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Attitudes and compliance to the WHO Surgical Safety Checklist; a review

Laltaksh Wangoo · Robin A. Ray · Yik-Hong Ho

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Abstract
Background This review aimed to assess surgical safety checklist compliance (SSC) and evaluate surgical team attitudes, post checklist implementation.
Method A thorough search of MEDLINE and PUBMED databases for English language studies using any adapted form of the WHO SSC was conducted. In total 26 studies; 13 assessing SSC compliance and 13 investigating surgical team attitudes of the checklist, were evaluated.
Results Compliance studies demonstrated a checklist initiation rate of >90 %, but showed completion rates to be significantly lower across studies. 'Sign out' was the most poorly performed phase (<50 %) with 'Time out' being the best. Verification of patient identity and procedure demonstrated high (>90 %) compliance, while 'Verification of team-members' varied greatly. Surgical team attitudes noted improved teamwork, communication, patient safety and staff awareness of adverse events.
Conclusion SSC compliance is highly dependent on staff perceptions, training and effective leadership. While, surgical teams have positive attitudes towards the SSC, resolving key barriers will improve compliance across all phases of SCC.

Keywords Surgical Safety Checklist · Surgical Safety Survey · Compliance · Attitudes

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Introduction

Surgical safety is an integral aspect of operating theatres globally. There are an estimated 234 million operations performed annually, resulting in 7 million complications and 1 million deaths [1]. In the USA, over 40 % of all in-hospital adverse events occur in operating theatres, with over half of these adverse events considered preventable within current means of care [2].

The WHO launched the Surgical Safety Checklist (SSC) to improve surgical care adherence, consistency and communication. Checklist designers hypothesized that the 19 part surgical safety tool would enhance communication and teamwork and increase surgical teams' performance of patient safety/care measures [2]. The standardized visual checklist requires procedures to be interrupted at certain times; Sign in (before induction of anaesthesia), Time out (before skin incision) and Sign out (immediately after skin closure), to allow important information to be communicated. The WHO estimated that worldwide implementation of this checklist could prevent at least 500,000 deaths annually. Consequently, The SSC has now been introduced in nearly 6000 hospitals, worldwide [1], with the Royal Australasian College of Surgeons having adopted an amended version in 2010 [2].

