Report prepared for the Health Quality & Safety Commission

Evaluation of the Safe Surgery NZ Programme, 2015-2017 - final report

David Moore, Gary Blick & Hazel Rook

20 June 2017

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Wellington Level 9, 1 Willeston St PO Box 587 Wellington 6140 Ph: +64 4 915 7590 Fax: +64 4 915 7596	**Auckland** Level 8, 203 Queen St PO Box 2475 Auckland 1140 Ph: +64 9 909 5810 Fax: +64 9 909 5828	
Sydney Level 14, 68 Pitt St Sydney NSW 2000 GPO Box 220 Sydney NSW 2001 Ph: +61 2 9234 0200 Fax: +61 2 9234 0201	**Canberra** Unit 3, 97 Northbourne Ave Turner ACT 2612 GPO Box 252 Canberra City ACT 2601 Ph: +61 2 6267 2700 Fax: +61 2 6267 2710	**Melbourne** Level 8, 90 Collins Street Melbourne VIC 3000 GPO Box 3179 Melbourne VIC 3001 Ph: +61 3 9005 1454 Fax: +61 2 9234 0201

For information on this report please contact:

Name:	Hazel Rook
Telephone:	+64 9 909 5816
Mobile:	+64 21 492 198
Email:	hrook@srgexpert.com

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Glossary

ACC	Accident Compensation Corporation
DHB	District Health Board
ESC	Elective Surgery Centre
FTE	Full Time Equivalent
MORSim	Multidisciplinary Operating Room Simulation training
MoH	Ministry of Health
NMDS	National Minimum Dataset
NZPSHA	New Zealand Private Surgical Hospitals Association
QSM	Quality and Safety Marker
RACS	Royal Australasian College of Surgeons
TPOT	The Productive Operating Theatre
WHO	World Health Organization

Executive summary

The Safe Surgery NZ Programme (the Programme) is the latest evolution of a long standing programme aimed at reducing perioperative harm. Reducing perioperative harm has been one of the Commission's quality improvement programmes since 2012. In 2015 the Programme changed its name from Reducing Perioperative Harm to Safe Surgery NZ.

The Safe Surgery NZ Programme supports DHBs to implement three key interventions in the operating theatre to improve teamwork and communication:

- a poster checklist in theatre based on the World Health Organization (WHO) Surgical Safety Checklist
- a briefing among the surgical team at the start of each day's list of procedures, and
- a debriefing at the end of the day's list.[1]

The Programme originally due to run until June 2018 has since been extended to 2020. This evaluation covers the period 2015-2017, although it does consider some key developments that occurred prior, where these informed the Programme design. Two years into its roll out the Safe Surgery NZ Programme is a good strategic fit and is making steady progress. Interventions continue to be rolled out in a sustainable way but the full impact of the Programme is yet to be seen.

Programme design and implementation

The key findings for the programme design and implementation was that it was based on three main principles:

1. Staggered roll out – so DHBs could continue to progress at their own pace
2. Multi-disciplinary training – it is essential to improving teamwork and communication that the whole surgical team is on board with the interventions and understand their purpose
3. Observational audits – to be used to submit data to the Commission and ranks the team's engagement with the interventions.

Staggered roll out

The programme design was intended to continue to progress DHBs at their own pace through a staggered roll out and a comprehensive training package. DHBs at a similar state of preparedness were grouped in self-selected cohorts, with the first cohort of DHBs in particular recruited to support later ones. The training programme (see Appendix 4) for the on-site intervention training in particular was very comprehensive and condensed, but had the potential to be modular so DHBs could select areas of focus. Some DHBs expressed

[1] Health Quality & Safety Commission. (2015a). *Safe Surgery NZ Programme Three-year plan 1 July 2015-30 June 2018*. Wellington: Health Quality & Safety Commission New Zealand.

surprise at covering interventions they had already implemented. More detail on the training can be found in the interim report[2]. A more detailed understanding of the current status of DHB activities, a broad introduction such as the learning launch and then a modular DHB training programme may have progressed DHBs at an individual and therefore quicker pace.

However it was important to ensure all DHBs understood the requirements and impact of the change from the paper based to the paperless checklist, and some DHBs still implemented multiple interventions at the same time. The QSM and the new observational audit process focused on the paperless checklist intervention which also potentially slowed progress in some DHBs.

Multi-disciplinary training

A multi-disciplinary approach to training was the best practice model to achieve the Programme's aims however it has proved difficult to achieve. In DHBs where there were high numbers of surgeons and anaesthetists at training this was due to strong clinical leadership, executive support and mandated attendance. There has to be commitment to set aside time for training to occur, either by utilising a theatre session, or planning early enough into the training calendars. Most DHBs adopted a peer pressure approach, using clinical champion and leaders to influence their peers within specialities. This approach could have been strengthened by formally approaching the professional bodies to support those key messages.

The Commission did engage the Royal College of Australasian Surgeons (RACS) on the Programme, and received their support, but this was not a factor that was promoted in the communications with DHBs or private facilities. Feedback from DHB staff and surgeons was that promotion of the interventions through professional channels may have encouraged surgical engagement. While using the professional bodies as a channel of communication does not encourage the multi-disciplinary approach, or break down the professional siloes, it does reach all staff regardless of setting, and therefore brings the private sector into the mix as well.

MORSim is a multi-disciplinary training programme that has developed in parallel to this programme by the University of Auckland, and funded by the Accident Compensation Corporation (ACC). There is potential that this programme will bridge the gap between individual professional training and a locally based multi-disciplinary approach. However there have been some concerns raised by DHBs as to the resourcing required by the MORSim programme, in terms of contribution costs, but also in terms of the backfilling of staff for the training.

Observational audit

The observational audits have been undertaken for nearly a year and the DHBs have become familiar with the resource required for it, although many struggled over the Christmas break. Resourcing has been raised as an issue in regards to the observational audit process (and for the initial release and backfill of staff at training). Support such as the reporting tool help with the administrative burden of auditing, particularly for smaller DHBs, but at a cost. The

[2] Moore, D., Esplin, J., Blick, G., & Rook, H. (31 January 2017). *Safe Surgery NZ Programme Evaluation - Interim Findings Report.* Auckland: Sapere Research Group.

reporting tool has been very valuable in supporting the auditors to give immediate feedback to teams on how they are doing and what is being looked at. Adopting a business as usual approach to the audit process as part of a working day will support its ongoing sustainability. There are risks that in times of workforce shortages the audits will be the first activity to be dropped.

Slower than expected implementation

At the time of this report, nearly two years into the Programme, all of the DHBs have implemented the paperless Surgical Safety Checklist, which is now business as usual for most. However there is still some variance between sites and specialities, which will not necessarily be evident in the QSM. Two-thirds of DHBs have implemented briefings in some form, and just over a quarter (six DHBs) debriefings. The majority of DHBs have expressed that having a QSM that covers briefings and debriefings would help focus the efforts on those interventions, although it could potentially be a double edged sword in terms of resource. During the drafting of this report it has been confirmed that a new measure will be added to the QSM from July 2017 which will require the auditors to confirm whether a briefing has occurred at the start of the list.

Most DHBs express that there are still pockets of resistance, with some surgeons or anaesthetists who are reluctant to participate. In some DHBs there are sites that are not at the same stage of implementation. While the initial tranche of implementation has gone well, there is still more work to do in terms of rolling out briefings and debriefings, and ensuring more consistency in the use of the checklist. Maintaining focus on the implementation over the next year, utilising different forums to reach surgical teams and providing advice and support to the DHBs will be required. A local story or evidence base that pushes the surgical team is needed, one which shows the impact the interventions can have, such as case studies of adverse events and capturing those 'near misses'. A powerful part of this next stage could be the inclusion of private elective surgical services and the involvement of consumers to set expectations for their DHB and private services.

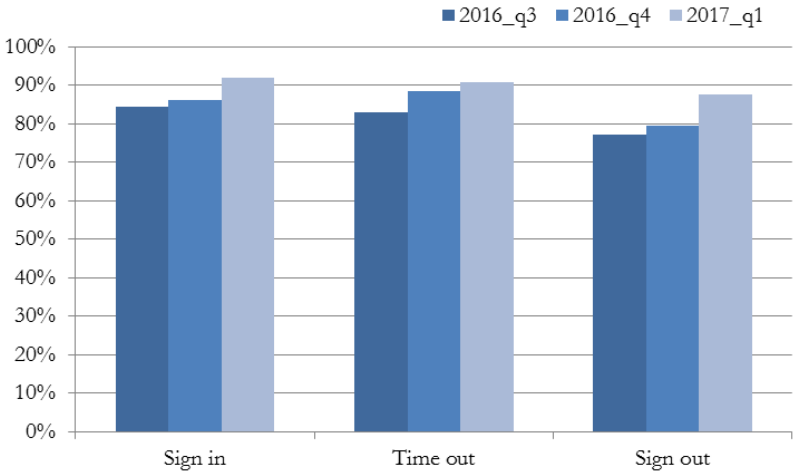
Benefits realisation

All interventions being implemented – the focus here is on the QSM process measures where there is extensive data on the use of the three parts of the Surgical Safety Checklist and the levels of team engagement.

- Uptake of the checklist – while the average uptake for the three parts of the checklist has been stable at around 90 percent, only a few DHBs have been able to reach the target of all three parts of the checklist being used in 100 percent of surgical procedures. This shows there is material room for improvement for all checklist components to be followed – although the extent of this differs among DHBs.
- Team engagement – where the checklist has been completed, the level of engagement has been improving for the health system as a whole, with an increasing proportion of audits being rated at 5 or above (high engagement). However the number of DHBs reaching the target of 95 percent of high engagement remains low, with fewer than half attaining this target for any part of the checklist by the first quarter of 2017.
- The Sign Out stage appears slightly less likely to be observed and rated as part of the audit process, with a noticeably lower number of moments being submitted by DHBs.

This is consistent with our interview findings that the Sign Out stage can be difficult for an auditor to observe because the timing of the end of a surgery is uncertain and / or the team is busy waking and transferring the patient and / or the team is dispersing.

Percentage of observational audits with engagement scores of 5 or more



Source: Health Quality & Safety Commission, QSM quarterly data, Sept 2016, Dec 2016, Mar 2017

Teamwork and communication – the full impact of the Programme is still to be seen. Most agree that it can or has the potential to improve communication, when done correctly. However there are still staff who perform the process in a perfunctory manner that does not encourage the right behaviour. Many of the earlier adopters interviewed were keen to see if the audits would highlight this behaviour. The other indicator of improved teamwork and communication was the surgical safety culture survey. The findings from the survey are supported by the interview findings: the interventions are being used and communication is improving. The main findings show improvement across most dimensions and factors between 2015 and 2017, in particular:

- **Interpersonal (teamwork)** – the average agreement score for this dimension increased from 70 to 76 percent (+6 percentage points), with notable increases in the factors of Communication (+10) and Coordination (+8), and
- **Practical (adherence)** – an increase in the average agreement score for this dimension, from 62 to 71 percent (+9 percentage points).

Clinical Leadership, a factor within the Interpersonal (teamwork) dimension remains an area of relatively lower scoring, with the average agreement scores for this dimension being 63 percent in 2015 and 66 percent in 2017.

In addition to progressing Programme implementation, some culture change within the executive and clinical leadership of DHBs is needed. Part of this is the culture of the DHBs and what is deemed acceptable behaviour, and what is considered to be creating unnecessary risks for patients. The evidence needs to be continually pushed. The other element is creating the generational change. The Royal Australasian College of Surgeons (RACS) mandatory bullying and harassment training is addressing this by setting minimum standards of cultural training for those in charge of registrars. MORSim is an attempt at the multi-disciplinary

training within the existing teams, which also needs to permeate through to undergraduate training.

Improving surgical safety for patients – the evidence on whether the use of the checklist under the Safe Surgery NZ Programme is resulting in safety benefits for patients is incomplete and somewhat mixed. There are some positive examples provided in participant interviews at DHBs that we have engaged with, although this evidence is not systematic.

- There have been fewer deep vein thrombosis/pulmonary embolism (DVT/PE) cases than expected since mid-2014. Further investigation is needed to determine whether the checklist has had an impact, e.g. around the consistent use of a plan for VTE prophylaxis being carried out.
- There have been more sepsis cases than expected in 2016, despite the efforts of multiple programmes aimed at preventing infections. Further data points will help shed light on whether this increase is sustained; in which case, further research may be needed into the drivers of this increase.
- Since the checklist has been taken up, there has not been a sustained and material decrease in the rate of the selected adverse surgical events of retained surgical items and inappropriate operations being carried out – although these numbers are not high.

