Compliance with the WHO Surgical Safety Checklist: deviations and possible improvements

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Abstract

Background. Previous research suggests that the World Health Organization Surgical Safety Checklist time-out reduces communication failures and medical complications and supports development of better safety attitudes. Previous research also indicates that different values can affect the implementation of interventions. 

Objective. To investigate the actual usage of the checklist in practice and to catalogue deviations for the purpose of identifying improvements.

Design. Twenty-four surgical procedures were video recorded. The time-out was analysed quantitatively assessing compliance with a predefined observational protocol based on the checklist and qualitatively to describe reasons for non-compliance.

Setting. The operating unit of a Swedish county hospital.

Main outcome measures. Compliance with checklist items and the participation of different personnel groups. Activities were conducted during the time-out.

Results. Highest compliance was associated with patient ID, type of procedure and antibiotics; the worst with site of incision, theatre nurse team reviews and imaging information. Team member introductions occurred in half of the operations. Surgeons and the anaesthesia team dominated the time-out.

Conclusion. The checklist is not always applied as intended. The components that facilitate communication are often neglected. The time-out does not appear to be conducted as a team effort. It is plausible that the personnel’s conception of risk and the perceived importance of different checklist items are factors that influence checklist usage. To improve compliance and involve the whole team, the concept of risk and the perceived relevance of checklist items for all team members should be addressed.

Keywords: checklists, communication, patient safety, quality improvement, teamwork

Introduction

Checklists applied in the form of a pre-operative time-out have gained considerable support in the last few years as a means to improve patient safety in the operating theatre [1–6]. The World Health Organization (WHO) has developed its own Surgical Safety Checklist and is currently promoting its usage [7, 8]. The Swedish version of the WHO checklist consists of 10 specific items, listed in Table 1, and the guidelines require all items to be checked off [9]. In many countries, including Sweden and the UK, the pre-operative checklist methodology is now being adopted [10, 11].

Previous research indicates that the implementation of a checklist can both decrease the number of communication failures in the operating theatre and the number of complications from surgery [2, 3, 12]. It can also reduce the risk of wrong-site surgery [13]. It has also been suggested that the use of the WHO Checklist is associated with the development of a better safety attitude among the operating personnel [4]. Paull et al. [14] report better compliance with the use of antibiotics and deep venous thrombosis prophylaxis after the implementation of a surgical safety checklist. They acknowledge, although, that the improvements simply could be due to better documentation.
The checklist facilitates communication and provides memory support for critical tasks [10]. The first part of the time-out is important for facilitating communication because this is when all the team members introduce themselves by name and role [11, 15]. This is not only because everybody needs to know who is doing what in the operating theatre, but also to ensure that all team members feel included and free to express their concerns [10, 15].

In recent years, considerable research has been carried out to better understand if checklist-based time-outs are beneficial [3, 4, 12]. Carney et al. [16] suggest that individual differences in the perceived value of a change, such as the implementation of a checklist, can affect its implementation. Previous research shows differences in how nurses and surgeons perceive communication and teamwork in the operating theatre [16, 17]. Conley et al. [18] stress the importance to not only initiate surgical safety checklist usage, but also to apply the practices of ‘explaining why’ and ‘showing how’ when managing the implementation process. Previous research on safety stresses the need to shift the focus on errors from deviations as such or human error to behaviour-shaping mechanisms and the context in which the action takes place [19, 20].

The WHO Checklist has gained acceptance and been adopted widely, but few studies have investigated how actual practice complies with the intended use of checklists. Vats et al. [21] investigated compliance with the WHO Checklist relying on reports of its usage sent to the researchers offering indirect data on the extent to which the checklist is used, but not the directly observed practice that might include workaround strategies [22]. In a study of the development and implementation of a checklist to improve communication in the operating theatre, Lingard et al. [2] investigated the actual usage of a checklist under development by applying ethnographic methods. Because their objective was development, the checklist implementation was facilitated and encouraged by researchers and may not have mirrored the environment of normal practice. Studies of the actual practice are essential to grasp the behaviour-shaping mechanisms and rationalities that actually result in deviations from intended usage [19, 20]. This is important both to better understand the reasons behind the decrease in complications previously reported [4, 12] and to alter how checklists are used and optimize the impact on patient safety and incidence of adverse events.