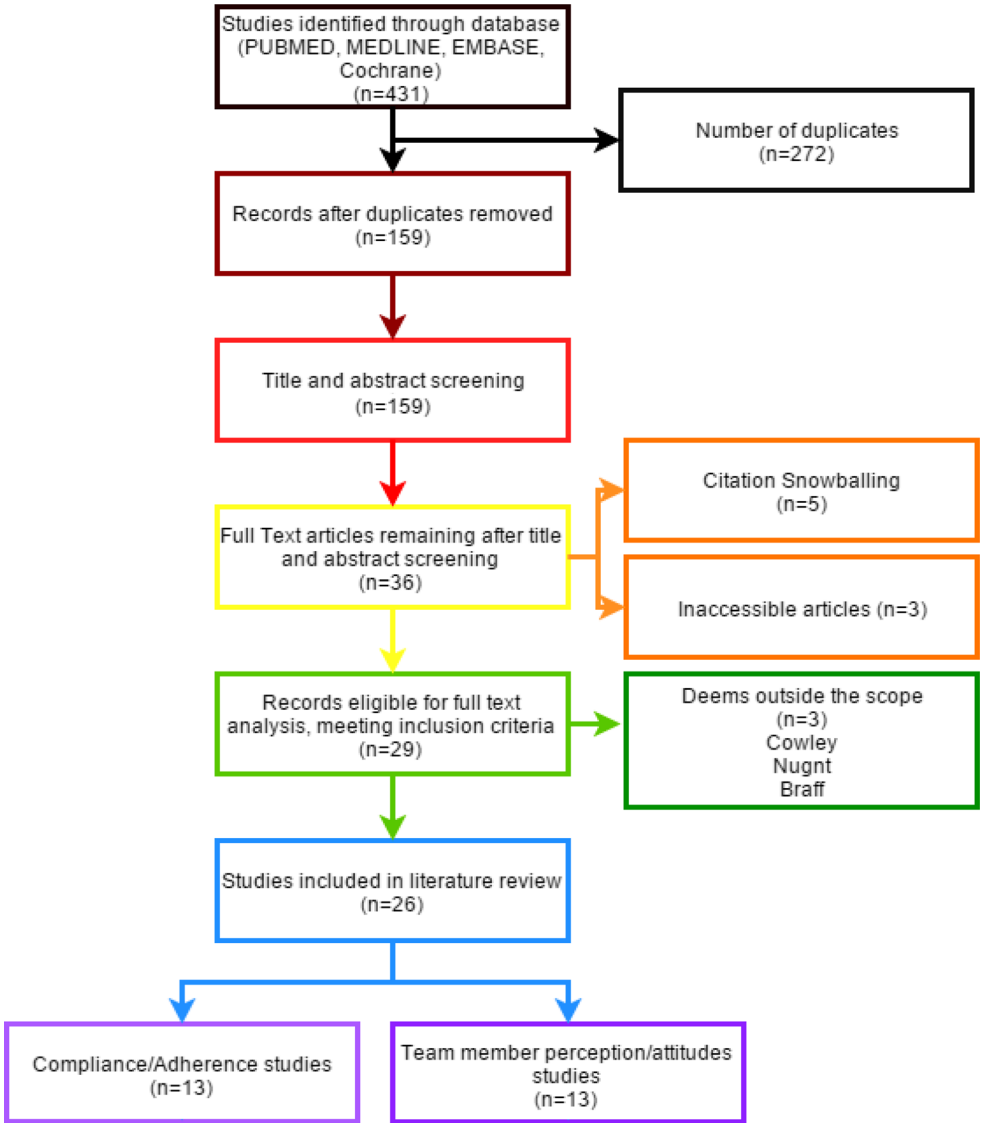

Fig. 1 PRISMA search strategy

However, the exact mechanism of by which SSC improves patient outcomes is poorly understood, with later studies unable to consistently reproduce the marked reduction in mortality and morbidity rates reported in the primary study [3]. A multicentre Canadian study of 215,000 procedures across 101 hospitals, found that morbidity and mortality only decreased by 0.05 % post-implementation, citing poor compliance; limited training or the consequence of cultural, hierarchal or staff priorities effecting outcomes [3].

Methods

Search strategy

An extensive database search of Medline, PubMed and Cochrane using specific keywords terms was carried out for all publications to December 2014. English language studies that used the WHO adapted SSC to provide a complete quantifiable measure of compliance, surgical team attitudes or self-perceived experiences of team members, irrespective of study designs were included (Fig. 1).

Study quality (risk of bias)

Our search identified a myriad of studies varying in design, strength and quality. The validated STROBE [1] tool was used to screen observational studies, while COREQ [1] was used to evaluate questionnaire studies. Domains selected to determine quality of study were: 'conflict of interest', appropriateness of; study design, participant size, data collection, data analysis and conclusive reporting.

Overall results

The search identified 431 articles, of which 31 were selected for full-text evaluation. Two studies were unob-

