Health Quality & Safety Commission New Zealand
Kupu Taurangi Hauora o Aotearoa

Safe Surgery NZ

Safer surgery journal articles (long version)

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Purpose of this document

This document includes the long version of the Health Quality & Safety Commission New Zealand's repository of selected research papers on safer surgery.

The short version is available on the Commission website:

https://www.hqsc.govt.nz/our-programmes/safe-surgery-nz/publications-and-resources/publication/4343/

Introduction

Welcome to the Health Quality and Safety Commission New Zealand's (the Commission's) repository of selected research papers on safer surgery. The World Health Organization (WHO) Surgical Safety Checklist (SSC) was introduced to operating rooms (ORs) in the late 2000s as an important patient safety measure. More recent evidence highlights the mutually reinforcing roles of checklist use along with enhanced multidisciplinary teamwork, briefing and debriefing practices, effective communication techniques and multidisciplinary simulation training. Teamwork has many efficiency and safety benefits other than just preventing sentinel errors: it is the antithesis of bullying and harassment.

This document provides the evidence base for using the full spectrum of these practices as well as evidence-based approaches to implementation.

The World Health Organization Surgical Safety Checklist and safer surgery

The WHO Surgical Safety Checklist (SSC) has been evaluated in longitudinal studies using pre- and post-implementation comparisons, in studies of between-hospital comparisons and in a stepped-wedge cluster randomised controlled trial (RCT). Safety benefits have been reported across surgical specialties and in acute and elective care. Systematic reviews of safety checklist use in the OR reveal substantial benefits in terms of improving patient outcomes.

When effectively implemented (including all parts completed), use of the SSC has been associated with: reduced mortality; reduced complications, including infections and transfusion costs; shorter stays; improved antibiotic and venous thromboembolism (VTE) prophylaxis; fewer specimen labelling errors; improved patient identity checks; improved frequency of sign-in, time out and sign-out; and improvements in teamwork and communication. Checklists improve self-reported safety climate and teamwork attitudes. At least one study (Healey et al. 2020) has found the WHO SSC to be cost saving.

Robust results from the Netherlands and Norway (which has conducted the only RCT involving the use of the WHO SSC) indicate that gains from the use of surgical checklists are not restricted to low-income nations. However, not every systematic review has found the checklist to be equally effective, and evidence suggests that impact depends on compliance and engagement. Unfortunately, evidence also suggests that often checklist completion is poor, despite the evidence that greater fidelity of implementation is associated with the improvements in safety.

Strict implementation strategies, involving implementation leaders and embedded in a wider safety programme, are needed to sustain checklist engagement. Wall-mounted electronic aids may be useful, along with shared checklist leadership, ongoing supervision and instruction, audit and feedback of local data, accountability and the use of validated assessment tools, including self and external-observer ratings.

Evidence indicates that the benefits of the checklist are enhanced if its use is embedded in a wider complementary multimodal safety programme. Additional roll-out of team training initiatives, routine use of briefing and debriefing, use of evidence-based communication tools, and multidisciplinary team simulation training can all enhance surgical patient safety, as the evidence cited below indicates.

Strong evidence supports the use of the World Health Organization’s Surgical Safety Checklist (in reverse chronological order)

Healey A, Søfteland E, Harthug S, et al. 2020. A health economic evaluation of the World Health Organization Surgical Safety Checklist: A single center assessment. *Ann Surg*. Online first. DOI: 10.1097/sla.0000000000004300 (accessed 16 June 2021).

(For every 100 admissions, use of the WHO checklist was estimated to save (Euro 55,899.)

Haugen AS, Wæhle HV, Almeland SK, et al. 2019. Causal analysis of World Health Organization's Surgical Safety Checklist implementation quality and impact on care processes and patient outcomes: Secondary analysis from a large stepped wedge cluster

randomized controlled trial in Norway. *Ann Surg* 269(2): 283–90. DOI: 10.1097/sla.0000000000002584 (accessed 16 June 2021).

(High-quality SSC implementation (all three checklist parts) improved processes and outcomes of care.)

Abbott TEF, Ahmad T, Phull MK, et al. 2018. The surgical safety checklist and patient outcomes after surgery: A prospective observational cohort study, systematic review and meta-analysis. *Br J Anaesth* 120(1): 146–155. DOI: 10.1016/j.bja.2017.08.002 (accessed 16 June 2021).

(A study of 45,000 patients at 497 hospitals in 27 countries. Checklist exposure was associated with reduced mortality [odds ratio (OR) 0.49 (0.32–0.77); P<0.01]. An additional systematic review found checklist exposure was associated with both reduced postoperative mortality [OR 0.75 (0.62–0.92); P<0.01; I(2)=87%] and reduced complication rates [OR 0.73 (0.61–0.88); P<0.01; I(2)=89%].)