This might be expected, given that the Programme is still to have its full impact – the room to improve in the measured level of staff engagement is evidence of this. In terms of **improving the teamwork and communication** – the findings from the surveys and interviews appear to be fairly consistent. While the interventions are being implemented and there have been improvements in adherence and communication, occurring there is still a way to go until they become embedded and embraced by all team members to the extent that it permanently shifts the culture of the operating theatres. This finding does not exclude the possibility that the use of the checklist has had a positive impact in other ways that are not measured here, such as reducing other types of errors (e.g. the mislabelling of specimen labels) and avoiding glitches (e.g. the right equipment being unavailable in a timely manner).

Strategic fit

The Safe Surgery NZ Programme is a strategic fit for the Commission both from a historic point of view, and has the potential for strengthening the alignment in the future. The area that has been least explored is the ability for consumers to be engaged, which is likely to be a focus for the future.

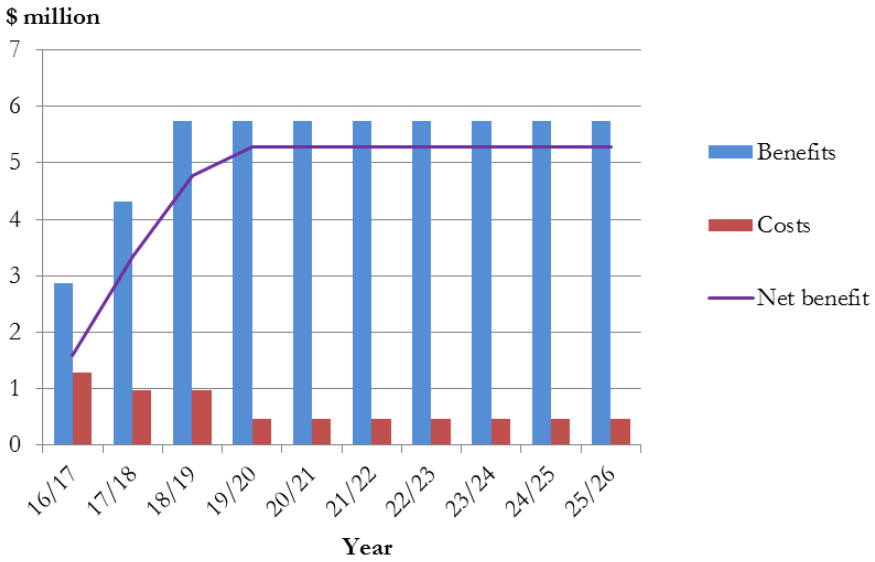
The Programme is also an important focus for the DHBs in terms of improving patient safety. There has to be strong managerial and clinical support to enable staff to implement the interventions, and to give them the time and resources to do so. Once fully embedded it can foster improved teamwork and communication, improve workplace culture and of most importance, improve patient safety.

By the programme strategically aligning through the Commission as quality lead, the DHBs as surgical team employers, and the professional bodies it is creating a new sector wide culture of what is acceptable practice.

Value for money

Our assessment of the value for money of the Programme is based on the cost benefit analysis (CBA) of the checklist produced for the Commission in 2012. That earlier work was necessarily prospective in nature as it focused on the potential gains if a programme were rolled out and if the checklist were fully adopted. Our updated model suggests that the successful implementation of the Programme, so that the potential benefits suggested by the literature are realised, would mean a steady state net benefit of $5.3 million per year for the public health system.

Modelled programme costs, benefits and net benefit over ten years



The key results from this updated cost benefit analysis are also shown in the table below and compared with the results obtained in 2012, prior to the launch of the Programme. Several points are worth stating here.

- **Costs** – the revised costs partly informed by Programme costs incurred to date, are modelled as being $5.8 million compared with the high-level ex-ante estimate of $2.0 million in the earlier work. These figures are on a present value basis. The main reason for this difference is that the national coordination costs, training costs and audit costs are all higher than was estimated in the earlier work.
- **Benefits** – in this base case scenario, the benefits are unchanged from those modelled in the earlier work –$45.0 million, on a present value basis.
- **Net benefit** – as a result of the incorporation of information about Programme costs, the revised model has a net benefit of $39.2 million – somewhat lower than the net benefit of $43.0 million obtained in 2012 (both figures are on a present value basis).
- **Benefit-cost ratio** – the ratio of benefits to costs is 7.8 which shows that the benefits to the health sector still would outweigh the costs significantly, being nearly eight times higher than the costs over a ten-year period (in present value terms).

The base case assumed gradual take-up over three years. To test the sensitivity of the results to the speed of uptake, this assumption was increased to eight years to reflect a scenario where the sector is slower to fully adopt the checklist. This reduces the net benefit to $22.5 million, with a benefit-cost ratio of 4.9. The key finding here is that after incorporating actual Programme costs and factoring in a potentially slower uptake across the sector, the results still point to the Programme as having a material net benefit for the health sector.

Key results – net benefit and benefit-cost ratio (2012 & 2016)

Measure (present value)	2012 CBA of the checklist (prospective)	2016 CBA scenarios for the Safe Surgery NZ Programme (prospective)	
Scenario	*base case*	*base case with updated costs*	*base case with updated costs, slower uptake*
Costs	$2.0 m	$5.8 m	$5.8 m
Benefits	$45.0 m	$45.0 m	$28.3 m
Net benefit	**$43.0 m**	**$39.2 m**	**$22.5 m**
Benefit-cost ratio	22.9	7.8	4.9

This approach to considering the value for money of the Programme has several limitations that must be kept in mind when considering the results presented here. Firstly, these results are prospective, or forward-looking. As such, they represent what the Programme could reasonably be expected to achieve in future if successfully implemented, rather than what has been achieved to date.

While the modelled benefits are based on credible literature, much of the research was conducted overseas in overseas health systems some years ago. This may limit the application to the New Zealand setting, for example, the lack of data on the incidence of avoidable adverse surgical events and the lack of comprehensive data on the marginal cost of adverse surgical events in New Zealand.

Sustainability

By its design the intention was to give the tools and support to the DHBs to implement the programme in a sustainable way. The observational audit provides an ongoing focus to ensure the interventions are implemented, and more importantly are being used appropriately and engaged with. The bi-annual surgical safety culture survey monitors the extent to which the interventions have improved teamwork and communication in theatres.

The QSM and bi-annual surgical safety culture survey will continue to monitor progress and provide periodic feedback to the DHBs. As well as these tools at the operational level, conversations need to continue at leadership levels so that the interventions are continued to be supported, and resourced. Other pressures on the DHBs such as elective surgery targets and the new elective patient flow put pressure on the finite resources in the surgical theatres.

Whether the programme is perceived to be a good use of resources and provide value for money is a major factor in considering its future sustainability within the DHBs.

Conclusion

The Safe Surgery NZ Programme has now reached the end of its second year. It has had a full first year of implementation rolling out training and support to the DHBs, and to a lesser extent to private facilities, where they have been included by their local DHB. At this point all of the DHBs have implemented the paperless checklist. However there are a couple of DHBs where there are variances as to how the checklist is implemented across multiple sites, and the leadership of the different stages of the checklist – which may not always be evident in the QSM results.

Briefings and debriefings are still variable across the DHBs. Briefings have been cited as one of the most beneficial interventions, setting the tone and culture for the day and all DHBs are planning to implement it if they have not already done so. Debriefings have not been a high priority for any to implement who are new to it, but those who do use it adapt to the needs of the day and find it useful. Essential to debriefing is the ability to action any issues raised and close the loop or it will stop being used. This finding was repeated in the surgical safety culture survey where only 58 percent of equipment issues or other problems discussed in the post op debriefing are addressed in a timely manner. At this stage not all DHBs are planning to implement debriefings, and others are intending to leave it up to individual surgeons to adopt.

At this critical juncture of the Programme there is still some work to be done to ensure consistent application of the interventions across all sites for all specialities; for briefings and debriefings in particular, but also the paperless checklist to a lesser extent. During the drafting of this report it has been confirmed that a new process measure will be added to the QSM from July 2017 which will require the auditors to confirm whether a briefing has occurred at the start of the list. The focus is on measuring compliance rather than engagement. While this is a useful tool to ensure DHBs continue to implement and develop the Programme locally, there is a risk that it could become a compliance exercise, as tended to be the case with the initial QSM in 2012. There is potential to capture some additional information about the briefings in the new process measure which may help inform the nature of its use without creating too much additional burden. Or continual messaging and communications to the DHBs, as well as checking in through tools such as the surgical safety culture survey, will be vital to ensure it is resulting in improved teamwork and communication.

There are opportunities to further support the uptake of the interventions through DHBs surgical teams and associated specialities such as interventional cardiology and radiology which has started to pick up the interventions in some DHBs. There also is a willingness within private facilities to progress the implementation where this has not already occurred, including participating in observational audits and the QSM. The more that the interventions are embedded, becoming standard practice over multiple disciplines and settings, the greater the likelihood of their sustainability.

Consistent messaging to the whole sector will be an important factor for the continued development of the Programme and its sustainability. Professional bodies, DHBs, private facilities, and consumers must be aligned in their expectations of surgical practice, including

safety checks, teamwork and communication. MORSim will have a visible presence in the DHBs over the next few years reinforcing those messages, influencing the current workforce and culture. The ethos of the Programmes will need to be developed into other medical training programmes to inform and influence the future clinical workforce.

2. Introduction and approach

2.1 Programme overview

The Safe Surgery NZ Programme (the Programme) is the latest evolution of a long standing programme aimed at reducing perioperative harm. Since 2012 reducing perioperative harm has been one of the Commission's quality improvement programmes. In 2015 the Programme changed its name from Reducing Perioperative Harm to Safe Surgery NZ.

The Safe Surgery NZ Programme supports DHBs to implement three key interventions in the operating theatre to improve teamwork and communication:

The three interventions are:

- a poster checklist in theatre based on the World Health Organization (WHO) Surgical Safety Checklist
- a briefing among the surgical team at the start of each day's list of procedures, and
- a debriefing at the end of the day's list.[3]

The Programme originally due to run until June 2018 has since been extended to 2020. This evaluation covers the period 2015-2017, although it does consider some key developments that occurred prior, where these informed the Programme design.

2.2 Approach to the evaluation

2.2.1 Purpose

The purpose of evaluating the Programme is to review, on behalf of the Commission, the effectiveness of the Programme over its first two years. The evaluation objectives centre around four main dimensions: (1) efficiency of the programme; (2) benefits realisation; (3) strategic fit (for the Commission and the DHBs), and (4) sustainability of the Programme, including value for money.

Evidence of the extent to which the Programme realises its intended benefits, remains a strategic fit, and provides value-for-money will inform its future design. Appendix 1 provides a summary of the evaluation framework, objectives and research questions.

2.2.2 Method

A mixed methods approach has been used for the evaluation, as outlined below.

Qualitative research

Our qualitative research includes interviews, site visits, surveys and analysis of existing documentation. Representatives from each DHB have been interviewed at least once by

[3] Health Quality & Safety Commission. (2015a). *Safe Surgery NZ Programme Three-year plan 1 July 2015 - 30 June 2018*. Wellington: Health Quality & Safety Commission New Zealand.

telephone over the course of the last two years. In total we have spoken to over 120 different DHB personnel as well as with key representatives from the private hospital sector.

- **Telephone interviews** – these involved talking with DHB project leads (usually theatre managers) and the clinical champions and, in some instances, the auditors. We sought to conduct three interviews with most DHBs at key stages of the Programme roll out, i.e. during the preparation period, during Programme implementation, and as they embed it into usual practice and begin undertaking observational audits. Supplementary interviews were conducted during the second year of the evaluation to obtain feedback from surgeons and anaesthetists and from the private hospital sector.
- **Site visits** – three DHBs were the focus of detailed site visits by members of the evaluation team. These visits involved interviews with key project and management leads, clinical personnel, as well as interviewing a cross section of theatre staff to try and understand if the interventions were having the desired impact on the ground.

We have also interviewed the Commission's programme team and clinical leaders, trainers, and the Quality Hub, the provider of the reporting software. The outputs from these interviews have been collated and summarised under key themes explored in this report.

The results of the Surgical Safety Culture Survey, delivered online to theatre staff in 2015 and 2017 by an independent research provider on behalf of the Commission were also made available to inform the evaluation.