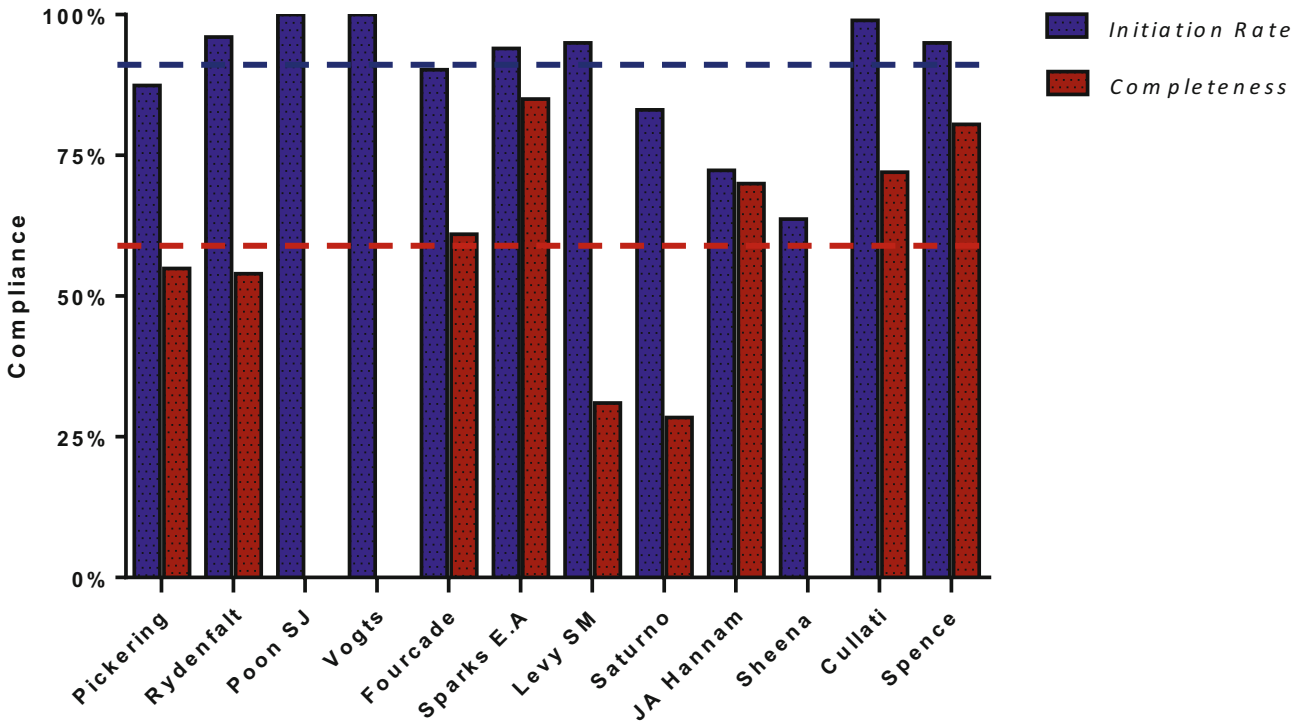

Fig. 2 Initiation rate (mean = 89.64) vs Checklist completion (mean = 59.64)

Tab. 1 Surgical Safety Checklist compliance rates in each study

Study	Study design	Proc.	Initiation rate (%)	Complete-ness (%)	Confirm Team mem-bers ID. (%)	Pt ID (%)	Confirm procedure (%)	Quality score/15
SP Pickering 2013 [1]	Observational	294	87.40	54.90 $p = 0.554$	77.40 $p = 0.172$	n/a	n/a	**13**
Rydenfalt C 2013 [1]	Observational	24	96	54	58	80	79	**11**
Poon SJ 2013 [1]	Observational	193	100	n/a	76.20	72	95.30	**9**
Vogts 2011 [1]	Observational	100	100	n/a	n/a	n/a	n/a	**8**
Fourcade 2012 [1]	Longitudinal chart review	1440	90.20	61	n/a	98	97	**10**
Sparks EA 2013 [1]	Observational	671	94 $p < 0.0001$	85 $p < 0.0001$	n/a	n/a	n/a	**14**
Levy SM 2012 [1]	Observational	142	95	31	10	96	96	**9**
Saturno 2014 [1]	Retrospective chart review	280	83.1 $p < 0.0001$	Sign in – 51.8 Time out – 49.3 Sign out – 43.1 All 3 – 28.4	95.3 $p < 0.0001$	88.2 $p < 0.0001$	88.2	**12**
	Observational	85			95 $p < 0.0001$	50.6 $p < 0.0001$	50	
JA Hannam 2013 [1]	Observational	100	72 $p < 0.0005$	70 $p < 0.0005$	46.5	n/a	n/a	**10**
Sheena Y 2012 [1	Observational	36	63.70 $p < 0.005$	n/a	n/a	90	50	**9**
Kasatpibal 2012 [1]	Self-reports by nursing staff	4340	n/a	n/a	79	96	96	**8**
Cullati 2013 [1]	Observational	80	99	72 %	n/a	100	94	**10**
Spence 2011 [1]	Observational	65	95	80.50	20	78.50	80	**9**

Tab. 2 Surgical team attitudes to the SSC

Study	Study design	Participant size	Imp team comm. (%)	Imp. pt or OR safety (%)	ID & prevent errors (%)	Quality score/15
Helmio 2011 [1]	Questionnaires survey	Pre-intervent. – 288 Post intervention – 412	83.0 $p < 0.001$	78.0 $p < 0.001$	68.0 $p < 0.001$	**10**
Kearn RJ 2011 [1]	Questionnaires Survey	Pre intervention – 288 Post-intervention – 412	57.7 $p < 0.001$ 85.0 $p < 0.046$	n/a	n/a	**11**
Ali M 2011 [1]	Staff interviewed 2/12 post-intervention	37 team members	89.0	n/a	89.0	**11**
Nilsson 2010 [1]	Longitudinal staff questionnaire	331 – 2 hospitals 47 % response rate	65	93.0	86.0	**12**
Bandari J 2012 [1]	Structured focused interview	40	n/a	83.0	87.0	**10**
Papaconstantinou 2013 [1]	Longitudinal staff questionnaire	437 surgical staff	n/a	65.0 $p < 0.05$	46.0 $p < 0.05$	**12**
Bohmer 2012 [1]	Quest.- post-implementation 3/12 & 24/12	99 co-workers Anesthesiology & traumatology	3/12–40 24/12–0	n/a	n/a	**10**
O'Connor Paul 2013 [1]	Questionnaires Survey	107 theatre staff	– General positive attitude towards building teamwork and improving patient safety – Nurses were more sensitive to the barriers than doctors – Reduces delays caused by miscommunication			**11**
Haynes A 2011 [1]	Questionnaires Survey	Pre-intervention – 281 Post-intervention – 257	84.8 $p = 0.0127$	80.2 $p = 0.0127$	78.6 $p < 0.05$	**9**
Takala RS 2011 [1]	Questionnaires Survey	Pre-intervention – 901 Post-intervention – 847	96.4 $p < 0.05$	n/a	n/a	**11**
Cullati 2014 [1]	Cross-sectional Questionnaire	152/433 Response rate – 35.1 %	68	89.0	61.5	**11**
Kawano T 2013 [1]	Post-implementation team surveys	Pre-intervention – 177 Post-intervention – 162	– Improvement in communication – Increase in safety was less than < 0.5 points in a 5 point scale in all questions, post-intervention			**7**
Haugen 2013 [1]	Cross-sectional survey	427 64 % response rate	91	n/a	n/a	**11**