Martis WR, Hannam JA, Lee T, et al. 2016. Improved compliance with the World Health Organization Surgical Safety Checklist is associated with reduced surgical specimen labelling errors. *NZ Med J* 129(1441): 63–67.

(Improved compliance with administering the sign-out domain of the SSC can reduce surgical specimen errors.)

Mayer EK, Sevdalis N, Rout S, et al. 2016. Surgical Checklist Implementation Project: The impact of variable WHO checklist compliance on risk-adjusted clinical outcomes after national implementation: A longitudinal study. *Ann Surg* 263(1): 58–63. DOI: 10.1097/sla.0000000000001185 (accessed 16 June 2021).

(Checklist completion significantly lowered risk of postoperative complication (with a drop from 16.9 percent of complications after operation to 11.2 percent after checklist completion) and was largely noticed when all three components of the checklist had been completed (odds ratio = 0.57, 95% confidence interval: 0.37–0.87, P<0.01).)

Perry W, Civil I, Mitchell S, et al. 2015. Reducing perioperative harm in New Zealand: The WHO Surgical Safety Checklist, briefings and debriefings, and venous thromboembolism prophylaxis. *NZ Med J* 128(1424): 54–67.

(There is strong evidence that engaged and effective use of the WHO Surgical Safety Checklist can reduce patient harm, and briefings and debriefings can add to these gains while simultaneously improving efficiency.)

Haugen AS, Søfteland E, Almeland SK, et al. 2015. Effect of the World Health Organization checklist on patient outcomes: A stepped wedge cluster randomized controlled trial. *Ann Surg* 261(5): 821–28. DOI: 10.1097/sla.0000000000000716 (accessed 16 June 2021).

(Implementation of the WHO SSC was associated with robust reduction in morbidity and length of in-hospital stay and some reduction in mortality.)

Bergs J, Hellings J, Cleemput I, et al. 2014. Systematic review and meta-analysis of the effect of the World Health Organization surgical safety checklist on postoperative complications. *Br J Surg* 101(3): 150–58. DOI: 10.1002/bjs.9381 (accessed 16 June 2021).

(The evidence is highly suggestive of a reduction in postoperative complications and mortality following implementation of the WHO SSC.)

Lyons VE, Popejoy LL. 2014. Meta-analysis of surgical safety checklist effects on teamwork, communication, morbidity, mortality, and safety. *West J Nurs Res* 36(2): 245–61. DOI: 10.1177/0193945913505782 (accessed 16 June 2021).

(Surgical safety checklists improve teamwork and communication, reduce morbidity and mortality, and improve compliance with safety measures.)

Russ S, Rout S, Sevdalis N, et al. 2013. Do safety checklists improve teamwork and communication in the operating room? A systematic review. *Ann Surg* 258(6): 856–71. DOI: 10.1097/sla.0000000000000206 (accessed 16 June 2021).

(Evidence suggests that safety checklists improve the perceived quality of OR teamwork and communication and reduce observable errors relating to poor team skills.)

van Klei WA, Hoff RG, van Aarnhem EE, et al. 2012. Effects of the introduction of the WHO "Surgical Safety Checklist" on in-hospital mortality: A cohort study. *Ann Surg* 255(1): 44–49. DOI: 10.1097/SLA.0b013e31823779ae (accessed 16 June 2021).

(The odds ratio for the association between full checklist completion and mortality outcome was 0.44 (95% CI, 0.28–0.70), compared with 1.09 (95% CI, 0.78–1.52) and 1.16 (95% CI, 0.86-1.56) for partial or noncompliance respectively.)

de Vries EN, Prins HA, Crolla RM, et al. 2010. Effect of a comprehensive surgical safety system on patient outcomes. *N Engl J Med* 363(20): 1,928–37. DOI: 10.1056/NEJMsa0911535 (accessed 16 June 2021).

(The proportion of patients with one or more complications decreased from 15.4 percent to 10.6 percent (P<0.001). In-hospital mortality decreased from 1.5 percent (95% CI, 1.2–2.0) to 0.8 percent (95% CI, 0.6 to 1.1) for an absolute risk reduction of 0.7 percentage points (95% CI, 0.2–1.2). Outcomes did not change in the control hospitals.)

Haynes AB, Weiser TG, Berry WR, et al. 2009. A surgical safety checklist to reduce morbidity and mortality in a global population. *N Engl J Med* 360(5): 491–99. DOI: 10.1056/NEJMsa0810119 (accessed 16 June 2021).

