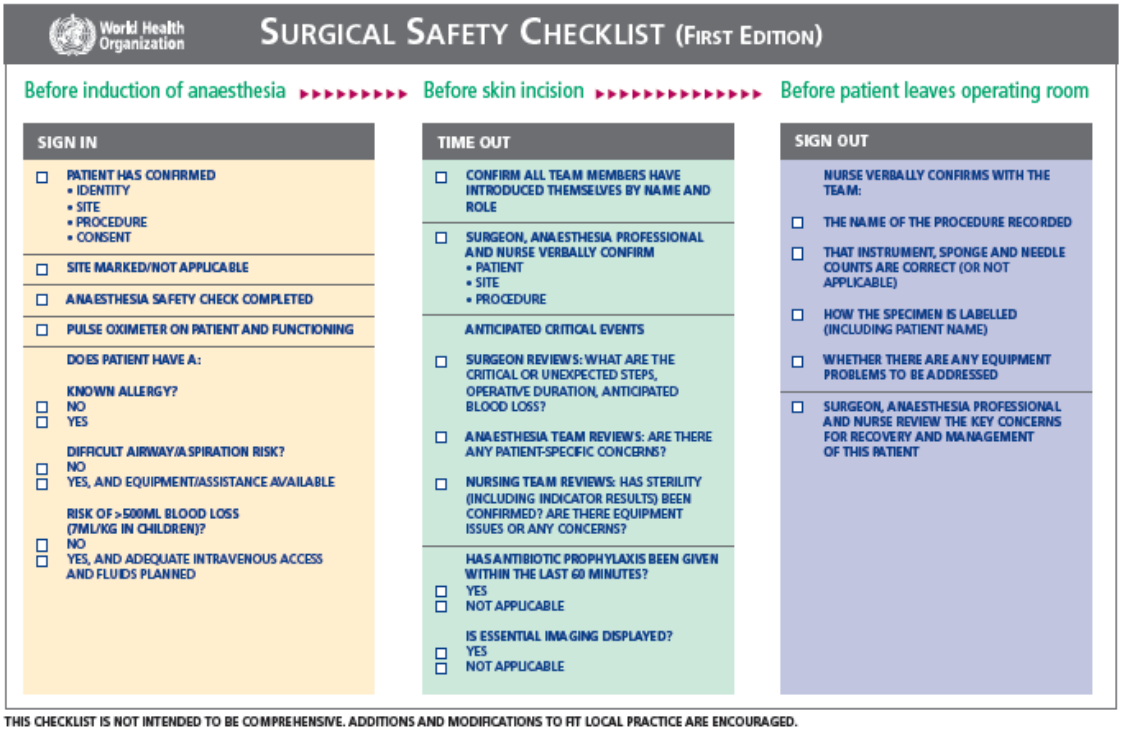
3. Is the procedure: Elective Emergent

	Yes	No	Don't know
Before the procedure, did the physician:			
Wash hands immediately prior	☐	☐	☐
Sterilize procedure site	☐	☐	☐
Drape entire patient in a sterile fashion	☐	☐	☐
During the procedure, did the physician:			
Use sterile gloves	☐	☐	☐
Use hat, mask, and sterile gown	☐	☐	☐
Maintain a sterile field	☐	☐	☐
Did all personnel assisting with the procedure follow the above precautions:	☐	☐	☐
After the procedure:			
Was a sterile dressing applied to site	☐	☐	☐

The control ICU in this study was a 15-bed cardiac ICU, where only the first intervention (education) was implemented to enhance provider awareness of the evidence-based guidelines for CVC insertion and maintenance. During the intervention period, the CRBSI rate in the surgical ICU (study ICU) dropped from 11.3 per 1000 catheter days to zero in the final quarter of the study. This was sustained for the following year. The cardiac ICU (control ICU) CRBSI rate dropped from 5.7 per 1000 catheter days to 1.6 per 1000 catheter days. The authors estimated that the intervention prevented 43 CRBSI, 8 deaths, and nearly $2 million in additional costs per year. Use of a checklist resulted in changes in systems as well as in behavior of individual surgical teams.

In 2008, the World Health Organization (WHO) launched a Safe Surgery Saves Lives program with a Surgical Safety Checklist (Figure 4) in an effort to improve safety of surgical care around the world.