tainable, three studies were excluded for non-specific parameters and irrelevant outcomes, leaving 26 studies for review. Studies were separated into SSC compliance and adherence (n = 13; Tab. 1) and accessing surgical team perceptions and attitudes towards SSC use in operating theatres (n = 13; Tab. 2).

Compliance and adherence studies

Compliance of SSC implementation was measured in 13 prospective observational, retrospective chart reviews, or self-reporting studies, with 10 studies evaluating team member completion of SSC by observation [1]. Retrospective chart reviews were used to determine the rate of compliance in two studies, one adding observational data. Compliance was measured across specialties, with three specialty specific studies in paediatrics, otolaryngology, and traumatology [1].

In eight studies, rates of initiation of the checklist were greater than >90 %, >80 % in two and 100 % in one [1]. In nine studies the completion rates were considerably less than the corresponding compliance rates, ranging widely [1]. In Sparks' study a high completion rate (85 %) was negated by a low accuracy rate of 54 % associated with direct observation. There was a consistent difference between initiation and compliance rates across the studies by Cullati, Fourcade, Levy and Saturno (Fig. 2). Two studies demonstrated a marked improved adherence rate of >90 %, following education and training, which illustrates the importance of SSC [1].

Eight studies concluded that compliance rates were generally higher for 'Sign in' and 'Time out' phases as compared to 'Sign out' (Fig. 3; [1]).

In four out of the seven studies that assessed verification or introduction of team members at the outset of the checklist there was marginal compliance (>80 %). Team identification rates varied across 95.3 %, 79 %, 74.4 % to only 10 %, citing role confusion between team members and lack of training as probable causes. The implementation of patient identity and/or procedure verification was >70 % in eight studies, while four out of seven studies demonstrated >95 % adherence (Fig. 4).

Three studies revealed poor adherence to attention to pertinent aspects of the checklist ,including allergies, blood loss and antibiotic prophylaxis. However, a high incidence (92 %) of 'antibiotic prophylaxis' given in 60 min was reported by Rydenfalt [1].

Staff perception

A total of 13 articles examined staff perceptions and attitudes to SSC using focused interviews of a random