(Mortality was 1.5 percent before the checklist was introduced and declined to 0.8 percent after (P=0.003). Inpatient complications occurred in 11.0 percent of patients at baseline and in 7.0 percent after the introduction of the checklist (P<0.001).)

Lingard L, Regehr G, Orser B, et al. 2008. Evaluation of a preoperative checklist and team briefing among surgeons, nurses, and anesthesiologists to reduce failures in communication. *Arch Surg* 143(1): 12–17; discussion 18. DOI: 10.1001/archsurg.2007.21 (accessed 16 June 2021).

(The mean (standard deviation, SD) number of communication failures per procedure declined from 3.95 (3.20 SD) before the checklist intervention to 1.31 (1.53 SD) after the intervention (P<0.001).)

The evidence spans a range of surgical contexts

Westman M, Takala R, Rahi M, et al. 2020. The need for surgical safety checklists in neurosurgery now and in the future: A systematic review. *World Neurosurg* 134: 614–28. e613. DOI: 10.1016/j.wneu.2019.09.140 (accessed 16 June 2021).

(Checklist use in neurosurgery was found to reduce hospital-acquired infectious complications and to enhance OR safety culture.)

Patel J, Ahmed K, Guru KA, et al. 2014. An overview of the use and implementation of checklists in surgical specialities: A systematic review. *Int J Surg* 12(12): 1,317–23. DOI: 10.1016/j.ijsu.2014.10.031 (accessed 16 June 2021).

(In general, the studies showed a significant reduction in morbidity and mortality following surgery as a result of checklist implementation.)

Weiser TG, Haynes AB, Dziekan G, et al. 2010. Effect of a 19-item surgical safety checklist during urgent operations in a global patient population. *Ann Surg* 251(5): 976–80. DOI: 10.1097/SLA.0b013e3181d970e3 (accessed 16 June 2021).

(The complication rate was 18.4 percent (n=151) at baseline and 11.7 percent (n=102) after the checklist was introduced (P=0.0001). Death rates dropped from 3.7 percent to 1.4 percent following checklist introduction (P=0.0067). Adherence to six measured safety steps improved from 18.6 percent to 50.7 percent (P<0.0001).)

Some studies did not find the checklist very effective

Weinger MB. 2021. Time out! Rethinking surgical safety: More than just a checklist. *BMJ Qual Saf*. Online first, March 23. DOI: 10.1136/bmjqs-2020-012600 (accessed 17 June 2021).

(When used in isolation or implemented incorrectly, checklists have significant limitations. Safety initiatives that take a systems-oriented multimodal approach can, with organisational leadership and determination, produce safety improvement.)

de Jager E, McKenna C, Bartlett L, et al. 2016. Postoperative adverse events inconsistently improved by the World Health Organization Surgical Safety Checklist: A systematic literature review of 25 studies. *World J Surg* 40(8): 1,842–58. DOI: 10.1007/s00268-016-3519-9 (accessed 17 June 2021).

(The checklist may be associated with a reduction in surgical adverse events, and this effect seems to be greater in developing nations. However, study quality was low.)

Appropriate implementation of checklists is crucial

Haugen AS, Søfteland E, Sevdalis N, et al. 2020. Impact of the Norwegian National Patient Safety Program on implementation of the WHO Surgical Safety Checklist and on perioperative safety culture. *BMJ Open Qual* 9(3). Online first. DOI: 10.1136/bmjoq-2020-000966 (accessed 17 June 2021).

(The Norwegian National Patient Safety Program, fostering engagement from trust boards, hospital managers and frontline operating theatre personnel, enabled effective implementation of the SSC.)

Taplin C, Romano L, Tacey M, et al. 2020. Everyone has their role to play during the World Health Organization Surgical Safety Checklist in Australia: A prospective observational study. *World J Surg* 44(6): 1,755–61. DOI: 10.1007/s00268-020-05397-2 (accessed 17 June 2021).

(Observed completion rates of the time-out section of the SSC were poor. Individual team members positively influenced checklist items more aligned to their roles.)

Weller JM, Jowsey T, Skilton C, et al. 2018. Improving the quality of administration of the Surgical Safety Checklist: A mixed methods study in New Zealand hospitals. *BMJ Open* 8(12): e022882. DOI: 10.1136/bmjopen-2018-022882 (accessed 17 June 2021).

(The WHO Behaviourally Anchored Rating Scale (WHOBARS) tool could be useful for self-audit and quality improvement as it enables OR staff to reliably discriminate between good and poor checklist administration.)