A short e-survey was also conducted of 35 private surgical hospitals, facilitated by the New Zealand Private Surgical Hospitals Association (NZPSHA). This resulted in 37 individual responses from 15 different facilities, although nearly half of the responses were from one facility. One group response was also submitted. Those results were explored in the interim findings report and are also referenced here, where relevant.

Quantitative research

Research into the Programme interventions focused on QSM data extracted by the data host (Quality Hub) for the Commission, which was then forwarded to the evaluation team for analysis and inclusion in this report. This data has been collected quarterly from July 2016 via a web-based collection tool. The first three quarters of data were available at the time of this report: the third and fourth quarters of 2016 (July to September and October to December) and the first quarter of 2017 (January to March). The variables included were date, time, stage, organisation, site, specialty, completeness and engagement scores.

In terms of Programme outcomes, the approach has been to draw on a variety of data sources to build up a composite picture of patient safety outcomes, including:

- the two outcome QSMs for safe surgery, monitored by the Commission – i.e. the analysis undertaken by the Commission of the postoperative sepsis rate and the deep-vein thrombosis/pulmonary embolism (DVT/PE) rate, and
- other selected adverse surgical events coded on discharge records. Anonymised discharge records from the National Minimum Dataset were analysed for the period from 2007/08. The focus was on adverse surgical events that are relatively straightforward to identify over time. The records were identified using the presence of two external-cause-of-injury codes:

- Y61.0 – *Foreign object accidentally left in body – during a surgical operation,* and
- Y65.5 – *Performance of inappropriate operation.*[4]

This analysis of outcomes was supplemented with data on adverse surgical events reported to the Commission over time and qualitative findings from interviews with participants.

Value for money analysis

Our assessment of the value for money of the Safe Surgery NZ Programme involves updating the cost benefit analysis of the checklist produced for the Commission in 2012.[5] That work was necessarily prospective in nature as it focused on the potential gains to the health system if the checklist were to be fully adopted in public hospitals in New Zealand. In doing so, it drew on credible international literature and New Zealand data to estimate the potential benefits from more systematic use of the checklist.

In the absence of systematic evidence about the benefits of the Programme itself, the cost benefit analysis here retains the approach used in the earlier analysis – with the main changes being the inclusion of Programme costs incurred to date and a scenario that allows for slower-than-expected uptake of the intervention.

2.2.3 Evaluation outputs

The outputs produced over the course of this evaluation include:

- reports on the three cohort learning days
- two brief fieldwork reports, and
- an interim findings report, based on data as at September 2016.

This final evaluation report expands on the interim findings report, with the inclusion of the latest QSM and outcome data and some additional interviews, as at 30 March 2017.

The early findings from the evaluation have formatively helped shape the roll out of the programme to subsequent cohorts of DHBs. It is expected that this evaluation will inform the evidence base with respect to implementing this type of quality improvement initiative in the New Zealand context.

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[4] Data extracted by the Commission, at the request of the evaluation team, in September 2016 and April 2017. The codes are ICD-10-AM 6th edition; the code Y65.5 covers a wrong procedure, site or patient.

[5] Hefford, M., & Blick, G. (2012). *Cost benefit analysis of the surgical safety checklist.* Sapere Research Group.

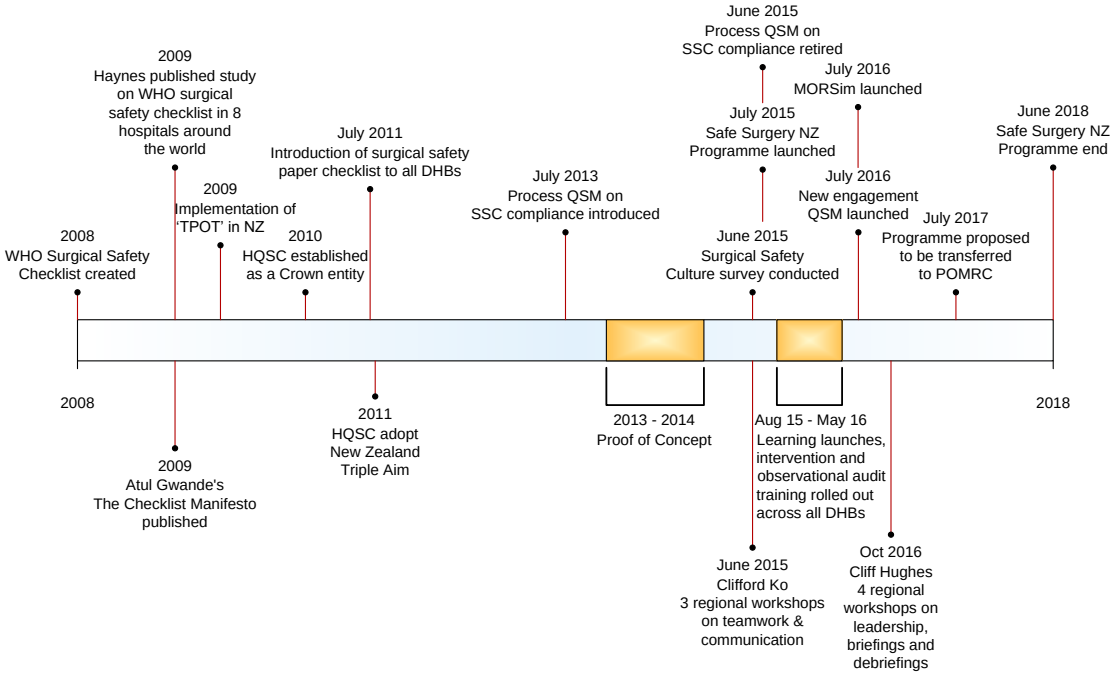
3. Programme design and implementation

3.1 Background to the Programme

A paper-based Surgical Safety Checklist was introduced to New Zealand in 2010, on the basis of evidence from international studies – one of which involved Auckland DHB.[6] [7] This initial programme – Reducing Perioperative Harm – included quality and safety markers (QSM) for:

- **process** – all three parts of the Surgical Safety Checklist being used (i.e. Sign In, Time Out and Sign Out), and
- **outcomes** – the rates of sepsis infections and deep vein thrombosis (DVT) or pulmonary embolisms (PE) events. The outcome measures were chosen on the basis of being amenable to the programme interventions and readily measurable.[8]

Figure 1: Programme context and timeline



Source: Authors, developed from programme documentation

6 Health Quality & Safety Commission. (2015b). *Checklists, briefings and debriefings An evidence summary*. Wellington: Health Quality & Safety Commission New Zealand.

7 Haynes, A. B., Weiser, T. G., Berry, W. R., Lipsitz, S. R., Breizat, A. S., Dellinger, E. P., et al. (2009). A surgical safety checklist to reduce morbidity and mortality in a global population. *The New England Journal of Medicine*, 711-717.

8 http://www.hqsc.govt.nz/our-programmes/health-quality-evaluation/projects/quality-and-safety-markers/baselines/

Along with this introduction of a paper-based checklist, other steps towards improving the safety culture of the surgical environment included NHS Productive Series:

- The Productive Operating Theatre – commonly referred to as TPOT and launched in 2009, this programme included a focus on teamwork as an 'enabler' module, and
- The Productive Ward or 'Releasing Time to Care' – this programme focused on empowering nurses to drive quality improvements within their wards.

3.1.1 Limits of a paper-based approach

DHBs all made good progress with the process QSM – with checklist compliance reaching an average 97 percent by June 2015, at which point the measure was retired. The high ratings of the QSM results were in contrast to reports of how the checklist was being used. The checklist only achieved the introduction of evidence-based safety check but the paper-based nature meant it was often treated as a compliance step being conducted by nurses in isolation to the rest of the surgical team. Therefore, the checklist was not fully contributing to improved teamwork and communication in operating theatres.

3.1.2 The proof of concept

To shift the Reducing Perioperative Harm Programme towards a more engaged approach, a 'proof of concept' was developed to trial tools to support improved teamwork and communication. Two DHBs volunteered to participate – Waikato and Lakes – along with a private facility, Southern Cross Auckland Surgical Centre. The proof of concept pilot was delivered by PricewaterhouseCoopers behalf of the Commission.[9] The pilot was originally intended to be a six month piece of work, but ran for 11 months from January until December 2014. The pilot provided feedback from the participating DHBs as to what was practically required for successful implementation and narrowed down the number of potential communication tools from ten to four.

The final report contained 29 recommendations, many being related to project and programme planning principles. Many of these recommendations were incorporated into the Safe Surgery NZ Programme design and these are summarised in Appendix 2.

3.1.3 Raising awareness

Alongside the proof of concept trial, safe surgery featured in the national patient safety awareness campaign: *Open for better care*. This media campaign was aimed at raising awareness of four of the Commission's programmes: falls, health related infections, surgery and medication – among clinicians and patients. Safe surgery was the focus between April and September 2014, prior to the official launch of the Safe Surgery NZ Programme. Regional workshops on topics in surgical teamwork and communication were also held just prior to the launch of the Programme.

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[9] PricewaterhouseCoopers. (2014). *Improving Teamwork and Communication within Surgical Teams A proof of concept project*. Wellington: Health Quality & Safety Commission.

3.2 The Safe Surgery NZ Programme

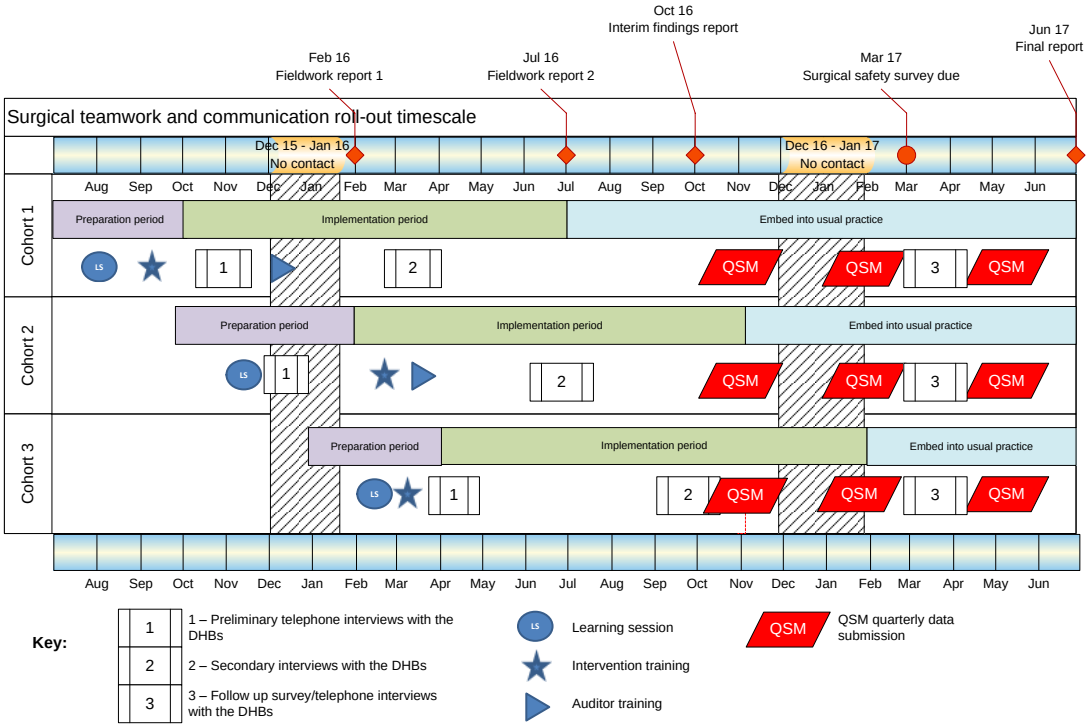
3.2.1 Design of the Programme

The main elements that support the evolution from Reducing Perioperative Harm to the Safe Surgery NZ Programme are as follows.

- Implementation of a paperless checklist, briefings and debriefings in a phased roll out across the 20 DHBs split into three cohorts, dependent on readiness.
- Project support split across three phases for each cohort of DHBs: (1) preparation, (2) implementation and (3) transition to business as usual.
- Regional launch days and observational audit training sessions plus half day on site intervention training
- Hard copy resources, regional launch days per cohort, on-site intervention training, regional auditor training and webinars and teleconferences.
- Supported from a range of Commission staff, including project manager, senior analyst and advisor, quality improvement and medical and nursing clinical leads.
- A new process quality and safety marker (QSM)on engagement with the paperless Surgical Safety Checklist. This was accompanied by:
  - an observational audit requirement for reporting the QSM, and
  - a reporting tool for capturing data against the QSM.
- Ongoing annual workshops to promote and support safe surgery messages.