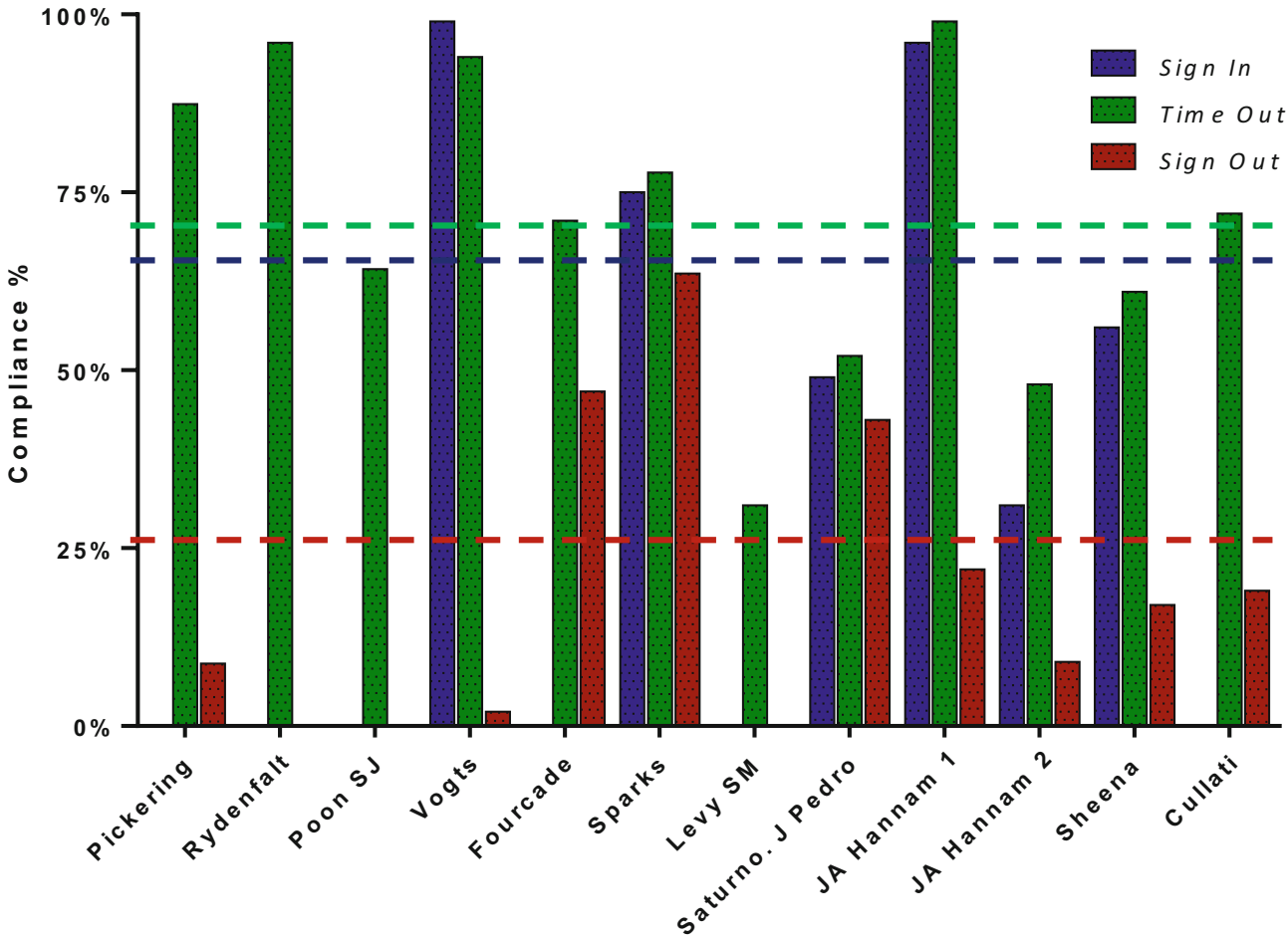

Fig. 3 Compliance in each of the three phases: Sign In (mean = 67.67), Time Out (mean = 71.12) , Sign Out (mean = 25.71)

sample of operating theatre staff or a surgical team questionnaire and pre and post-SSC intervention (10 studies). Sample sizes varied from 37–40 in the focus group to 1748 in surveys.

The SSC had a positive impact on teamwork within the operating room in nine studies (Fig. 5). Improvements noted were increased 'team feeling', 'strengthened teamwork and efficiency' and 'improved communication' [4]. However, in Bohmer's study the 40 % improvement in staff cooperation and communication found at 3 months was no longer evident 24 months post-implementation [4].

Establishing each team member's identity and responsibilities during SSC initiation enhanced team integrity, functionality and sense of worth [1]. Yet, in Nilsson's study only 14 % of participants thought that 'Introduction of team members' was important in SSC. A further three studies suggested that SSC did not substantially improve team member identification [1].

The degree to which the SSC builds staff awareness of the procedure to prevent errors was measured by seven studies, resulting in only minor improvements in team awareness (Fig. 6). Moreover, six studies reported significant positive responses about the overall contribution of SSC to patient or operating room safety. The SSC provided brief pertinent information about a patient's history, risk, and the required procedure, increasing the overall situational awareness. However, Nilsson's study stated that the SSC did not provide any new information, it just ensured that common 'mishaps' were not overlooked [1]. Significantly, studies in which thorough training prior to SSC introduction was undertaken, confirmed a dramatic improvement in attitudes towards the SSC across all professions.

Discussion

Since the development of the SSC, several prominent authorities in the field of patient safety have promoted these checklists to limit complications and foster a lasting safety culture in the OR [1]. This systematic review examined the evidence around SSC compliance and operating teams' perceptions against common outcomes. It was discovered that while SSC initiation rates were generally high across the majority of studies, actual observed compliance varied widely across studies from 2 to 99 %. In the majority of studies 'Sign out' completion was often neglected