Ong AP, Devcich DA, Hannam J, et al. 2016. A 'paperless' wall-mounted surgical safety checklist with migrated leadership can improve compliance and team engagement. *BMJ Qual Saf* 25(12): 971–76. DOI: 10.1136/bmjqs-2015-004545 (accessed 17 June 2021).

(Improvements in team engagement and compliance with administering checklist items followed the introduction of migrated checklist administration leadership and a wall-mounted checklist.)

Bergs J, Lambrechts F, Simons P, et al. 2015. Barriers and facilitators related to the implementation of surgical safety checklists: A systematic review of the qualitative evidence. *BMJ Qual Saf* 24(12): 776–86. DOI: 10.1136/bmjqs-2015-004021 (accessed 17 June 2021).

(Implementation leaders must facilitate team learning to foster the mutual understanding of perspectives and motivations and the realignment of routines.)

Russ SJ, Sevdalis N, Moorthy K, et al. 2015. A qualitative evaluation of the barriers and facilitators toward implementation of the WHO surgical safety checklist across hospitals in England: Lessons from the "Surgical Checklist Implementation Project". *Ann Surg* 261(1): 81–91. DOI: 10.1097/sla.0000000000000793 (accessed 17 June 2021).

(Implementation barriers could be overcome by modifying the checklist, providing education/training, feeding back local data, fostering strong leadership (particularly at attending level) and instilling accountability.)

Sendlhofer G, Mosbacher N, Karina L, et al. 2015. Implementation of a surgical safety checklist: Interventions to optimize the process and hints to increase compliance. *PLoS One* 10(2): e0116926. DOI: 10.1371/journal.pone.0116926 (accessed 17 June 2021).

(Implementation of new tools such as the adapted WHO SSC needs constant supervision and instruction until it becomes self-evident and accepted.)

Hannam JA, Glass L, Kwon J, et al. 2013. A prospective, observational study of the effects of implementation strategy on compliance with a surgical safety checklist. *BMJ Qual Saf* 22(11): 940–47. DOI: 10.1136/bmjqs-2012-001749 (accessed 17 June 2021).

(Compliance with administration of SSC domains was lower at Hospital 2, which introduced the SSC outside the context of a strict study protocol.)

Team training and safer surgery

Research evidence, including systematic reviews, indicates a connection between surgical multidisciplinary team training and improved knowledge, team processes and outcomes. Team training was found to improve OR processes, including: reduced incorrect surgical counts; more timely antibiotic administration, deep vein thrombosis (DVT) prophylaxis and beta-blockade; reduced technical and procedural errors and increased compliance with briefings, checklists and time out. Team training has also been shown to enhance OR efficiency, including turnover time, cases starting on time and reduced delays. Evidence suggests that teamwork training can also: improve teamwork processes in the OR and staff attitudes towards safety; reduce communication errors and improve scores for communication between team members. However, not all studies demonstrated the effectiveness of team training. It appears that high-quality comprehensive programmes are important. Teamwork has many efficiency and safety benefits other than just preventing sentinel errors: it is the antithesis of bullying and harassment.

There are some common features of effective team training interventions. The effective Veterans Health Administration (VHA) medical team training programme and the TeamSTEPPS® (team strategies and tools to enhance performance and patient safety) programme are both comprehensive. Training is led by senior clinical staff and conducted with all multidisciplinary members of the OR team together along with active participation, follow-up contact, and top-down mandates with local flexibility. Implementation and the overall success of team training appears to be enhanced by organisational factors such as leadership support, learning climate and a commitment to data-driven change, as well as the use of principle-based and simulation-based training and combining teamwork training with systems rationalisation.

Team training programmes are associated with safer surgery

Babic B, Volpe AA, Merola S, et al. 2018. Sustained culture and surgical outcome improvement. *Am J Surg* 216(5): 841–45. DOI: 10.1016/j.amjsurg.2018.02.016. Epub 2018 Feb 16.

(A mass educational conference for all staff, along with a comprehensive unit-based safety programme, was associated with improved safety culture scores and reduced surgical site infection and overall mortality.)

Hughes AM, Gregory ME, Joseph DL, et al. 2016. Saving lives: A meta-analysis of team training in healthcare. *J Appl Psychol* 101(9): 1,266–304. DOI: 10.1037/apl0000120 (**full text not freely available**).

(Health care team training improves each of Kirkpatrick's criteria (reactions, learning, transfer, results; d = 0.37–0.89).)

Sacks GD, Shannon EM, Dawes AJ, et al. 2015. Teamwork, communication and safety climate: A systematic review of interventions to improve surgical culture. *BMJ Qual Saf* 24(7): 458–67. DOI: 10.1136/bmjqs-2014-003764 (accessed 17 June 2021).