Figure 4. 2008 WHO Surgical Safety Checklist[6]



World Health Organization

SURGICAL SAFETY CHECKLIST (FIRST EDITION)

Before induction of anaesthesia ▸▸▸▸▸▸▸▸▸ Before skin incision ▸▸▸▸▸▸▸▸▸▸▸▸▸ Before patient leaves operating room

SIGN IN

- ☐ PATIENT HAS CONFIRMED
  - IDENTITY
  - SITE
  - PROCEDURE
  - CONSENT
- ☐ SITE MARKED/NOT APPLICABLE
- ☐ ANAESTHESIA SAFETY CHECK COMPLETED
- ☐ PULSE OXIMETER ON PATIENT AND FUNCTIONING
- DOES PATIENT HAVE A:
- KNOWN ALLERGY?
  - ☐ NO
  - ☐ YES
- DIFFICULT AIRWAY/ASPIRATION RISK?
  - ☐ NO
  - ☐ YES, AND EQUIPMENT/ASSISTANCE AVAILABLE
- RISK OF >500ML BLOOD LOSS (7ML/KG IN CHILDREN)?
  - ☐ NO
  - ☐ YES, AND ADEQUATE INTRAVENOUS ACCESS AND FLUIDS PLANNED

TIME OUT

- ☐ CONFIRM ALL TEAM MEMBERS HAVE INTRODUCED THEMSELVES BY NAME AND ROLE
- ☐ SURGEON, ANAESTHESIA PROFESSIONAL AND NURSE VERBALLY CONFIRM
  - PATIENT
  - SITE
  - PROCEDURE
- ANTICIPATED CRITICAL EVENTS
- ☐ SURGEON REVIEWS: WHAT ARE THE CRITICAL OR UNEXPECTED STEPS, OPERATIVE DURATION, ANTICIPATED BLOOD LOSS?
- ☐ ANAESTHESIA TEAM REVIEWS: ARE THERE ANY PATIENT-SPECIFIC CONCERNS?
- ☐ NURSING TEAM REVIEWS: HAS STERILITY (INCLUDING INDICATOR RESULTS) BEEN CONFIRMED? ARE THERE EQUIPMENT ISSUES OR ANY CONCERNS?
- HAS ANTIBIOTIC PROPHYLAXIS BEEN GIVEN WITHIN THE LAST 60 MINUTES?
  - ☐ YES
  - ☐ NOT APPLICABLE
- IS ESSENTIAL IMAGING DISPLAYED?
  - ☐ YES
  - ☐ NOT APPLICABLE