### Aims

The primary purpose of this study was to investigate deviations from the time-out portion of the WHO Surgical Safety Checklist from a practical viewpoint. The secondary aim was to observe the team activities during the time-out procedure to explain deviations and identify possible improvements.

### Methods

#### Design

The study was part of a larger study aiming to improve patient safety and the work environment in the operating theatre. It was designed as a naturalistic observation study in which a passive observer records events occurring in their natural, non-manipulated setting [23]. Naturalistic observation studies can avoid the selective perception of participants and enable researchers to notice things that escape the

### Table 1

<table>
<thead>
<tr>
<th>Time-out checklist item</th>
<th>Number of occurrences (total n = 24)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction by name and role addressed</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td>14 (58%)</td>
</tr>
<tr>
<td>Anaesthesiologist/anaesthetist nurse, theatre nurse and surgeon verbally confirm:</td>
<td></td>
</tr>
<tr>
<td>Patient ID&lt;sup&gt;b&lt;/sup&gt;</td>
<td>20 (83%)</td>
</tr>
<tr>
<td>Site of incision</td>
<td>6b (25%)</td>
</tr>
<tr>
<td>Planned operation</td>
<td>19 (79%)</td>
</tr>
<tr>
<td><strong>Anticipated critical events</strong></td>
<td></td>
</tr>
<tr>
<td>Anaesthesia team reviews: are there any patient-specific- or anaesthesiological problems?</td>
<td>12 (50%)</td>
</tr>
<tr>
<td>Theatre nursing team reviews: has sterility been confirmed? Are there equipment issues or any concerns? Is the patient correctly disposed?</td>
<td>2b (8%)</td>
</tr>
<tr>
<td>Surgeon reviews: what are the critical or unexpected steps, operative duration and anticipated blood loss?</td>
<td>18 (75%)</td>
</tr>
<tr>
<td>Has antibiotic prophylaxis been given within the last 60 min?</td>
<td>22 (92%)</td>
</tr>
<tr>
<td>Has thrombosis prophylaxis been given according to prescription?</td>
<td>13 (54%)</td>
</tr>
<tr>
<td>Is essential imaging displayed?</td>
<td>4b (17%)</td>
</tr>
</tbody>
</table>

<sup>a</sup>This checklist item is concerned with the confirmation of name and role for all team members, sometimes this was only done partly.

<sup>b</sup>Denotes statistically significant negative difference from the mean proportion of occurrence (130 out of 240).
awareness of the participants [24]. Because participants could reoccur in the observations, it was not deemed suitable to complement the observed data with surveys or interviews as this doubtlessly would have affected the following sessions being observed.

Sample
The data were collected in the operating unit of a Swedish county hospital. The unit has approximately 280 employees and 11 active operating theatre. In 2010, 10,091 operations were conducted at the unit. Four different types of surgery (thyroidectomy, hysterectomy, cholecystectomy and osteosynthesis of hip fractures), each with an occurrence of more than a 100 procedures a year, were selected to provide a reasonable diversity of procedures. The operating unit studied has transient teams; hence, working group composition varied between the operations. The number of operations in which each member of the staff participated in the study ranged from nine operations (a surgeon) to only one operation. The checklist time-out was customarily performed just before skin incision, as recommended by the WHO [7].

The data consisted of 24 surgical procedures video recorded in their entirety, from preparation until the operating theatre was ready to be prepared for the next patient. The number of team members present during the time-out procedure varied, but at least one surgeon, one anaesthetist nurse, one theatre nurse and one assistant nurse were assigned to the surgical procedures. Before the operations, a member of the research team had approached the patients to get their written informed consent to participate. All participating personnel had consented to participation prior to the study at a general workplace assembly. The study was also approved by the union liaison group. The overall study design and data collection methodology were approved by the Regional Ethical Review Board, Lund, Sweden.