(Forty-seven studies reported on interventions that targeted three domains of culture: teamwork (n=28), communication (n=26) and safety climate (n=19). All moderate-quality

studies showed improvements in at least one of these domains as a result of the introduction of interventions.)

Weller J, Boyd M. 2014. Making a difference through improving teamwork in the operating room: A systematic review of the evidence on what works. *Current Anesthesiology Reports* 4(2): 77–83. DOI: 10.1007/s40140-014-0050-0 (accessed 17 June 2021).

(Evidence supports: structured approaches to information sharing between OR team members; ongoing programmes of team training; and organisational changes to support team function. Many studies demonstrated improved team function in the clinical environment, improved OR processes and/or improved patient outcomes.)

Young-Xu Y, Neily J, Mills PD, et al. 2011. Association between implementation of a medical team training program and surgical morbidity. *Arch Surg* 146(12): 1,368–73. DOI: 10.1001/archsurg.2011.762 (accessed 17 June 2021).

(The VHA medical team training programme is associated with decreased surgical morbidity.)

Neily J, Mills PD, Young-Xu Y, et al. 2010. Association between implementation of a medical team training program and surgical mortality. *JAMA* 304(15): 1,693–700. DOI: 10.1001/jama.2010.1506 (accessed 17 June 2021).

(Participation in the VHA medical team training programme was associated with decreased surgical mortality.)

Some studies did not find team training very effective

Leuschner S, Leuschner M, Kropf S, et al. 2019. Non-technical skills training in the operating theatre: A meta-analysis of patient outcomes. *Surgeon* 17(4): 233–43. DOI: 10.1016/j.surge.2018.07.001 (accessed 17 June 2021).

(This meta-analysis failed to find a statistically significant improvement in patient outcomes as a result of team training efforts.)

Sun R, Marshall DC, Sykes MC, et al. 2018. The impact of improving teamwork on patient outcomes in surgery: A systematic review. *Int J Surg* 53: 171–77. DOI: 10.1016/j.ijsu.2018.03.044 (accessed 17 June 2021).

(At present, there is insufficient evidence to support the hypothesis that teamwork training interventions improve patient outcomes.)

Effective implementation of team training is important

Buljac-Samardzic M, Doekhie KD, van Wijngaarden JDH. 2020. Interventions to improve team effectiveness within health care: A systematic review of the past decade. *Hum Resour Health* 18(1): 2. DOI: 10.1186/s12960-019-0411-3 (accessed 17 June 2021).

(Principle-based training, that is, CRM and TeamSTEPPS®, and simulation-based training seem to provide the greatest opportunities for reaching the improvement goals in team functioning.)

Hill NM, Fisher DM. 2019. Reinforcing collaboration and teamwork: The role of team communication and training. *ANZ J Surg* 89(7–8): 957–961. DOI: 10.1111/ans.15272 (accessed 17 June 2021).

(Briefing and debriefing are formal tools used to improve teamwork and collaboration in the perioperative setting. Simulation and other team training workshops are an opportunity to practice using these communication tools in a safe environment.)

McCulloch P, Morgan L, New S, et al. 2017. Combining systems and teamwork approaches to enhance the effectiveness of safety improvement interventions in surgery: The Safer Delivery of Surgical Services (S3) Program. *Ann Surg* 265(1): 90–96. DOI: 10.1097/sla.0000000000001589 (accessed 17 June 2021).

(Safety interventions that combine teamwork training and systems rationalisation are more effective than those adopting either approach alone.)

Weller J, Boyd M, Cumin D. 2014. Teams, tribes and patient safety: Overcoming barriers to effective teamwork in healthcare. *Postgrad Med J* 90(1061): 149–54. DOI: 10.1136/postgradmedj-2012-131168 (accessed 17 June 2021).

(Improvement in teamwork in health care can lead to significant gains in patient safety, measured against efficiency of care, complication rate and mortality.)

Salas E, Almeida SA, Salisbury M, et al. 2009. What are the critical success factors for team training in health care? *Jt Comm J Qual Patient Saf* 35(8): 398–405. DOI: 10.1016/s1553-7250(09)35056-4 (accessed 17 June 2021).

(Success is highly dependent on organisational factors such as leadership support, learning climate and commitment to data-driven change.)

Briefing/debriefing and safer surgery

There is good evidence to support the use of surgical briefings and debriefings to reduce patient harm. Staff should foster effective briefings and handovers at every opportunity. Briefings and debriefings can reduce unexpected delays and improve communication and teamwork (see *Checklists, Briefings and Debriefings: An evidence summary*, Health Quality and Safety Commission 2016).