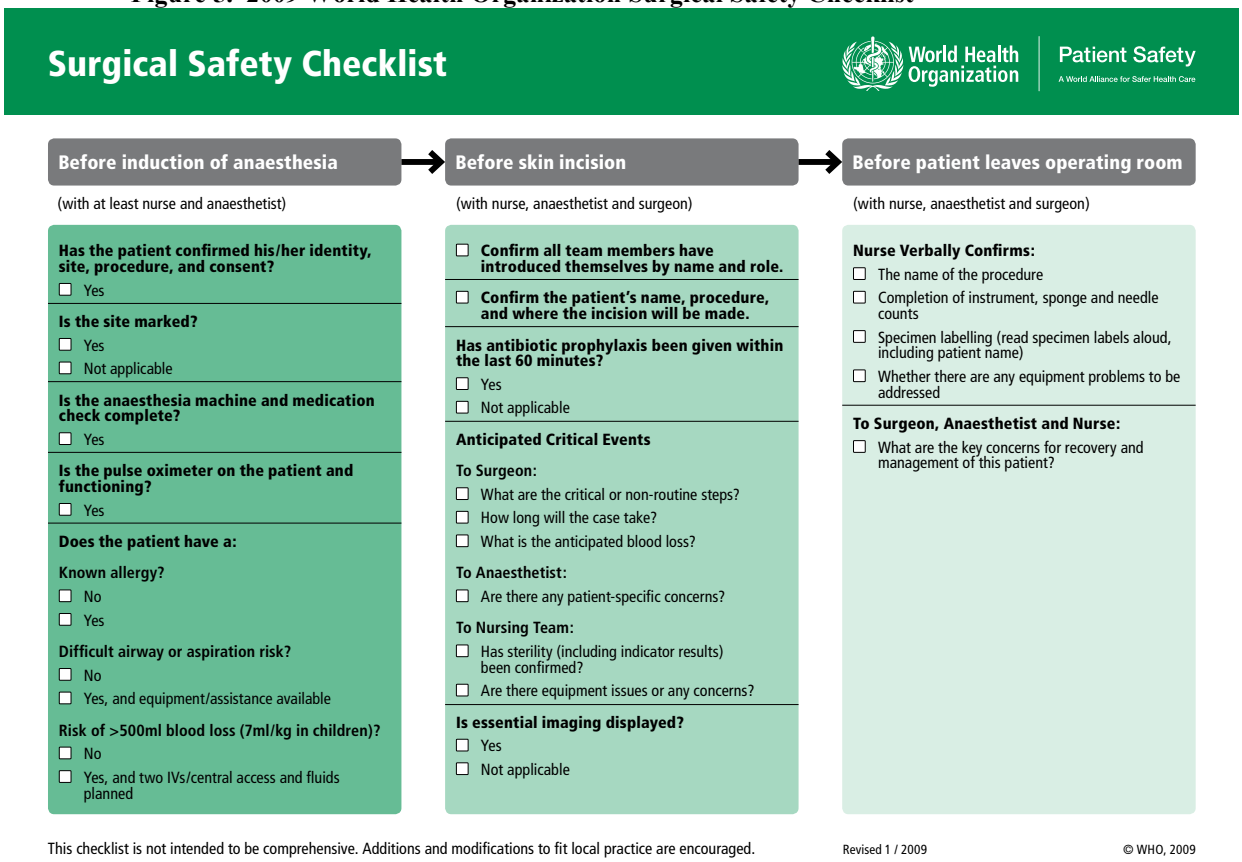
SIGN OUT

- NURSE VERBALLY CONFIRMS WITH THE TEAM:
- ☐ THE NAME OF THE PROCEDURE RECORDED
- ☐ THAT INSTRUMENT, SPONGE AND NEEDLE COUNTS ARE CORRECT (OR NOT APPLICABLE)
- ☐ HOW THE SPECIMEN IS LABELLED (INCLUDING PATIENT NAME)
- ☐ WHETHER THERE ARE ANY EQUIPMENT PROBLEMS TO BE ADDRESSED
- ☐ SURGEON, ANAESTHESIA PROFESSIONAL AND NURSE REVIEW THE KEY CONCERNS FOR RECOVERY AND MANAGEMENT OF THIS PATIENT

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

Eight hospitals were selected to participate as pilot sites for this program. Selection was based on geographic distribution within WHO regions with the goal of representing diverse socioeconomic groups: Amman, Jordan; New Delhi, India; Seattle, WA; Ifakara, Tanzania; Manila, Philippines; Toronto, Canada; London, England; Auckland, New Zealand. Baseline data were collected on 3733 consecutive patients that included demographics, procedure, type of anesthetic, complications, and safety data currently in place. Routine use of pulse oximetry, verbal confirmation of patient identification and surgical site, routine administration of prophylactic antibiotics, a standard plan for vascular access for high blood loss cases, and formal team briefing (preoperative) and debriefing (post-procedure). After implementation of the checklist, data were collected on 3955 consecutive patients. The rate of any complication at all sites dropped from 11% to 7% after the checklist was introduced ($p<0.001$). The total in-hospital death rate dropped from 1.5% to 0.8% ($p=0.003$), the overall rates of surgical site infection dropped from 6.2% to 3.4% ($p<0.001$), and unplanned re-operation dropped from 2.4% to 1.8% ($p<0.001$).[7] This checklist was revised in 2009 (Figure 5).

Figure 5. 2009 World Health Organization Surgical Safety Checklist[6]



Surgical Safety Checklist

World Health Organization | Patient Safety
A World Alliance for Safer Health Care

Before induction of anaesthesia
(with at least nurse and anaesthetist)

Has the patient confirmed his/her identity, site, procedure, and consent?
- ☐ Yes

Is the site marked?
- ☐ Yes
- ☐ Not applicable

Is the anaesthesia machine and medication check complete?
- ☐ Yes

Is the pulse oximeter on the patient and functioning?
- ☐ Yes

Does the patient have a:

Known allergy?
- ☐ No
- ☐ Yes

Difficult airway or aspiration risk?
- ☐ No
- ☐ Yes, and equipment/assistance available

Risk of >500ml blood loss (7ml/kg in children)?
- ☐ No
- ☐ Yes, and two IVs/central access and fluids planned

Before skin incision
(with nurse, anaesthetist and surgeon)

- ☐ **Confirm all team members have introduced themselves by name and role.**
- ☐ **Confirm the patient's name, procedure, and where the incision will be made.**

Has antibiotic prophylaxis been given within the last 60 minutes?
- ☐ Yes
- ☐ Not applicable

Anticipated Critical Events

To Surgeon:
- ☐ What are the critical or non-routine steps?
- ☐ How long will the case take?
- ☐ What is the anticipated blood loss?