DHBs were also encouraged to include their private hospital colleagues in training sessions.

Figure 2: Safe Surgery NZ Programme roll out 2015-2017



Source: Authors; adapted from the Commission Safe Surgery NZ Programme Three Year Plan 1 July 2015–30 June 2018

3.2.2 Preparation for implementation

To support the DHBs with implementing the interventions the main focus of the Programme design was:

- Hard copy resources of an implementation guide and evidence summary (updated annually)
- Bi-monthly webinars or teleconferences
- A regional launch day
- On site intervention training (half day)
- Regional auditor training
- Support team consisting of clinical leads, project manager, policy analyst and advisor and quality improvement support.

One of the main focuses for the project was to have multi-disciplinary training so that the team were all receiving the same messages together, in particular at the on-site intervention training. Over 750 staff from different disciplines attended the training, which included 95 surgeons and 129 anaesthetists. However many of the DHBs struggled to get significant numbers of surgeons and anaesthetists to attend and over half the surgeons were from just three DHBs. In those three DHBs high numbers of attendance were achieved through mandated attendance at one, strong leadership from both the Director of Surgery and Head of Anaesthetics at another who had an agreed approach that 'non-participation was not an option'; and in the third it was scheduled on a non-operating day, and it was also part of a

much larger theatre utilisation project. Where there were significant numbers the DHBs either mandated attendance, cancelled the theatre list and/or paid for staff to come in on scheduled days off. The DHBs also used clinical champions and project leaders to discuss the changes at surgical and anaesthetist meetings to communicate the changes.

Despite the push for multi-disciplinary training many clinicians do not feel the training was targeted towards them. More general sessions with broader appeal such as the workshops held for Clifford Ko (Director, Division of Research and Optimal Patient Care, American College of Surgeons) and Cliff Hughes (President of the International Society for Quality in Health Care) have attracted a broader audience. Another alternative is to drive the interventions through professional channels such as the Royal Australasian College of Surgeons (RACS). They have a parallel piece of work aimed at reducing bullying and harassment in the workplace, tackling the same issues from a stronger approach aimed squarely at those inappropriate workplace cultures.

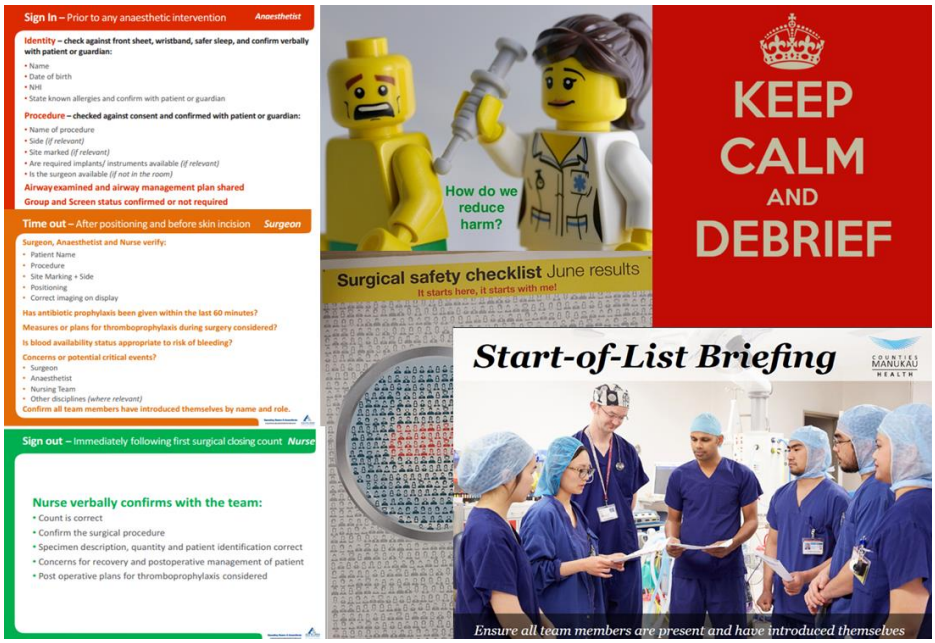
3.2.3 Implementation by DHBs

At the time of this report, nearly two years into the programme, all of the DHBs have implemented the paperless Surgical Safety Checklist. Many used the intervention training as an internal launch of the programme. Many DHBs intended to test the interventions in a pilot approach, using their clinical champions, and conduct an incremental roll out, as per the advice in the Commission's resources. However many adopted a set go live date, a 'big bang approach' across all theatres. This was cited as due to time pressures (in relation to the QSM start date), staff working across specialities and sites, and easier to manage.

However the socialisation of the change prior to the implementation is more important than the method itself. All of the DHB project leads communicated the changes through a variety of methods, via clinical champions within each speciality, departmental meetings, posters, signage and even competitions to encourage adoption. No DHBs expressed there was a single point of contact for surgical teams as a whole, there are often theatre governance groups which included heads of departments, but all other activities are professionally driven.

Thirteen DHBs adopted a big bang approach, and seven used an incremental approach. One DHB used a big bang approach for the checklist, and an explicit incremental approach for briefings and debriefings. Many other DHBs have adopted an incremental approach to the briefings and debriefings, but without any formal project structure, supporting those who wish to use the interventions, distributing information, but not formally launching it or mandating its use. Some DHBs spoken to expressed that they felt briefings and debriefings in particular had to be driven by the surgeon as they led them, rather than a multidisciplinary approach. Therefore they had to be on board and willing to drive the implementation.

Figure 3: Examples of DHB publicity for interventions



Source: Auckland, Counties Manukau and Waikato DHB posters, reproduced with permission and internet open source

Auckland DHB, for instance, used traffic light colours to make the posters easier to read for staff. Others used humour and pictures of their own staff in promotional materials. Some DHBs ran competitions with prizes for those who performed the interventions the best, or achieved high ratings in the observational audit process.

It is important to note that as the QSM was focused on the Surgical Safety Checklist, this was also the focus for the DHB for implementation. DHBs have an enormous amount of workplace pressure in terms of external requirements such as national targets, as well as internal pressures in terms of workforce. It is of note that over the second quarter of the QSMs there was a drop in the number of DHBs submitting the required number of moments. Many DHBs cited workforce shortages as reasons why audits were not done, particularly over the Christmas period and so they focus on the immediate requirements placed upon them, the interventions will still be used, but auditing them is not a priority.

3.2.4 Briefings

Fourteen DHBs have formally implemented briefing in some form as at the end of 2016. Two further DHBs planned implementations in 2017. An additional four DHBs have pockets or patchy implementations which are driven by individual clinical champions, but are not part of a planned implementation. Of those fourteen DHBs, seven had implemented the briefings prior to this programme, either as part of the TPOT programme or the proof of concept. Three of those DHBs decided to use this opportunity to refresh or re-launch the briefings at the same time as the paperless checklist

- Fourteen DHBs have formally implemented briefing in all their theatres.
- Four DHBs have pockets or patchy implementations driven by clinical champions.
- Two DHBs were planning implementation in early 2017.

However these numbers can be misinterpreted, similarly as to how the paper checklist was implemented but not necessarily achieving the require changes. Most confidence can be attributed to the seven DHBs that implemented during the course of the Programme in that they are most likely to have implemented in accordance to the Programme advice; and in

that achieve the required teamwork and communication improvements. Measuring compliance to the numbers of briefings occurring may establish the breadth of implementation across DHBs, but may not highlight the levels of engagement. Briefing numbers when considered as part of the other measures for each DHB will give an overall sense of the DHBs progress and potential improvements in teamwork and communication.

The main resistance to briefings has been a perception of that it will either waste time, that briefing issues are already covered in the Sign In or Time Out, or that there are other mechanisms in place that achieve the same purpose. This refers to 'standing orders' for straight forward procedures such as carpal tunnels, whiteboard plans used for private lists and detailed planning sheets for complex procedures such as neurosurgery. While all of these processes are relevant and appropriate, they still need to be accompanied by a briefing to achieve its desired effect – improve teamwork and communication. It ensures that everyone knows each other, feels able to speak to one another, understands the orders or instructions (however they have been shared), that everyone has shared information about the patient and establish the tone within the theatre for the day.

This would be a minimal expectation from patients undergoing surgery – that those who are in charge of their care while they cannot be – all share the same information, and prioritise their wellbeing over all else. The surgical safety culture survey[10] showed a positive increase in many of these communication factors with;

- 75 percent of surgical team members sharing key information when it becomes available, up from 69 percent in 2015
- 74 percent of surgical team members making sure their comments or instructions are heard (from 69% in 2015) and;20 percent increase in team discussions (briefings and debriefings, with 71 percent stating they are common.

Many DHBs that had push back regarding the impact briefings would have on their on-time starts, actually had implementations that were easier than expected. This is likely to be due to the fact that they did not impact on their start times, and they experienced the benefits of it. One DHB commented;

> *"after an initial few runs at it the benefit was obvious; the surgeons and anaesthetists find it works really well and see the improvement in how the day runs" (project lead)*

> *"we had one anaesthetist who was always late for procedures who is now always on time for the briefing" (project lead)*

Some also echoed that being late for the briefing and the start of the list showed disrespect to the patient undergoing surgery, and the surgical team, and was unacceptable. The acceptable culture and workplace norm seems to be shifting. Other issues cited with the briefing was conducting it for acute lists when the full list wasn't known – it appears all but two DHBs use briefings for acutes, and they use it for the procedures they have or know about at that point, which may just be the first two.

[10] Mobius Research and Strategy Ltd. (April 2017). *Surgical Culture Safety Survey Draft Research Report.* Wellington: Health Quality & Safety Commission.

3.2.5 Paperless Surgical Safety Checklist

All of the 20 DHBs have implemented the paperless Surgical Safety Checklist. Only three DHBs had implemented the paperless Surgical Safety Checklist prior to the launch of the Programme in July 2015. Seven DHBs implemented it shortly following intervention training between November and March 2016. The majority of DHBs (nine) implemented it between May –August 2016 which coincided with the launch of the QSM (in July 2016).

Some DHBs felt that there was too much emphasis put on the effort required to shift from the embedded paper based checklist process to the paperless checklist. However one of the early adopters advised that it took them a year to fully embed the new process. Another DHB who felt they were very confident with their current paper process, did not anticipate the level of resistance they got when they asked the other professions in the surgical team to lead parts of the checklist. They subsequently required some further assistance from the Programme to push this through. Therefore it would seem that reiterating all of the interventions and their drivers, while an annoyance for a few was actually needed to ensure everyone understood the foundations of the Programme.

For example we often had to clarify whether the DHB was referring to the paper or paperless checklist as it was often stated 'we've been doing that for ages' when in actual fact they were referring to the paper nurse led process. Many did not see the need for the change: as 'it was working here, if it isn't broke don't fix it' and 'others may have needed to change but we were doing fine'.

3.2.6 Debriefing

Is the hardest to implement. The intervention is not fixed to a specific point in the surgical process, and deliberately so as the end of surgery will vary with each DHB. It struggles due to the fact that everyone heads off to other things after a surgery;

"operate and walk away mentality prevails" (Theatre manager)

Only six DHBs have formally implemented the debrief, only two of these were prior to the programme. In another seven DHBs the processes have been left to be adopted 'ad-hoc' by those who wish to implement it. However the majority of the DHBs don't feel it is embedded as yet because it is only used when it is needed, for any issues. Some DHBs have adapted the process rolling it into the Sign Out for every case. This has the advantage of occurring with all the surgical team still present, often the theatre team that starts the list may not be the same one that finishes it, particularly with nursing staff. There are also seven DHBs which did not have any explicit plans to implement when last interviewed, and these were evenly spread across the three cohorts of the DHBs which reflect a regional and

- Six DHBs have implemented the debrief in some form
- Seven DHBs have allowed the debrief to be used by those who wish to; it may be for certain theatres, specialities, or if an incident has occurred
- Seven DHBs do not have any plans as yet to introduce the debrief
- Two DHBs were due to implement in the first half of 2017

The debrief is seen as 'the hardest sell', occurring at a busy time, with less evidence, and it is not a priority, particularly as the QSM is focused on the paperless checklist. Those where it seems to be working is where there is an acceptance that everyone is aware of the process, it

is used formally with a feedback loop in place for any issues raised, and at other times it may just be a thank you to the team. One DHB commented that service that did adopt the debrief quickly dropped it again if processes weren't in place to ensure issues that were raised were followed through. Some DHBs allocate issues to particular team members if it is related to a piece of equipment, others may log it in their risk system. Generally it was the circulating nurses or manager's responsibility. One surgical lead advised that he was:

> *"actually quite surprised as to how useful the debriefing was for team building, everyone thinks it's a waste of time and it was a struggle due to the timing as half the staff had left but it all brought everyone back together" (Surgeon)*

3.2.7 Ongoing support

Once the programme was launched each of the cohorts had bi-monthly webinars, and later teleconferences arranged and all resources were available on a shared workspace. The webinars experienced technical difficulties and were utilised more as a video conference facility, than presenting set topics. The switch to teleconference medium tried to engage DHBs more in the content but suffered from a lack of input. The DHBs feedback was mixed, with some appreciating the opportunity to work with other DHBs, and others finding that they weren't really useful. Some suggestions around the best way in which to support DHBs were email links to relevant topics/resources rather than a separate website, a members only section of the Commission's website, and regular webinars on relevant topics of interest, or recordings of them from other providers. The usual participants into these forums were project and quality leads.