Systematic reviews have found that briefings:

- improve teams' attitudes towards safety
- decrease unexpected delays
- reduce communication failures between team members by two-thirds
- reduce the rate of non-routine surgical events by 25 percent
- effectively surface potential surgical safety hazards
- enhance the timely administration of prophylactic antibiotics and preoperative VTE prophylaxis
- increase efficiency
- reduce staff's perceptions of risk and increase their sense of team collaboration
- reduce disruptions to surgery.

The VHA medical team training programme showed that compliance with briefings related directly to patient mortality.

Implementing multi-professional team briefings in operating theatres requires changes at various systems levels. Factors contributing to the success of programmes to introduce briefing into the OR include:

- engagement of OR leaders and managers
- an extended period of implementation
- engagement of OR team members in the development of the items to be included in the briefing
- video modelling of ideal implementation
- in-theatre prompting and feedback on the use of the briefing during the introductory phase.

Barriers could be overcome by demonstrating evidence of benefit, emphasising an institutional safety culture and utilising champions. Nurse manager involvement is important, as is leadership involvement at training sessions.

Briefings and debriefings have a positive impact on patient safety

Leong K, Hanskamp-Sebregts M, van der Wal RA, et al. 2017. Effects of perioperative briefing and debriefing on patient safety: A prospective intervention study. *BMJ Open* 7(12): e018367. DOI: 10.1136/bmjopen-2017-018367 (accessed 17 June 2021).

(Perioperative briefing and debriefing improved the climate in surgical teams and the efficiency of their work within the operating theatre with acceptable duration per briefing.)

Civil I, Shuker C. 2015. Briefings and debriefings in one surgeon's practice. *ANZ J Surg* 85(5): 321–23. DOI: 10.1111/ans.13017 (**full text not freely available**).

(Evidence suggests briefings can reduce communication failures and non-routine events, reveal hazards, reduce perceptions of risk, increase the sense of collaboration and enhance efficiency.)

Glymph DC, Olenick M, Barbera S, et al. 2015. Healthcare Utilizing Deliberate Discussion Linking Events (HUDDLE): A systematic review. *AANA J* 83(3): 183–88.

(Briefings are associated with improved working climate, reduced non-routine events, timely administration of prophylactic antibiotics and preoperative VTE prophylaxis, and increased efficiency.)

Jain AL, Jones KC, Simon J, et al. 2015. The impact of a daily pre-operative surgical huddle on interruptions, delays, and surgeon satisfaction in an orthopedic operating room: A prospective study. *Patient Saf Surg* 9: 8. DOI: 10.1186/s13037-015-0057-6 (accessed 17 June 2021).

(Surgeon satisfaction increased and fewer delays occurred after introduction of huddles. Interruptions decreased in all categories, including equipment, antibiotics, planned procedures/side. Time required for a huddle was less than 1 minute per case.)

McDowell DS, McComb SA. 2014. Safety checklist briefings: A systematic review of the literature. *AORN J* 99(1): 125–37. e113. DOI: 10.1016/j.aorn.2013.11.015 (accessed 17 June 2021).

(Common themes in the studies included enhanced patient safety, improved compliance over time and increased communication among team members when checklists were used.)

Effective implementation of briefings and debriefings

Hill N. 2021. Perceptions of value: A qualitative study of the barriers to the routine use of preoperative briefing in New Zealand. *ANZ Journal of Surgery: Abstract Journal Safety in Surgical Practice* (8 May): QA003. DOI: 10.1111/ans.16825?af=R (accessed 17 June 2021).

(Approaches to overcoming briefing barriers could include demonstrating evidence of benefits, visual reminders, emphasising an institutional safety culture and using champions.)

Fruhen L, Carpini JA, Parker SK, et al. 2020. Perceived barriers to multiprofessional team briefings in operating theatres: A qualitative study. *BMJ Open* 10(2): e032351. DOI: 10.1136/bmjopen-2019-032351 (accessed 17 June 2021).

(Successful implementation of a multiprofessional team briefing requires changes at various systems levels.)

Robinson LD, Paull DE, Mazzia LM, et al. 2010. The role of the operating room nurse manager in the successful implementation of preoperative briefings and postoperative debriefings in the VHA Medical Team Training Program. *J Perianesth Nurs* 25(5): 302–06. DOI: 10.1016/j.jopan.2010.07.003 (accessed 17 June 2021).

(The nurse manager's participation in planning was associated with higher rates of implementation of preoperative briefing and postoperative debriefing.)