Data collection
The data collection period lasted from December 2009 to November 2010. The time-out procedure had been introduced in the operating unit 3 months prior to the start of the data collection. The camera was placed in one of the corners of the operating theatre, providing a good overview of the overall communication and activity of the operating team. The placement was such that medical details as to exactly what was happening in the operation incision or what drugs were being administrated and close-ups of the patient were avoided. During the whole procedure, a member of the research team with whom the staff was familiar was present in the operating theatre. Because the camera was on during the entire surgical procedure, not just during the time-out, some habituation could be expected, which could reduce reactivity [23]. The observer interacted as little as possible with the subjects during the observations in order not to affect the results.

Data analysis
The assembled material was analysed by the main author with the help of the Noldus Observer 10™ software according to a predefined observational protocol based on the Swedish version of the WHO Checklist time-out procedure [9]. The occurrence of each item of the list was categorized as performed or not, and an assessment was made as to whether all participants participated actively. Criteria for occurrence were pronunciation by at least one team member providing some information with relevance to the checklist item. To be regarded as answered, information relevant to the question needed to be shared verbally with the team during the time-out. For instance, a statement regarding the patient’s ID and type of operation planned was disqualified when answered with the phrase, ‘I know who it is and I know what we are going to do’, because such an answer would not result in any information being shared with the team. On the other hand, verbally stating the patients’ name and social security number, or the planned procedure being mentioned, are examples of information exchange and, hence, regarded as acceptable answers. For anticipated critical events, the subject was expected to be raised for each responsible profession and some kind of answer required. Active participation was defined as a team member having some input either by asking or by answering questions on the checklist. The analysis was discussed with the second and the third authors, until consensus was achieved.

Occurrence of items and active participation was subjected to quantitative analysis. Quantitative data regarding compliance were analysed as contingency tables using the Statistica™ software package (Statsoft, Tulsa OK, USA). To compare differences between proportions, Fisher’s exact test was used; \( P < 0.05 \) was considered statistically significant [25]. To determine how much effort and focus were put into the time-out, as well as the nature of the deviations, it was also noted qualitatively in descriptive form, and when it could be discerned, if someone was doing something else in the operating theatre during the time-out. The episodes on the videos, where the checklist time-out should occur were defined as the 10 min before incision. If the time-out was not initiated within that time frame, it was regarded as a missed time-out.

Results
Time-outs were initiated in 23 of the 24 analysed procedures, and staff introductions were initiated in 14 procedures. Table 1 lists the number of operations in which the questions in the checklist were raised and answered as well as the checklist questions. In a total of 240 expected checklist items in the whole study; 130 were classified as occurring during the 24 studied time-out procedures (54%).

Of the 14 operations, where the question of introductions was addressed, introductions were deemed unnecessary in
In the remaining 12 operations, complete introductions, defined as anaesthesia team, surgeon and theatre nurse stating their names and roles, occurred 6 times. In the remaining 6 operations, incomplete introductions were performed. In 5 of the 14 operations, the introductions did not come up as an initial event and were delayed until later in the time-out.

In general, surgeons and anaesthetist nurses did most of the talking during the time-out. Surgeons and the anaesthesia team (anaesthesiologists and anaesthetist nurses are grouped together as anaesthesia team as they fill the same function in the time-out) were active in all the observed time-out procedures. Theatre nurses were active in nine of the observed procedures, but if the introduction was excluded, the number was reduced to six procedures.

We observed that team members sometimes conducted other professional tasks, irrelevant to the time-out, during the time-out procedure. But, we did not observe any occasion on which the other team members questioned this. Examples of other activities going on during the time-out can be found in Table 2.