Table 1: Overview of DHBs' implementation as at 31 March 2017

DHB	Cohort	Size	Theatres	TPOT	Paperless Go Live	Approach
Auckland	1	Large	39	Partly	Mar-14	I
Counties Manukau	1	Large	24	No	Nov-15	BB
Lakes	1	Medium	7	PoC	Jul-16	I
Northland	1	Medium	10	Yes	Jul-16	I
Taranaki	1	Medium	6	Yes	Sept-15	I
Waikato	1	Large	24	PoC[11]	May-16	BB
Waitemata	1	Large	19	No[12]	2014	I
Bay of Plenty	2	Medium	11	Yes	Feb-16	BB
Canterbury	2	Large	22[13]	No	Jul-16	BB
Capital & Coast	2	Large	17	No	Dec-15	BB
Hutt Valley	2	Medium	8	Yes	Mar-16	BB
Nelson Marlborough	2	Medium	9	Yes	2016	BB
Tairawhiti	2	Small	3	Yes	Jul-16	I
Wairarapa	2	Small	3	No	2016	BB
Whanganui	2	Small	4	Yes	Jul-16	BB
Hawkes Bay	3	Medium	7	Yes	May-16	BB
Mid Central	3	Medium	7	No	Jun-16	I
Southern	3	Large	15	Yes	Feb-16[14]	I
South Canterbury	3	Small	4	Yes	2010	BB
West Coast	3	Small	3	No	Apr-16	BB

Key:
BB stands for Big Bang approach when all theatres and specialities go live on the same date.
I stands for Incremental approach, when selected theatres are used as pilots and then the interventions are rolled out incrementally across all theatres.

11 Waikato DHB was part of the Safe Surgery NZ Programme 'Proof of Concept' for the interventions in 2014 and participated in the 'Releasing Time to Care' module of the Productive Ward programme.

12 Waitemata DHB did initially start to implement both the Productive Series modules, the productive ward - releasing time to care and the productive operating theatre but these were subsequently ceased

13 An additional 10 theatres will be operational in 2018/19 as part of construction of a new acute services building

14 Although implemented in Dunedin site much earlier

3.3 Barriers and enablers

Below is a table of barriers and enablers that have been discussed as part of the interviews conducted with DHBs. In the final round of interviews most DHBs felt fairly positive about how the implementation had gone, with many stating that although they were anticipating resistance it was not as much as expected. However all DHBs still felt they had at least one or two resistant to the process, and how this was dealt with was variable across the DHBs.

Table 2: Barriers and enablers to implementation of the interventions

Enablers	Barriers
• Localise the project: – Adapt the checklist – Use photos of staff, DHB logos and colours – Develop local evidence • Ensure easy readability of the posters e.g. traffic light colours to differentiate, split into three, enlarge text • Support the process for the team: – Stop all theatres for training and run multidisciplinary sessions – Reconfigured processes to support interventions • Recruit support – Peer pressure – Use clinical champions theatres as pilots – Make the auditors 'patient safety champions' (volunteers) – Use registrars as change leaders • Play the videos, show what is expected • Get visible and vocal senior clinical leadership / support • Be flexible – let surgeons call in if they can't be there in person for the briefing • Use local audits to measure progress • Create incentives – Utilise competition between theatres, specialties – Do not bring patient in until after Briefing • Use reminders and prompts such as – Red STOP sticker on instrument tray for Time Out – Yellow sticker on count sheet for Sign Out – Posters on doors e.g. Did you Sign Out?	• Readability of posters • Current theatre throughput processes • Lack of seniority of clinical champions • Balancing theatre & ward needs (on time starts, discharges) • Debrief loop – process of allocating, recording and completing actions • "Getting people to stick to script" e.g. examples of processes being truncated or extended depending on individual • Culture of the workplace • Training of surgeons (to be autonomous) • Sign Out process not being assigned to a natural pause in the theatre • Surgical culture

3.4 Embedding into usual practice

The programme was designed so that by February 2017 all DHBs would have transitioned into the 'embed into usual practice' or 'business as usual' phase, see

Figure 2 on page 16. However the earlier Programme plans are not specific as to what interventions were expected to be embedded at that point, presumably due to the universal roll out all interventions. However the early focus appears to have been the paperless checklist, and as such the majority of the DHBs have focused their efforts on embedding that first. Potentially the Programme could have split the interventions across the two years, with an early focus on the checklist and later on briefings and debriefings. However this may have lost engagement from some of the DHBs who were further along in their implementation.

During the course of the programme the interventions have generally been applied across acute and elective surgeries within DHBs. There are two DHBs which are not performing the checklist in some form in their acute lists, although most make allowances or adjustments for the nature of acute surgery, such as combining the Sign In and Time Out, or excluding certain procedures such as obstetric emergencies. One DHB commented that the impact of the checklist is visible in acutes in particular, where people are calling out when the theatre is particularly hectic which wouldn't have happened previously. Although briefing may only be able to cover the first few known cases, the checklist creates a pause to confirm the plan for the patient for everyone there.

The interventions have also started to be adopted by wider specialties such as interventional cardiology, radiology and endoscopies; however these areas are often under different management and so will not be captured in the audit process.

3.5 Observational audit process

A core part of the Safe Surgery NZ programme was the use of observational audit as the method to capture the QSM data. This replaced the case note review used for the previous process QSM which captured compliance only. The process of observational audit uses a trained auditor to first capture the elements of the Surgical Safety Checklist the teams action, and also to rate how engaged the team is against a seven-point scale. This is to ensure that the intention of the checklist is being met, engaging the theatre staff as a surgical team in the safety checks, and thereby improving teamwork and communication.

The auditor training was designed and delivered by the University of Auckland on behalf of the Commission. It was held as a full day session for each cohort. The aim of the session was to give the group an understanding of the role of the auditor, to instil a sense of inter-rater reliability and proficiency in the rating tools through videos of theatre scenarios. The intention was also to train a first group of auditors by the University of Auckland trainer, to try and ensure a nationally consistent approach, and then enable these auditors to locally train others as needed to meet their organisational needs.

The initial training sessions were held in Auckland (December 2015), Wellington (February 2016), and Christchurch (April 2016). There was some angst before the first session by DHBs in terms of a lack of understanding about the training, around who to send and what it would entail, in part probably due to how early the training was there was not a full understanding of what the auditing process entailed.

The majority of auditors are nurses and anaesthetist technicians. Some DHBs used nurse educators, theatre managers and charge nurses as well, with the view that they had the ability to 'walk the floors', and potentially be anonymous observers, however in reality many DHBs have found that they did not have the capacity to include it within their working day. Some

DHBs have used quality staff to either audit, or manage the process. While this is useful from a resourcing point of view, it is important that the audit outcomes are still 'owned' by the service. There have been issues from both sides of this process; from theatre teams not being able to control the audit process and get them done when the only auditors were in the quality team; to those quality auditors who feel unsupported in the process, and the outcomes.

Only two DHBs reported issues with some surgeons not wanting auditors in the theatres; when this is the case, the auditor leaves and escalates the issue. Many more expressed sharing the audit results from the app to the surgical teams and sharing an understanding of what 'engagement' looks like.

There are a few DHBs who have to audit while participating as part of the surgical team, although they try not to be the only representative of their profession in the team. At times this has been said to be like 'auditing yourself'. Most try to have them as supernumerary to the surgical team. However most seemed unclear as to what was 'allowed' for the audit process. It was expressed that at times it wasn't possible to contribute to patient care and audit so then some moments are missed.

The resourcing of the observational audits has been cited as an issue for a number of DHBs. Because the audits are capturing various points across different surgical procedures and theatres they occur throughout the day, so the audits take as long as the activity itself. One DHB commented that the audit was very costly when the time, hardware (e.g. tablets) and licensing fees are factored in. The DHBs have all worked through their own solution to the number and timing to capture the audit moments. One DHB found that their ability to capture the required number of audits across two sites became too difficult to manage, and therefore adopted a process to embed it into 'business as usual'. They trained an additional 20 auditors and now audit each theatre every day as standard practice.

The Programme has included annual refresher training to occur to ensure the same standards and interpretation of the auditing results will be sustained over time. Holding this regionally will provide some peer support to those lone auditors, and provide cross reference and alignment. Making the same decisions on your own over extended periods of time in comparison to peer supported in a scenario could alter perspectives of engagement. Periodic reviews of the video resources will also support this. These sessions can also be used to address some of the teething issues from the first year of implementation such as clarification of what is acceptable and 'best practice'. A few DHBs expressed that they thought they were conducting the audits to high standards, ensuring a good spread of theatres and sites in their result but wasn't sure if this was being applied universally.

Some of the earlier cohorts in particular ran their own training sessions with the materials that were developed and provided. Others found that although the resources such as ratings and videos were provided, they did not feel equipped in a practical sense to know how to run their own training sessions. The Commission has recently (March 2017) posted on its website all of the resources including a training guideline which may support other DHBs in the future.

Below are a few examples of the different approaches to the observational audits.

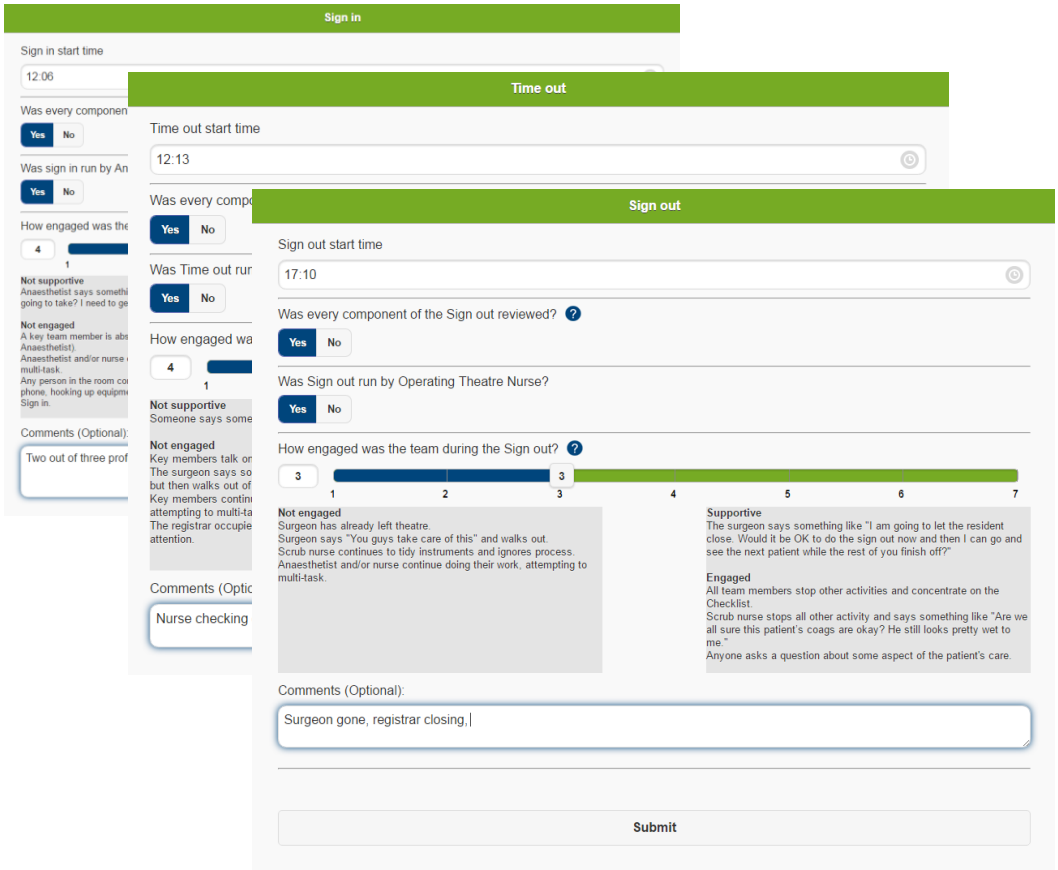
Table 3: Overview of different approaches to the observational audit

No. of theatres	No. of auditors	Roster method	Data collection	Outcome
22	14	Half or full day per week	Pool tablet or smartphone	Checks being done correctly but not getting consistent engagement as yet, Sign Out being the lowest.
28	20+	Audit each theatre every day	Manual	Didn't meet required moments for first two quarters, now in excess of 200 per stage
7	5	Hours as available through day	Dedicated tablet	Checks being done correctly and consistently high engagement so far
9	1 + 3	Free time	Manual	Checks being done correctly but low engagement, with Sign Out the lowest
3	2	Session	Tablet	Checks being done correctly and consistently high engagement so far
19	1 active, 12 trained	As available	Personal smartphone	Checks being done correctly but not getting consistent engagement as yet, time out being the lowest

3.6 The reporting tool

The reporting tool has been developed by the Quality Hub. All DHBs are entering their QSM data through the tool, but three are still collecting the data manually and re-entering later. The main reason for manual collection is linked to internet connectivity or reliability in the theatres, easy access to devices, and how the auditing is being rostered. For those without dedicated devices and using pool devices and auditing when they have free time devices may not always be available, or reliable (e.g. charged up) some work around this by using their personal smartphones. Also if some are involved in surgery as well as auditing it is easier to collect the data manually.