Paull DE, Mazzia LM, Izu B, et al. 2009. Predictors of successful implementation of preoperative briefings and postoperative debriefings after medical team training. *Am J Surg* 198(5): 675–78. DOI: 10.1016/j.amjsurg.2009.07.008 (accessed 17 June 2021).

(Leadership involvement at the time of the learning session was the best predictor of future briefing/debriefing success.)

Team communication and safer surgery

Failures in information transfer and communication adversely affect patient care, and evidence reviews underscore the importance of effective communication strategies. There are a number of tools available to improve communication in the surgical suite. Following the Commission's Proof of Concept project, the following communication tools were identified to be rolled out to district health boards (DHBs): call-outs, closed-loop communication, the two-challenge rule and ISBAR (identify, situation, background, assessment, recommendation).

Closed-loop communication has been shown to enhance the speed of critical actions. Checklist- or proforma-based interventions can help in surgical handoffs or handovers. ISBAR is included in the guidelines of some professional organisations. Barriers and enablers to speaking up are largely modifiable, and this may include training senior staff to 'hear' concerns more clearly.

A range of techniques exist that enhance team communication

Etherington N, Wu M, Cheng-Boivin O, et al. 2019. Interprofessional communication in the operating room: A narrative review to advance research and practice. *Can J Anaesth* 66(10): 1,251–60. DOI: 10.1007/s12630-019-01413-9 (accessed 17 June 2021).

(Factors that support effective communication include team integration, flattened hierarchies and structure/standardisation. Checklists, safety briefings and teamwork / communication training are common techniques. Closed-loop communication is practical and inexpensive.)

Pattni N, Arzola C, Malavade A, et al. 2019. Challenging authority and speaking up in the operating room environment: A narrative synthesis. *Br J Anaesth* 122(2): 233–44. DOI: 10.1016/j.bja.2018.10.056 (accessed 17 June 2021).

(Barriers and enablers to speaking up are largely modifiable within institutions. However, education about the importance of speaking up will need to accompany these modifications for any significant changes to occur.)

Weller JM, Long JA. 2019. Creating a climate for speaking up. *Br J Anaesth* 122(6): 710–13. DOI: 10.1016/j.bja.2019.03.003 (accessed 17 June 2021).

(Speaking up is an important mechanism in preventing errors progressing to patient harm. However, team-based training and training that helps senior members ‘hear’ concerns that are raised are just as important as training juniors to speak up.)

El-Shafy IA, Delgado J, Akerman M, et al. 2018. Closed-loop communication improves task completion in pediatric trauma resuscitation. *J Surg Educ* 75(1): 58–64. DOI: 10.1016/j.jsurg.2017.06.025 (accessed 17 June 2021).

(Orders with closed-loop communication were completed 3.6 times sooner than orders with an open-loop communication [HR = 3.6 (95% CI: 2.5, 5.3)].)

von Dossow V, Zwissler B. 2016. Recommendations of the German Association of Anesthesiology and Intensive Care Medicine (DGAI) on structured patient handover in the perioperative setting: The SBAR concept. *Anaesthesist* 65(Suppl 1): 1–4. DOI: 10.1007/s00101-016-0237-5 (accessed 17 June 2021).

(The German Society of Anesthesiology and Intensive Care Medicine (DGAI) recommends the implementation of the so-called SBAR concept for standardising patient handover.)

Pucher PH, Johnston MJ, Aggarwal R, et al. 2015. Effectiveness of interventions to improve patient handover in surgery: A systematic review. *Surgery* 158(1): 85–95. DOI: 10.1016/j.surg.2015.02.017 (accessed 17 June 2021).

(Improvements in information transfer may be achieved through checklist- or proforma-based interventions in surgical handover.)

Gillespie BM, Chaboyer W, Murray P. 2010. Enhancing communication in surgery through team training interventions: A systematic literature review. *AORN J* 92(6): 642–57. DOI: 10.1016/j.aorn.2010.02.015 (accessed 17 June 2021).

(There were statistically significant before-and-after improvements in teamwork practices and in some secondary outcomes, such as complication rates.)

Nagpal K, Vats A, Lamb B, et al. 2010. Information transfer and communication in surgery: A systematic review. *Ann Surg* 252(2): 225-39. DOI: 10.1097/SLA.0b013e3181e495c2 (accessed 17 June 2021).

(Information transfer and communication deficits adversely affect patient care.)

Simulation team training and safer surgery

Systematic reviews of multidisciplinary team simulations identify them as an opportunity for system-level improvement and to help address issues like hierarchy. Simulation training helps improve crisis resource management skills, including attitudes, teamwork and communication, with possible transfer to the clinical setting and indications of improved patient outcomes. In New Zealand, a comprehensive simulation course has been associated with improved teamwork scores in the ORs at two large hospitals.