### Discussion

The purpose of the WHO checklist is to improve patient safety [7]. Each checklist item is presumed to be important, but the usage of a checklist on the item level has not been investigated in previous studies. We believe that this kind of information is crucial from an organizational perspective, to be able to identify possible improvements to the time-out checklist. To address this issue, we studied compliance with each checklist item and assessed the frequency of deviations and factors that may have contributed to deviations. In total, the checklist procedure was performed in some form during 23 of the 24 studied operations, which could be reported as 96% compliance. But, when we look separately at each checklist item, only 130 occurrences out of 240 possible occurrences, were found, which could be interpreted as a compliance of merely 54%. We cannot exclude the possibility that our method affected the results because the participants knew that they were being observed [23]. If so, our results may suggest better compliance than exists in unobserved practice.

The results show that the WHO Checklist time-out is not always applied as intended [9]. This raises the question, what are the behaviour-shaping mechanisms behind the deviations [19, 20]? One explanation could be linked to the personnel's underlying understanding of the intention of the checklist. The tool is designed to reduce risk, so the understanding of risk among those conducting the time-out may be important to implementation. From a safety perspective, the checklist can be regarded as a barrier or a 'defence' against failure [26]. Reason [26] distinguishes between defences against two types of failures or conditions: ‘active failures’, unsafe acts committed at the sharp end and that contribute to direct, immediate adverse effects and ‘latent conditions’, underlying

<p>| Table 2 Examples of qualitative data from observed activities conducted during the time-out that were unrelated to the time-out itself |</p>
<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>1. The other team members (first surgeon, anaesthetist nurse and theatre nurse) initiate the time-out, whereas the second surgeon gets dressed in sterile clothing. The second surgeon has no input in the time-out and his/her attention appears to be elsewhere. The others did not appear to wait for the second surgeon to get dressed before the time-out was initiated. Whereas the first surgeon and anaesthetist go through the patient's medication, the theatre nurse asks the assistant nurse for adhesive tape.</td>
</tr>
<tr>
<td>2. The surgeon initiates and conducts the time-out while getting dressed in sterile clothing. The assistant nurse is helping the surgeon to get dressed. The surgeon runs the time-out almost single handily with input on antibiotics from the anaesthetist nurse. The other questions are answered by the surgeon in a way which the team appears to agree with as they nod as he speaks.</td>
</tr>
<tr>
<td>3. The assistant nurse is throwing out trash during the time-out. The theatre nurse works with supplies on the assistant table and applies cushions to the site of incision. Somewhere midway through, the surgeon takes the cover off his scalpel while still involved in the time-out. In the background, you can hear a machine with a fan, possibly an electrosurgical device.</td>
</tr>
<tr>
<td>4. The first surgeon asks the nurses to raise the operating table in the middle of the time-out. The theatre nurse and assistant nurse attach tools to the operating table, whereas the others conduct the time-out.</td>
</tr>
<tr>
<td>5. The patient is awake during the operation, and the anaesthetist nurse gives a considerable amount of attention to the patient during the time-out, by asking the patient how he/she feels and checking the patient's pulse by hand.</td>
</tr>
<tr>
<td>6. During the time-out, which is mainly conducted by the anaesthetist nurse and the first surgeon, the second surgeon is getting dressed in sterile clothing. The theatre nurse and the assistant nurse are testing the laparoscope camera by looking at an instrument sheet with it and verifying the readability on the monitor.</td>
</tr>
<tr>
<td>7. The time-out is initiated by one of the surgeons, whereas the theatre nurse and the theatre nurse student are draping the patient with sterile cloth. The way the time-out is initiated (by stating that, &quot;We can do the time out in the meantime.&quot;) indicates that the surgeon intends for it to be done parallel with the draping.</td>
</tr>
</tbody>
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causes that if left unguarded can build up to circumstances, where active failures can occur.

The questions with the best compliance on the checklist (Table 1), patient ID, 'planned operation', 'anticipated critical events': 'surgeons review', 'antibiotic prophylaxis' are all concerned with avoiding direct harm to the patient by avoiding active failures [26]. In contrast, the theatre nurse assuring sterility and the facilitation of communication through team member introductions are defences against latent conditions. This may indicate that the participants' concept of 'risk' is primarily concerned with active failures and not latent conditions. People usually do what locally makes sense to them in the given context, with their focus and knowledge [27]. Hence, a concept of risk mainly concerned with active failures could explain why those checklist items aiming at latent conditions are neglected.