Figure 4: Snapshot of checklist audit pages in reporting tool



Source: https://safesurgerynz.qualityhub.co.nz/app/

Most of the DHBs felt that the reporting tool was really useful. It was easy to enter data into, and gave them a good overview of progress. They used it within theatres to give immediate results and feedback to the teams they audited, and used it to track their numbers. However concerns have been raised about the procurement process and cost of the tool, in particular when the central funding for the tool ceases in June 2018.

There was some feedback which suggested improvements to the tool which included:

- A greater level of granularity in reporting was needed for the larger DHBs – to enable drilling down to understand any 'trouble spots' such as particular theatres
- An ability to 'design your own report' from the tool in terms of selecting required elements and excluding others that may not contain data such as by speciality
- Others who did not use the tool so regularly felt they wanted more real time reporting
- Removal of the mandatory inclusion of the time of the audit to make manual input quicker
- Ability for the tool to help them plan the spread of audits e.g. a report that can advise which theatres or specialities required more audits

3.7 The Programme and private surgical facilities

As explored in the interim findings report, the Safe Surgery NZ Programme was focused on the public sector, and therefore through DHBs. The Commission encouraged the DHBs to invite their local private facilities to participate in their training opportunities. As stipulated in the 'improving surgical teamwork and communication' guide (p.8) which was developed by the Commission for DHB use in 2015:

> *"It is expected that private surgical hospitals will work with their local DHB to implement the interventions. The Commission, the New Zealand Private Surgical Hospitals Association and Southern Cross Hospitals Ltd are working together to confirm how this will be facilitated."*

The relationship between local DHBs and local private providers therefore became the critical success factor as to whether the private providers were included. Some DHBs work very closely with their private providers around surgical volumes they may contract them for, and so this approach has worked for them. Others focused on the shared workforce and saw opportunities in adopting the same processes to reiterate the approach to anaesthetists and surgeons, and to "*ensure the same processes right across town*". However, it is not the only factor in determining whether or not private facilities implemented the programme as some facilities have implemented the interventions regardless.

Reasons for adopting a similar approach across both public and private to ensure the "same processes right across town" for a shared workforce is common sense. However those that are carrying out the implementation may just not have the resources or capacity to extend this any further;

> *"There was an expectation that we would support the private hospitals alongside their work but it was hard. We were willing but when came to the meeting we could not progress our work as had to 'start again' with them. We couldn't run a parallel process. I felt bad we couldn't support them more. [We were] keen to support private but we couldn't do it. We left the door open to them attending but it was difficult to progress our issues and upskill them at the same time." (Quality lead)*

It was also expressed that in some instances both the private and public sector felt the other had more ability to influence the surgeons than they had:

"[For a previous intervention] we had to battle really hard with the surgeons to get it implemented […] if they were in the public then it just gets done… its either do it or face the committee" (Private facility)

This meant that the facility opted to wait until after the DHB had implemented it which they saw as having more weight, and they could then adopt a similar approach afterwards.

"better to be behind the public hospital"

"In the public sector you are surrounded by large committees that can take this up for you – the system battles them" (Private facility)

Whereas the public sector often felt that the surgeons had more incentive to abide by the requirements of private facilities to ensure they could continue operating there. In reality the surgeon agrees to abide by a code of conduct with the private hospital, there is no direct employment relationship as with the public providers. Other differences between public and private include a potentially leaner team, without registrars, so private facilities feel they have had to reconfigure more processes to make the interventions work with all the professions present.

As an alternate approach to implementation through individual organisations and partner DHBs, is the New Zealand Private Hospital Surgical Association (NZPSHA) which represent a large number of the private facilities. As was signalled in the programme documentation this is a way of working with the sector but was not progressed in the earlier years of the programme. In order to fully participate, support and resource programme implementations the NZPSHA needs to be involved early so that they may include it in their own programmes such as their bi-annual conferences. In their conference in March 2017 for example there were two sessions dedicated to workplace culture. One included working with the RACS to bring about culture change and another on practical approaches. In 2016 this forum was used by the Commission to present on the Safe Surgery NZ programme.

The NZPSHA also collects and publishes anonymously a number of clinical indicators which are also provided to the Commission for their adverse event reporting:

- Total numbers of all SAC 1, 2, 3, and 4 events
- Perioperative death within 30 days of admission
- Unplanned or unexpected return to the operating theatre during the current admission
- Unplanned or unexpected transfer to a higher level of clinical care during current admission
- Unplanned or unexpected readmission to the same hospital within 30 days of discharge
- Wrong site/wrong person events (SAC 1 or SAC 2)
- Medication errors requiring intervention (SAC 1 or SAC 2)
- Falls requiring intervention during admission.

There is potential that the observational audit process and QSM reporting could be implemented within private hospitals in a similar anonymous way. Three private facilities spoken to did express a wish to do this to help progress their own implementation internally, as well as align to standards adopted in public, if it was applicable to all private hospitals.

"we should be scrutinised in the same way" (Private hospital worker)

Also those spoken to that are implementing the interventions are also implementing the observational audit process, so that the engagement can be measured along with the process.

Box 1: Private surgical facilities survey – summary from interim findings report (2016)

> The paperless Surgical Safety Checklist is by far the most utilised tool, and although there is a good level of understanding and engagement of how the checklist should now be used, there is still a mixed picture of utilisation between paper based and paperless processes. It would appear however that most facilities are working towards implementation of the paperless process.
>
> Briefings and debriefings are being used in some theatres.
>
> Southern Cross Hospitals Ltd, as are a number of NZPSHA member hospitals, are further along with implementation and see the paperless checklist as business as usual across the network, and are promoting individual sites to implement briefing and debriefing.
>
> The Programme has not helped progress private implementation consistently at this stage. There is not a clear direction as to the next phase that this programme will take with private facilities. It would be worthwhile working more closely with the private surgical hospital sector to identify their needs and work towards a QSM which is measured across both elective private and elective public facility admissions (excluding acutes).

3.8 Summary of findings

The programme design was one that was intended to be modular, as explored in the interim findings report. However in reality a uniform programme was rolled out. While it is important to ensure all DHBs understood the requirements and impact of the changes, it may be that a more detailed understanding of the current status of DHB activities, a broad introduction such as the learning launch and then a modular DHB training programme may progress DHBs at an individual and therefore quicker pace. Alternatively the Programme could have been slower paced to tackle each intervention in stages, regardless of the method, the outcome of current implementation would have likely been the same, albeit a little simpler to track.

While in theory the multi-disciplinary approach to training was the best practice model it has proved difficult to realise. A total of 95 surgeons did attend the onsite intervention training, but over half of these were from three DHBs. In those three DHBs high numbers of attendance were achieved through mandated attendance at one, strong leadership from both the Director of Surgery and Head of Anaesthetics at another, and an agreed approach that 'non-participation was not an option'; and in the third it was scheduled on a non-operating day, and it was also part of a much larger theatre utilisation project. Other DHBs that had good attendance similarly scheduled on a non-operating day, or actually cancelled a theatre list and paid staff to come in on days off. There has to be commitment to set aside time for this to happen, either by utilising a theatre session, or planning early enough into the training calendars. Most DHBs adopted a peer pressure approach, using clinical champion and leaders to influence their peers within specialities. However this approach could have been

strengthened by formally approaching the professional bodies to support those key messages.

The Commission did engage the RACS on the Programme, and received their support, but this was not a factor that was promoted in the communications with DHBs or private facilities. Feedback from DHB staff and surgeons was that promotion of the interventions through professional channels may have encouraged surgical engagement. While using the professional bodies as a channel of communication does not encourage the multi-disciplinary approach, it does reach all staff regardless of setting, and therefore brings the private sector into the mix as well.

MORSim is a multi-disciplinary training programme that has developed in parallel to this programme. It has been developed by the University of Auckland and has been initially funded by ACC to start the roll out. There is potential that this programme will bridge the gap between individual professional training and locally based multi-disciplinary approach. There have been some concerns raised by DHBs as to the resourcing required by the MORSim programme, in terms of contribution costs but also in terms of the staffing resource that has to be replaced.

Resourcing has also been raised as an issue in regards to the Safe Surgery NZ Programme in terms of the initial release and backfill of staff at training, and in terms of the resource intensive observational audit process. Support such as the reporting tool help with the administrative burden of auditing, particularly for smaller DHBs, but at a cost. Adopting a business as usual approach to the audit process as part of a working day will support its ongoing sustainability. There are risks that in times of workforce shortages the audits will be the first activity to be dropped.

At the time of this report, nearly two years into the programme, all of the DHBs have implemented the paperless Surgical Safety Checklist. Three DHBs had implemented a paperless checklist prior to the Programme, seven DHBs were already using briefings prior to the programme, and just two debriefings. All of these DHBs had been involved in TPOT or the proof of concept. Therefore this would seem to reinforce the idea that these best practice interventions, such as TPOT and Safe Surgery do require some form of national leadership to give them priority amongst all the DHBs 'business as usual' work. The majority of DHBs have also expressed that having a QSM that covers briefings and debriefings would help focus the efforts on those interventions, although it could potentially be a double edged sword in terms of resource.

Most DHBs express that there are still pockets of resistance, at a minimum one or two surgeons or anaesthetists who are reluctant to participate. In some DHBs there are sites that are not at the same stage of implementation. While the initial tranche of implementation has gone well, there is still more work to do in terms of rolling out briefings and debriefings, and ensuring more consistency in the use of the checklist. Maintaining focus on the implementation over the next year, utilising different forums to reach surgical teams and providing advice and support to the DHBs will be required. How far the processes need to be aligned across the DHBs can probably be aligned to the surgical culture of the DHBs and/or their adverse event reporting. There needs to be the local story or evidence base that pushes the surgical team. A powerful part of this next stage could be the concurrent inclusion of private elective surgical services and the involvement of consumers to set expectations for their local DHB and private services.

4. Benefits realisation

This chapter considers evidence of the benefits of the Safe Surgery NZ Programme with respect to the following objectives identified at the outset:

- All interventions being implemented by all DHBs.
- Improving the teamwork and communication within surgical teams.
- Improving surgical safety for patients.

4.1 Implementation of interventions

The focus of the analysis here is on the QSM process measures – the consistent use of the three parts of the Surgical Safety Checklist and the levels of team engagement.[15]

> *All three parts (sign in, time out and sign out) of the surgical safety checklist are used in 100 percent of surgical procedures, with levels of team engagement with the checklist at five or above, as measured by the seven-point Likert scale, 95 percent of the time.*[16]

The focus on the checklist here is driven by the fact that there is extensive quantifiable data available about uptake and staff engagement, with respect to this intervention.