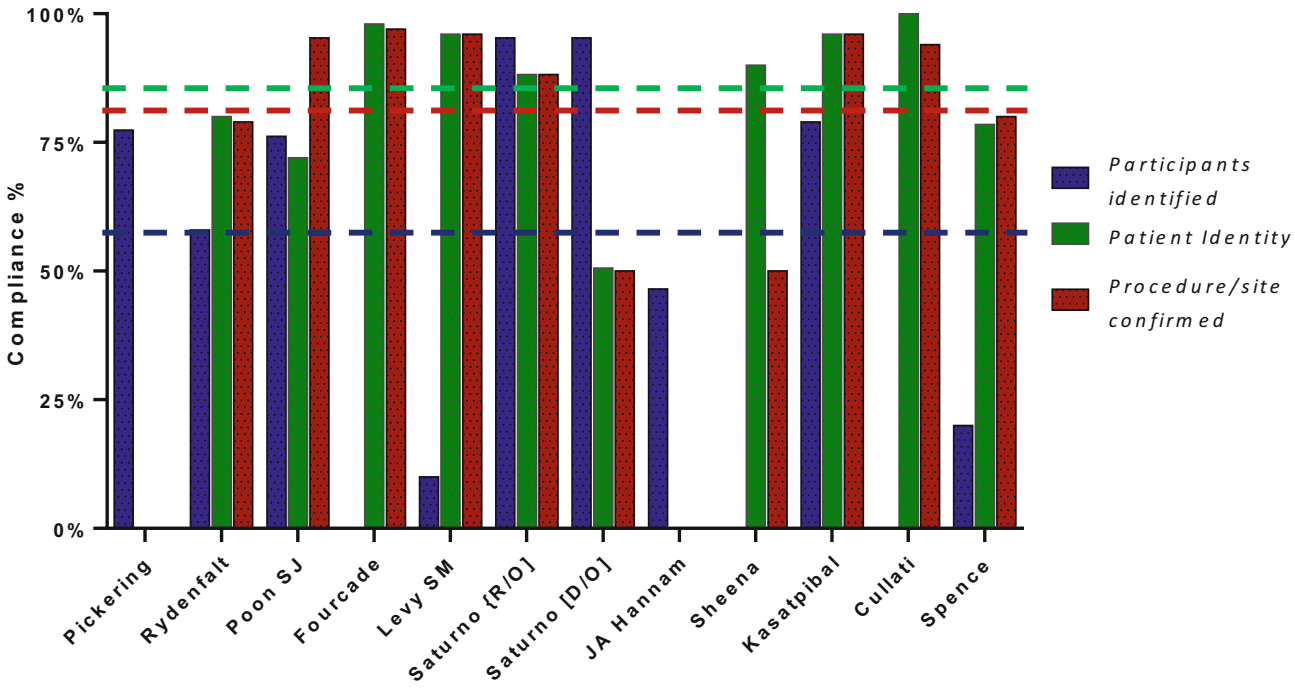

Fig. 4 Compliance assessment across three domains. Mean values (Part. Identity = 61.97 Pt identity = 84.93 Procedure/site = 82.55)