Large-scale, standardised simulation team training has been shown to be feasible and is currently being implemented in New Zealand. Evidence suggests that successful implementation of simulation training should involve teams that normally work together, take place in the workplace and be developed and delivered by a multidisciplinary team. Adequate ongoing resourcing will be necessary to realise the benefits.

Multidisciplinary simulation training can enhance team processes and outcomes

Armenia S, Thangamathesvaran L, Caine AD, et al. 2018. The role of high-fidelity team-based simulation in acute care settings: A systematic review. *Surg J (N Y)* 4(3): e136–e151. DOI: 10.1055/s-0038-1667315 (accessed 17 June 2021).

(In situ simulations have provided the opportunity for system-level improvements and discussions of complex topics, such as social hierarchy. There is limited evidence supporting the impact of simulation on patient outcomes, sustainability of simulation efforts or cost-effectiveness of training programmes.)

Weller JM, Cumin D, Civil ID, et al. 2016. Improved scores for observed teamwork in the clinical environment following a multidisciplinary operating room simulation intervention. *NZ Med J* 129(1439): 59–67.

(This study demonstrated an improvement in scores for teamwork and communication in general surgical ORs following a simulation intervention.)

Weller J, Civil I, Torrie J, et al. 2016. Can team training make surgery safer? Lessons for national implementation of a simulation-based programme. *NZ Med J* 129(1,443): 9–17.

(Surgical multidisciplinary team simulation training appears to have had lasting effects on reported attitudes and behaviours in clinical practices, consistent with more effective teamwork and communication.)

Fung L, Boet S, Bould MD, et al. 2015. Impact of crisis resource management simulation-based training for interprofessional and interdisciplinary teams: A systematic review. *J Interprof Care* 29(5): 433–44. DOI: 10.3109/13561820.2015.1017555 (accessed 17 June 2021).

(Simulation-based crisis resource management (CRM) team training was associated with significant improvements in CRM skill acquisition. One study showed significant improvements in team behaviours in the workplace, while two studies demonstrated sustained reductions in adverse patient outcomes.)

Boet S, Bould MD, Fung L, et al. 2014. Transfer of learning and patient outcome in simulated crisis resource management: A systematic review. *Can J Anaesth* 61(6): 571–82. DOI: 10.1007/s12630-014-0143-8 (accessed 17 June 2021).

(CRM skills learned at the simulation centre are transferred to clinical settings, and the acquired CRM skills may translate to improved patient outcomes.)

Paull DE, Deleeuw LD, Wolk S, et al. 2013. The effect of simulation-based crew resource management training on measurable teamwork and communication among interprofessional teams caring for postoperative patients. *J Contin Educ Nurs* 44(11): 516–24. DOI: 10.3928/00220124-20130903-38 (accessed 17 June 2021).

(Simulation-based team training for staff caring for perioperative patients is associated with measurable improvements in teamwork and communication.)

Implementation of multidisciplinary simulation training for surgical teams

Weller J, Long JA, Beaver P, et al. 2020. Evaluation of the effect of multidisciplinary simulation-based team training on patients, staff and organisations: Protocol for a stepped-wedge cluster-mixed methods study of a national, insurer-funded initiative for surgical teams in New Zealand public hospitals. *BMJ Open* 10(2): e032997. DOI: 10.1136/bmjopen-2019-032997 (accessed 17 June 2021).

(For a team training to have widespread and lasting impact, it should: involve teams that normally work together, take place in the workplace, be developed and delivered by a multidisciplinary team, use a sound theoretical framework, be locally ‘owned’ and led, and provide a ‘sufficient dose’ to involve the majority of staff.)

Long JA, Jowsey T, Henderson KM, et al. 2020. Sustaining multidisciplinary team training in New Zealand hospitals: A qualitative study of a national simulation-based initiative. *NZ Med J* 133(1516): 10–21.

(NetworkZ is appreciated as a valuable and unique programme for developing important teamwork and communication skills. Its sustainability is dependent on adequate resourcing and funding.)

Arriaga AF, Gawande AA, Raemer DB, et al. 2014. Pilot testing of a model for insurer-driven, large-scale multicenter simulation training for operating room teams. *Ann Surg* 259(3): 403–10. DOI: 10.1097/sla.0000000000000342 (accessed 17 June 2021).

(A standardised multi-centre team training programme involving full operative teams is feasible with high-fidelity simulation and modest compensation for lost time.)