The Commission requested DHB to collect a minimum of 50 observational audits for each of the three parts of the checklist in each quarter of the year. These audits involve a trained person observing the use of the checklist by the surgical team and rating team engagement. This data has been collected on a quarterly basis from July 2016 via a web-based collection tool. Three quarters are available for this evaluation: July to September 2019 ('2016_q3'), October to December 2016 ('2016_q4') and January to March 2017 ('2017_q1').

The analysis is focused is on three measures:

- the number of observational audits carried out
- the percentage of audits where all three parts of the checklist were used (uptake)
- the percentage of audits with engagement scores of 5 or higher.

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15 See http://www.hqsc.govt.nz/our-programmes/health-quality-evaluation/projects/quality-and-safety-markers/baselines/#[Perioperative]

16 Health Quality & Safety Commission; "Information about the Safe Surgery NZ programme quality and safety marker"; information sheet retrieved from http://www.hqsc.govt.nz/assets/Perioperative-Harm/PR-files--images/Safe-surgery-QSM-factsheet-Jun-2016.pdf

4.1.1 Observational audits carried out

The most recent quarter of 2017_q1 saw the largest number of observational audits being collected by DHBs – from among the first three quarters for which data is available. The number of audits declined from 2,794 in 2016_q3 to 2,311 in 2016_4 before increasing to 3,582 in 2017q1. The overall increase in the number of audits between 2016_q3 and 2017q1 was 788 or 28 percent, as shown in Table 4.

This fluctuating pattern across the first three quarters of audit data holds for all three parts of the checklist, as Figure 5 shows. The Time Out part tended to have the highest number of audits collected, while there are noticeably fewer audits carried out for the Sign Out part.

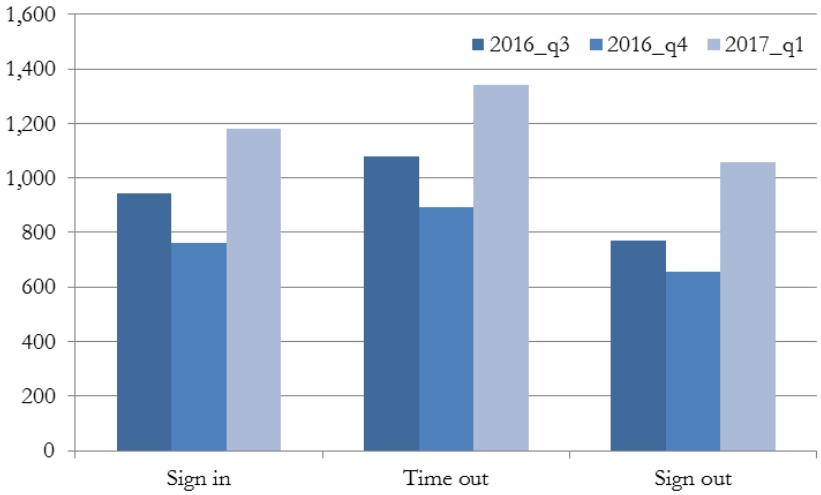
This pattern is consistent with the finding from our interviews – i.e. that the Sign Out part is more difficult to observe than the other parts of the checklist. The reasons offered for this include – the timing of the end of a surgery being less certain than the beginning, the surgical team being focused on waking and transferring the patient, and the surgical team beginning to disperse following completion of the surgical procedure.

Table 4: Total number of observational audits carried out in each quarter

	2016_q3	2016_q4	2017_q1	Total
Number of observational audits	2,794	2,311	3,582	8,687
Change from prior quarter	-	-483	1,271	788
Change from prior quarter (%)	-	-17%	55%	28%

Source: Health Quality & Safety Commission, QSM quarterly data, Sept 2016, Dec 2016, Mar 2017

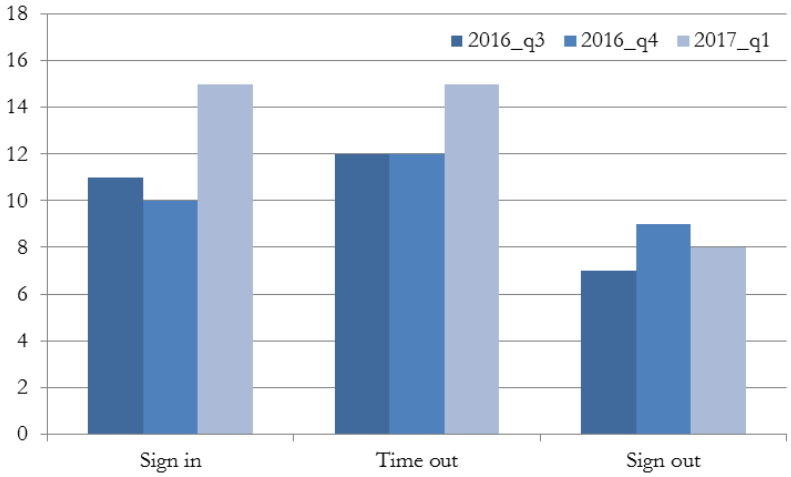
Figure 5: Number of observational audits carried out for each part of the checklist



Source: Health Quality & Safety Commission, QSM quarterly data, Sept 2016, Dec 2016, Mar 2017

There has been some improvement in the number of DHBs reaching the target number of 50 audits for each part of the checklist in each quarter. Figure 6 shows that 15 out of 20 DHBs reached this target in 2017_q1 for the Sign In and Time Out parts, a higher number than in the two prior quarters. In contrast, only 8 DHBs collected 50 audits for the Sign Out part in 2017_q1, slightly fewer than the prior quarter. The number of DHBs collecting 50 audits in all three parts has remained fairly stable, ranging from 7 out of 20 DHBs in 2016_q3 to 9 in 2016_4, with a slight decline to 8 in 2017q1. Figure 7 details the number of audits carried out by each DHB across the three quarters for each part of the checklist.

Figure 6: Number of DHBs achieving 50 observational audits



Source: Health Quality & Safety Commission, QSM quarterly data, Sept 2016, Dec 2016, Mar 2017

Figure 7: Number of observational audits carried out in each quarter, by DHB

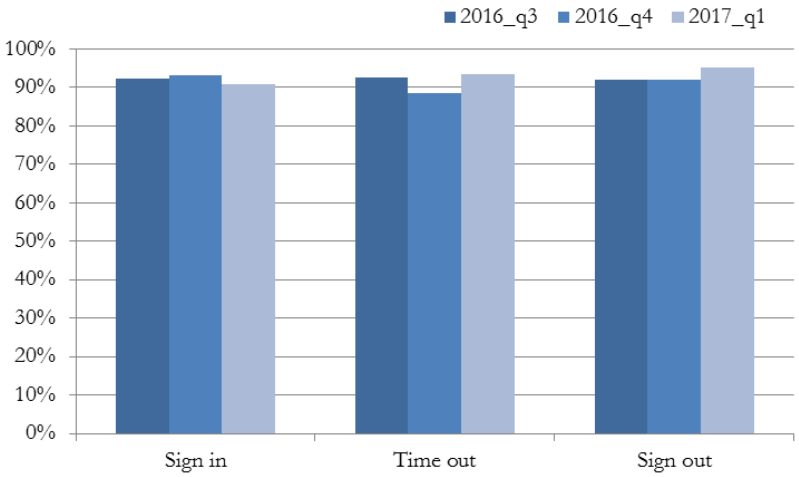
	Sign in			Time out			Sign out		
District health board	2016_q3	2016_q4	2017_q1	2016_q3	2016_q4	2017_q1	2016_q3	2016_q4	2017_q1
Auckland	37	61	57	37	59	60	30	60	58
Bay of Plenty	56	55	24	57	66	23	49	54	17
Canterbury	107	61	82	110	76	101	87	50	82
Capital & Coast	41	56	100	51	95	162	36	59	120
Counties Manukau	51	23	225	48	19	215	35	7	224
Hawke's Bay	58	68	16	107	98	44	33	51	9
Hutt Valley	51	0	0	51	0	0	35	0	0
Lakes	46	4	50	46	4	50	44	4	46
MidCentral	54	52	52	61	56	53	55	50	54
Nelson Marlborough	68	54	67	76	53	68	57	55	60
Northland	44	23	70	78	38	103	36	28	45
South Canterbury	0	0	2	0	0	3	0	0	2
Southern	66	49	18	72	52	18	61	38	17
Tairawhiti	59	35	61	60	36	54	50	28	54
Taranaki	21	2	50	34	1	59	4	0	15
Waikato	37	62	60	43	62	57	27	30	33
Wairarapa	52	59	51	53	52	64	50	50	43
Waitemata	63	54	52	59	62	56	58	56	49
West Coast	16	0	88	19	0	88	16	0	85
Whanganui	16	43	57	18	66	62	8	35	47
Total DHBs submitting audits	19	17	19	19	17	19	19	16	19
Total DHBs meeting the target	11	10	15	12	12	15	7	9	8

Source: Health Quality & Safety Commission, QSM quarterly data, Sept 2016, Dec 2016, Mar 2017

4.1.2 Uptake of the checklist

The audits monitored whether the components that comprise each part of the checklist were reviewed by the surgical team. Uptake rates can be calculated by measuring the number of audits where all components of the checklist were reviewed against the total number of audits undertaken. Nationally, the rate of uptake for the Sign In part remained steady, at 92 percent in 2016_q3, 93 percent in 2016_q4 and 91 percent in 2017_q1, as Figure 8 shows. Uptake for Time Out was 93 percent in 2016_3, falling to 88 percent in 2016_q4 and returning to 93 percent in 2017_1. Uptake for Sign Out was at 92 percent for 2016_q3 and 2016_q4 with an increase to 95 percent in 2017_q1.

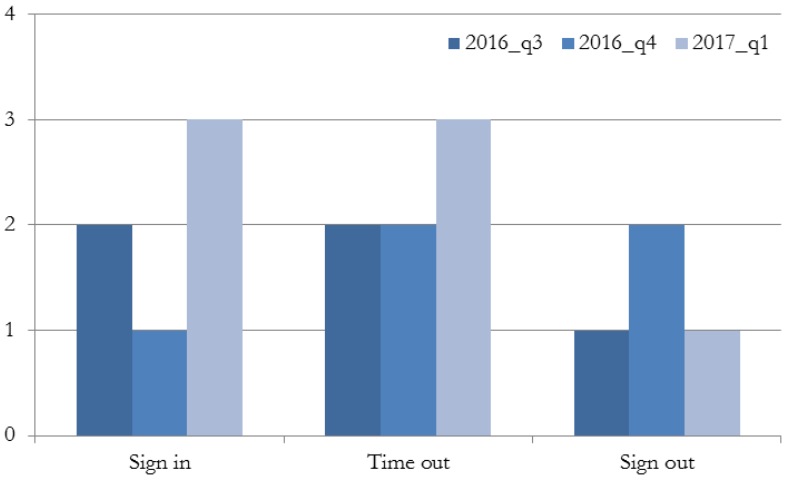
Figure 8: Checklist uptake rate for all observational audits carried out



Source: Health Quality & Safety Commission, QSM quarterly data, Sept 2016, Dec 2016, Mar 2017

The QSM has a target of all three parts of the checklist being used in 100 percent of surgical procedures. Few DHBs have been able to reach this target, as at 2017_q1. Figure 9 shows that three DHBs achieved 100 percent uptake for Sign In and Time Out in 2017_q1, a slight increase over prior quarters. One DHB achieved the target for the Sign Out part.

Figure 9: Number of DHBs achieving 100 percent uptake rate



Source: Health Quality & Safety Commission, QSM quarterly data, Sept 2016, Dec 2016, Mar 2017

Figure 10 shows the uptake rates for each DHB across the three quarters and for each part of the checklist. The uptake rates are only presented where at least 50 audits were carried out for a given part of the checklist. The highlighted cells show where a DHB achieved an uptake rate of 100 percent. In most other cases, DHBs at least reached an uptake rate of 80 percent.

- **Sign In** – three DHBs reached the uptake target in 2017_1, compared with one DHB in 2016_q4 and two DHBs in 2016_q3.
- **Time Out** – three DHBs reached the uptake target in 2017_1, compared with two DHBs in 2016_q4 and 2016_q3.
- **Sign Out** – one DHB reached the uptake target in 2017_1, compared with two DHBs in 2016_q4 and one DHB in 2016_q3.

Overall, three DHBs achieved the target of 100 percent uptake rate in at least one part of the checklist in 2016_q3. This figure increased to five DHBs for 2016_q4, before falling back to three DHBS for 2017_q1.