A second explanation for differing attention to checklist items could be variations in the perceived importance of the items. Nilsson et al. [15] found that at least 60% of the respondents in their study regarded 'patient ID', 'planned operation' and 'antibiotic prophylaxis' as very important. It is plausible that the checklist items showing the best compliance are also the ones perceived as most important by the personnel. This is consistent with Carney et al.'s [16] suggestion that the perceived value of the change among those involved affects its implementation. Conley et al. [18] stress the importance of 'explaining why' the checklist is used. Although we regard explaining why as a sound strategy, it could be questioned if this is enough, as we are dealing with a personal conception of its value. A change effort can only be expected to be successful when there is correspondence between the 'explaining why' and the individual's perception of what is of value. Hence, factors relevant for the formation of the individuals' concepts of meaning and value are crucial components to work with to achieve successful change.

A third interpretation may be a difference among team members in the perceived need for exchange of information. 'Site of incision', 'theatre nursing team reviews' and 'is essential imaging displayed?' were given significantly less attention than other checklist items. Different professionals ask for information they need to continue their own tasks, but other items on the checklist could be perceived as relevant only to the professional who needs to respond. The most attention went to those items that involved information exchange between the surgeons and the anaesthesia team. 'Patient ID', 'anaesthesia team reviews' and 'antibiotic prophylaxis' are typically answered by the anaesthesia team, whereas 'planned operation' and 'surgeon reviews' are typically answered by the surgeons and provide important information for the anaesthesia team. Site of incision and the need for imaging information could be regarded as not relevant to the anaesthesia team. Theatre nurses were much less active in the time-out than others. Only one question directly addresses the theatre nurse ('theatre nursing team reviews'), and its main features are 'sterility and equipment', which for the theatre nurse, at least in Sweden, are largely handled alone. The question on sterility could even be perceived as a questioning of the theatre nurse's competence.

One important goal for the WHO checklist is to facilitate communication between the team members [10]. Because the question of team member introductions was not raised in 10 of the 24 procedures (Table 1), some sort of misinterpretation of its purpose is likely. This is supported by Nilsson et al.'s [15] results showing that only 14% perceived the introductions as very important. When introductions did occur in our study, they often were postponed until later in the time-out. Nilsson et al. [15] suggest that the purpose of the introductions is to ensure that all involved personnel know each other, feel included and free to speak about any issues during the time-out and the following surgical procedure. Introductions can also support trust and team building by encouraging communication of concerns regarding common goals and the ways of working [28]. Therefore, it seems crucial to have the introductions first. If postponed until later, their positive effects on the time-out may not occur.

Considering the other activities that we found to occur during the time-out (Table 2), and variation in participation between professionals, it is not clear that the WHO time-out procedure is regarded as a team effort, but rather may be seen as a double-checking routine that someone should go through. This is contradictory to the intention with the time-out as published by the WHO [7].

The WHO Checklist time-out is not always applied in the way it is intended. In practice, this does not mean that the time spent conducting it is wasted. But, it indicates that there is potential for improvement. From an organizational perspective, our results can be used to identify possible improvements to the time-out checklist. To get the theatre nurse more involved, it is important to make sure that the checklist has questions directed to the theatre nurse regarding information that is of interest to the rest of the team and not only to the theatre nurse. This could be done by adding a new checklist item regarding functionality testing of the ordered equipment. The theatre nurse and assistant nurse provide the equipment, but it is used by the surgeons and so is of concern for the team. Today, this is included in the theatre nurse team review question, but it could be made more explicit. To improve compliance with the time-out checklist, staff attitude towards checklist items may need to be changed. To achieve this, the personnel's conceptions of risk and patient safety could be two important factors. By altering these conceptions in such a way that the checklist items make more sense, it is likely that compliance will increase.

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