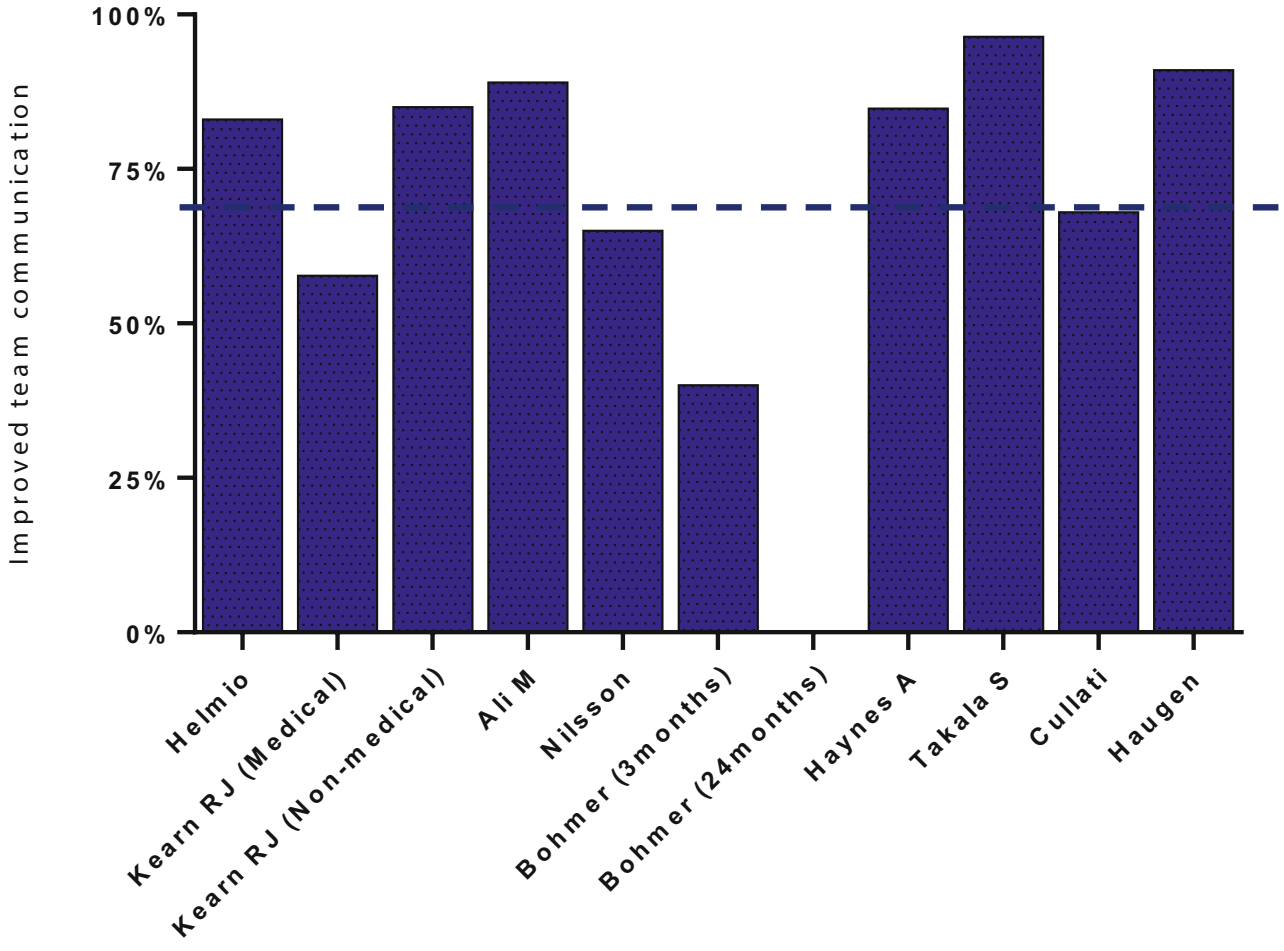

Fig. 5 Improvement in team communication following SSC implementation (mean = 69.08)