To Anaesthetist:
- ☐ Are there any patient-specific concerns?

To Nursing Team:
- ☐ Has sterility (including indicator results) been confirmed?
- ☐ Are there equipment issues or any concerns?

Is essential imaging displayed?
- ☐ Yes
- ☐ Not applicable

Before patient leaves operating room
(with nurse, anaesthetist and surgeon)

Nurse Verbally Confirms:
- ☐ The name of the procedure
- ☐ Completion of instrument, sponge and needle counts
- ☐ Specimen labelling (read specimen labels aloud, including patient name)
- ☐ Whether there are any equipment problems to be addressed

To Surgeon, Anaesthetist and Nurse:
- ☐ What are the key concerns for recovery and management of this patient?

This checklist is not intended to be comprehensive. Additions and modifications to fit local practice are encouraged.

Revised 1 / 2009

Not all checklists have been as effective as the ones discussed above. Pre-anesthesia checkout checklists that have been in place for over 20 years have not been reliably used or understood by anesthesia providers. Studies comparing the Food and Drug Administration (FDA) checklist[8,9] with the user's own checkout method showed no difference in finding machine faults.[10,11] In addition, the FDA checklist was less applicable to advancing technology in anesthesia equipment. To address this issue, the American Society of Anesthesiologists (ASA) Sub-committee on Equipment and Facilities published recommendations in 2008 for pre-anesthesia checkout that listed 15 items to be completed at the beginning of each day, and of these, eight items to be completed prior to each procedure.[12] These checklist items are intended to replace the existing FDA recommendations. The daily checkout is shown in Figure 6. Studies to determine the effectiveness of this guideline are yet to be published.

Figure 6

SUMMARY OF CHECKOUT RECOMMENDATIONS BY FREQUENCY AND RESPONSIBLE PARTY

TO BE COMPLETED DAILY

ITEM TO BE COMPLETED	Responsible Party
Item #1: **Verify Auxiliary Oxygen Cylinder and Self-inflating Manual Ventilation Device are Available & Functioning**	Provider and Tech
Item #2: **Verify patient suction is adequate to clear the airway**	Provider and Tech
Item #3: **Turn on anesthesia delivery system and confirm that ac power is available.**	Provider or Tech
Item #4: **Verify availability of required monitors, including alarms.**	Provider or Tech
Item #5: **Verify that pressure is adequate on the spare oxygen cylinder mounted on the anesthesia machine**	Provider and Tech
Item #6: **Verify that the piped gas pressures are ≥ 50 psig**	Provider and Tech
Item #7: **Verify that vaporizers are adequately filled and, if applicable, that the filler ports are tightly closed.**	Provider or Tech
Item #8: **Verify that there are no leaks in the gas supply lines between the flowmeters and the common gas outlet**	Provider or Tech
Item #9: **Test scavenging system function.**	Provider or Tech
Item #10: **Calibrate, or verify calibration of, the oxygen monitor and check the low oxygen alarm.**	Provider or Tech
Item #11: **Verify carbon dioxide absorbent is not exhausted**	Provider or Tech
Item #12: **Breathing system pressure and leak testing.**	Provider and Tech
Item #13: **Verify that gas flows properly through the breathing circuit during both inspiration and exhalation.**	Provider and Tech
Item #14: **Document completion of checkout procedures.**	Provider and Tech
Item #15: **Confirm ventilator settings and evaluate readiness to deliver anesthesia care. (ANESTHESIA TIME OUT)**	Provider

Automated electronic checklists are part of the most up-to-date anesthesia machine software technology. In aviation, electronic checklists have been shown to reduce errors by an additional 46% when compared to paper checklists.[13] Similar to aviation, anesthesia is moving toward electronic checkouts supplemented with machine prompts for checks of items such as suction and monitoring equipment.

Checklists must be used judiciously. Overuse can lead to checklist fatigue and cries of "Not another checklist!" Checklist development should always include the users, and an evaluation trial should be conducted before implementation to determine its usefulness and impact.

In conclusion, effective checklists may be used as tools to reduce errors, enhance best-practice compliance and improve outcomes.

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