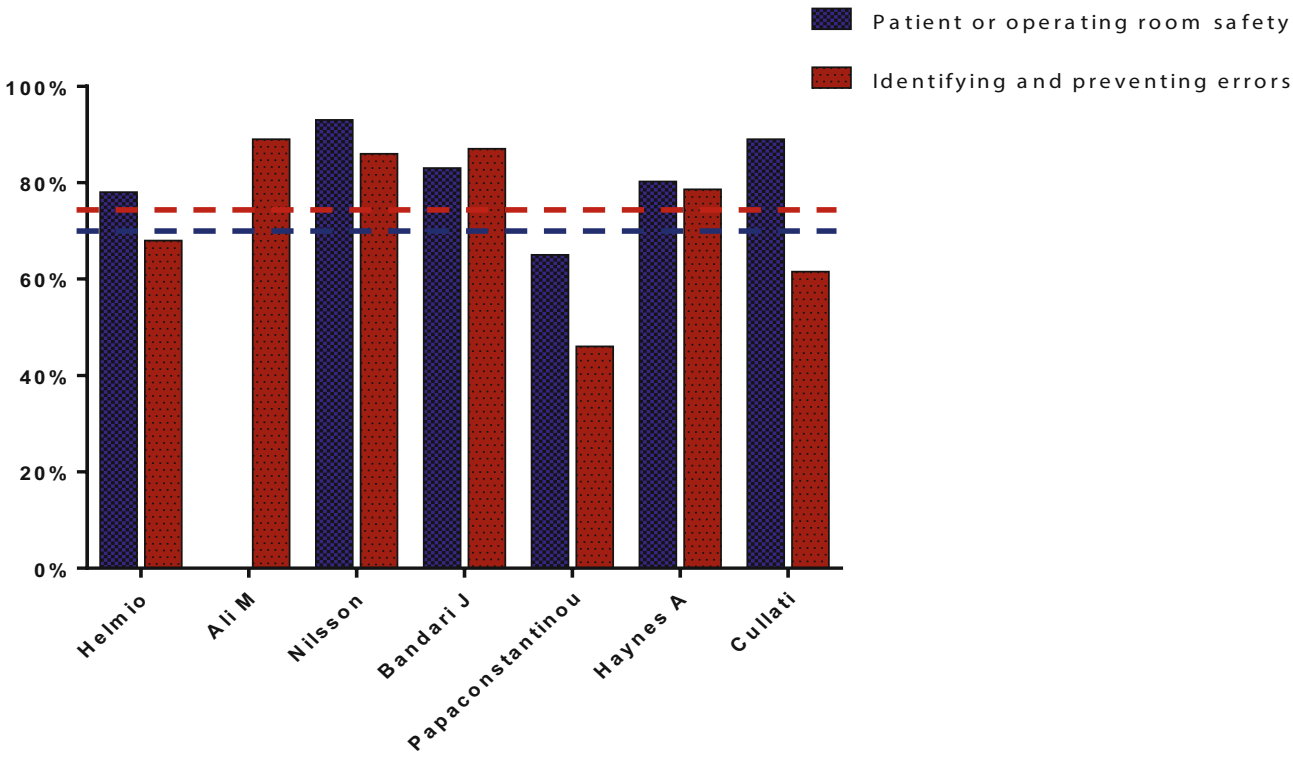

Fig. 6 Improvement in patient or operating room safety (mean = 69.74) vs identifying and preventing errors (mean = 73.73)

and extensive differences were found, at times greater than 30 %, between checklist documentation and observed completion rates [1].

These findings illustrate the informal 'tick and flick' attitude towards SSC completion that impedes SSC's effectiveness [3]. Considering this difference between documented and observed compliance rates, some studies have suggested ways of improving the existing WHO SSC [3]. For example, staff could be asked to determine the status or value of an 'anticipated critical event' or 'completion of instrumental count'. Importantly, studies suggested the SSC's key perceived advantage is that it brings together existing surgical protocols into a concise, simple, easy to use checklist [1].

Key barriers to SSC use such as confusion about responsibility, poor preparation for SCC use and organizational issues related to timing have been reported. However, gradual, phased intervention with good senior staff support and ongoing staff education, does improve implementation of the SSC [2].

Surgical team perceptions

SSC implementation did improve teamwork and communication in the operating theatre (OR). However, there was substantial variability in these improvements across the literature, between a more than 95 % ($p < 0.05$) improvement in communication 6 weeks post-implementation, to no significant improvements 24 months post-implementation [1]. These mixed results suggest that team-member positive perceptions of the SSC may change over time as complacency grows and pragmatic barriers such as hierarchal differences, staff shortages or prioritization of other duties become more evident [1].

Although the checklist is generally well received by OR staff, a lack of rigor in its application is evident, leading to a false sense of security and the possibility of compromised safety [4]. Furthermore, OR staff place differing importance on SSC adherence, with nursing personnel perceiving maximum benefit, while surgeons perceive the least positive impact. Given that most hospitals delegate the responsibility for SSC completion to nursing staff this might actually antagonize team relationships/interactions and widen pre-existing power-differentials. Importantly in some studies, SSC implementation did not mitigate the professional hierarchy, but actually accentuated the power differential due to its perceived 'staged' nature. Therefore, it is quintessential to involve all OR staff in the implementation and education processes, to mitigate inherent interdisciplinary differences in attitudes towards the importance of SSC [4].

Prospective research implications and review limitation

The heterogeneity of methodology, study design, response rate and study quality for both compliance and staff perception studies limited the ability to comprehensively analyze all data. Consequently, it is difficult

to establish causal links between compliance and improvement in communication, teamwork, or self-perceived reduction in errors, as no reproducible standardized tool to measure compliance against mortality/morbidity rates has been developed to date [5]. However, validated, reliable tools measuring clearly defined outcomes such as communication, teamwork and patient safety in a surgical setting are now available. Follow-up studies using recognized tools such as the 'Safety Attitudes Questionnaire' or 'Observational Teamwork Assessment for Surgery Instruments' are warranted [5].

Another limitation is the lack of reliability of recorded SSC compliance due to the Hawthorne effect [4]. This effect was alluded to in a number of studies, with SSC adherence declining marginally when observers were not present [4]. Perhaps a better way of assessing SSC compliance involves routine or random recording of procedures by OR staff as observers.

Conclusion

This short review revealed that SSC compliance varies across phases and studies, being highly dependent on staff perceptions, training, implementation strategies and effective senior leadership. A detailed, thorough systematic review of the articles with extensive analyses was concurrently conducted and is currently in press. In our short review, we noted surgical team members to generally have a positive view of the checklist; some more so than others; perceiving that the process improves teamwork, communication, patient safety and staff awareness of adverse events. Nonetheless, misconceptions and barriers to its implementation remain. Education, good guidance for staff and amelioration of obstacles will improve SSC compliance rates across all phases. Further studies that concurrently explore SSC compliance and team member attitudes could provide valuable information for improvement of the SSC.

Conflict of interest L. Wangoo, R.A. Ray and Y.-H. Ho state that there are no conflicts of interest.

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