Figure 10: Checklist uptake rates for each DHB

	Sign in			Time out			Sign out		
	2016_q3	2016_q4	2017_q1	2016_q3	2016_q4	2017_q1	2016_q3	2016_q4	2017_q1
Auckland		98%	95%		90%	90%		98%	97%
Bay of Plenty	96%	98%		96%	95%			96%	
Canterbury	90%	93%	90%	93%	93%	85%	95%	100%	93%
Capital & Coast		91%	97%	88%	93%	99%		93%	98%
Counties Manukau	100%		100%			100%			97%
Hawke's Bay	83%	91%		85%	59%			71%	
Hutt Valley	98%			98%					
Lakes			100%			100%			
MidCentral	94%	96%	96%	90%	89%	94%	95%	100%	93%
Nelson Marlborough	81%	98%	84%	89%	96%	91%	91%	91%	85%
Northland			81%	88%		93%			
South Canterbury									
Southern	94%			94%	100%		90%		
Tairawhiti	100%		98%	100%		98%	100%		98%
Taranaki			46%			90%			
Waikato		79%	77%		77%	61%			
Wairarapa	96%	98%	96%	100%	100%	98%	98%	90%	
Waitemata	94%	100%	90%	93%	98%	93%	84%	98%	
West Coast			100%			100%			100%
Whanganui			68%		88%	81%			
Total DHBs meeting the target	2	1	3	2	2	3	1	2	1

Note: highlighted cells denote the target of 100% uptake has been reached; rates are only presented where at least 50 audits were undertaken for a checklist part.

Source: Health Quality & Safety Commission, QSM quarterly data, Sept 2016, Dec 2016, Mar 2017

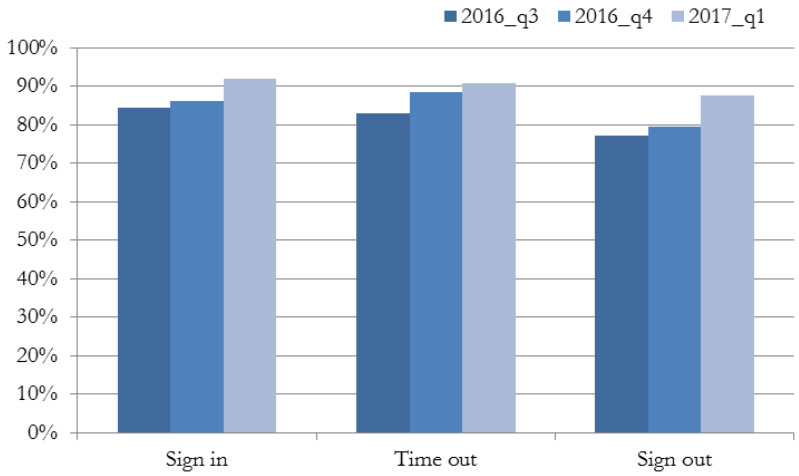
4.1.3 Engagement with the checklist

A rating on the level of surgical team engagement with the checklist is applied by the observer carrying out the audit. The ratings are applied using a seven-point Likert scale developed by the World Health Organization, with '1' being low and '7' being high engagement. A score of '1' represents poor engagement from the team while '7' means team engagement was excellent. The QSM target is that 95 percent of surgical procedures score engagement levels of five or above

Among all audits collected, the proportion of audits rated as having relatively higher engagement (i.e. a score of 5 or above) has increased over the three quarters for all three parts of the checklist. The increase is particularly noticeable in 2017_q1 relative to 2016_q4.

- **Sign In** – 84 percent of audits in 2016_q3 were rated at 5 or above, with the equivalent figure being 86 percent for 2016_4 and 92 percent for 2017_q1.
- **Time Out** – 83 percent of audits in 2016_q3 were rated at 5 or above, with the equivalent figure being 88 percent for 2016_4 and 91 percent for 2017_q1.
- **Sign Out** – 77 percent of audits in 2016_q3 were rated at 5 or above, with the equivalent figure being 79 percent for 2016_4 and 88 percent for 2017_q1.

Figure 11: Percentage of observational audits with engagement scores of 5 or more

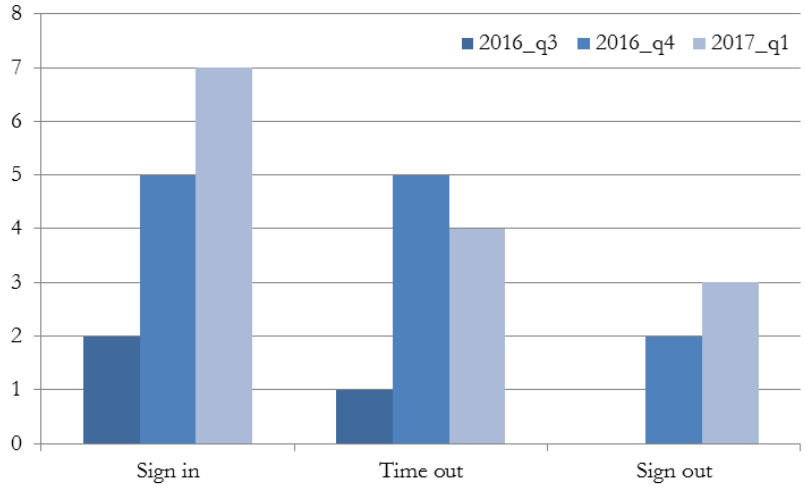


Source: Health Quality & Safety Commission, QSM quarterly data, Sept 2016, Dec 2016, Mar 2017

The number of DHBs reaching the target of 95 percent of audits with an engagement rating of 5 or more has increased for all three checklist parts between 2016_q3 and 2017_q1. However, there is still scope for improvement in the number of DHBs reaching this target.

- **Sign In** – seven DHBs reached the engagement target of 95 percent in 2017_1, an increase from two DHBs in 2016_q3.
- **Time Out** – four DHBs reached the engagement target in 2017_1, an increase from one DHB in 2016_q3, albeit a slight decrease from five DHBs in 2016_q4.
- **Sign Out** – three DHBs reached the engagement target in 2017_1, an increase from no DHBs reaching the target in 2016_q3.

Figure 12: Number of DHBs with engagement scores of 5 or more



Source: Health Quality & Safety Commission, QSM quarterly data, Sept 2016, Dec 2016, Mar 2017

Figure 13 shows the proportion of audits meeting with an engagement score of 5 or more, for each DHB across the three quarters. The results are presented where at least 50 audits were carried out for a given part of the checklist. DHB results that meet the target of 95 percent or more are shaded.

Among the DHBs that reached the uptake target of 100 percent for any part of the checklist in 2007_q1, the engagement target of 95 percent of scores being 5 or more was only met in one case (West Coast for Sign Out).

Figure 13: Percentage of audits with engagement scores of 5 or more, for each DHB

	2016_q3			2016_q4			2017_q1		
	sign in	time out	sign out	sign in	time out	sign out	sign in	time out	sign out
Auckland				98%	98%	98%	96%	83%	91%
Bay of Plenty	85%	76%		80%	95%	77%			
Canterbury	86%	72%	55%	89%	75%	72%	91%	79%	72%
Capital & Coast		69%		73%	90%	89%	91%	94%	97%
Counties Manukau	100%						98%	99%	95%
Hawke's Bay	88%	71%		100%	78%	56%			
Hutt Valley	98%	90%							
Lakes							80%	98%	
MidCentral	84%	76%	71%	98%	96%	90%	98%	90%	86%
Nelson Marlborough	55%	85%	71%	53%	82%	46%	57%	85%	65%
Northland		83%					86%	78%	
South Canterbury									
Southern	85%	88%	80%		94%				
Tairawhiti	86%	93%	80%				90%	92%	85%
Taranaki							96%	74%	
Waikato				98%	98%		98%	86%	
Wairarapa	90%	96%	94%	100%	100%	98%	100%	100%	
Waitemata	86%	87%	88%	87%	79%	93%	85%	92%	
West Coast							100%	100%	99%
Whanganui					86%		92%	88%	
Total DHBs reaching target	2	1	0	5	5	2	7	4	3

Source: Health Quality & Safety Commission, QSM quarterly data, Sept 2016, Dec 2016, Mar 2017

4.2 Teamwork and communication within surgical teams

Insights into the extent to which the checklist is making a positive impact on teamwork and communication among surgical theatre team can be gain from two sources:

- the Surgical Safety Culture Survey – delivered online to surgical theatre staff in 2015 and 2017 by an independent research provider on behalf of the Commission
- themes from our interviews with surgical team staff, conducted via telephone and in-person during our site visits to three DHBs.

4.2.1 Surgical Safety Culture Survey, 2015 and 2017

The Surgical Safety Culture Survey is a version of a survey developed by the Harvard School of Public Health, with modifications for language differences (used with permission).[17] There are four overarching dimensions deemed, by the Harvard researchers, to be of most interest in the surgical environment and more feasible to obtain:

1. Contextual (readiness)
2. Interpersonal (teamwork) including five factors of communication, coordination, respect, assertiveness, and clinical leadership
3. Practical (adherence), and
4. Consequential (other items).

Safe surgery champions within each DHB were requested to assist in disseminating the survey to all members of their surgical teams.[18] The analysis here focuses on the responses that were considered to have completed enough questions to be included in the data set – N=833 in the 2017 survey, an increase of 5 percent from N=843 in the 2015 survey.

Table 5 summarises the results of the 2015 and 2017 surveys, with further detail being available in the full report. The main findings include some improvement across most dimensions and factors between 2015 and 2017, in particular:

- **Interpersonal (teamwork)** – the average agreement score for this dimension increased from 70 to 76 percent (+6 percentage points), with notable increases in the factors of Communication (+10) and Coordination (+8)
- **Practical (adherence)** – an increase in the average agreement score for this dimension, from 62 to 71 percent (+9 percentage points).

[17] Singer, S. J., Jiang, W., Huang, L. C., Gibbons, L., Kiang, M. V., Edmondson, L., et al. (2015). Surgical Team Member Assessment of the Safety of Surgery Practice in 38 South Carolina Hospitals. *Medical Care and Research Review*, 298 - 323.

[18] Mobius Research and Strategy; *Surgical Culture Safety Survey DRAFT Research Report 2017*

Clinical Leadership, a factor within the Interpersonal (teamwork) dimension remains an area of relatively lower scoring, with the average agreement scores for this dimension being 63 percent in 2015 and 66 percent in 2017.

Table 5: Surgical Safety Culture Survey – summary results, 2015 and 2017

Survey dimensions/factors	Average agreement score 2015	Average agreement score 2017	Difference 2017 vs. 2015
1. Contextual (readiness)	71%	72%	+1
2. Interpersonal (teamwork):	70%	76%	+6
Factor 1: Communication	63%	73%	+10
Factor 2: Coordination	72%	80%	+8
Factor 3: Respect	74%	80%	+6
Factor 4: Assertiveness	76%	79%	+3
Factor 5: Clinical Leadership	63%	66%	+3
3. Practical (adherence)	62%	71%	+9
4. Consequential (other items)	81%	82%	+1

Notes: (1) the score for each dimension is an average of the agreement scores for sub-factors within each dimension; (2) 2015, N=843; 2017, N=883

Source: Mobius Research and Strategy; *Surgical Culture Safety Survey DRAFT Research Report 2017*

4.2.2 Themes from interviews with surgical team staff

Our findings from in-person interviews with theatre staff at DHBs are broadly consistent with the findings of the Surgical Safety Culture Surveys – i.e. some improvement in the implementation of the interventions (i.e. adherence), as have team communications.

- There was strong and consistent feedback that the briefing and the checklist did improve communication among the team members. Interviewees were more mixed as to whether that improvement is beneficial in improving actual teamwork.

  Most interviewees felt that the interventions have the potential to improve communication – when they are fully implemented. Only a few interviewees stated that they felt this was not the case.

- Only a few people spoken to had experienced a debriefing; one felt that it was more beneficial than first thought for creating teamwork, while another did not think so.

The most commonly stated issue – raised by nearly all interviewees – is the difficulty in getting everyone to stop doing other things, at all three parts of parts of the checklist. In particular, there were references to the timing of the Time Out being inconvenient for anaesthetists and the Sign Out being for the registrars or surgeons who were closing. Some interviewees responded that this perception will adjust as the culture shifts in terms of what is acceptable behaviour – potentially being reinforced by the observational audit process.

Eleven surgeons and anaesthetist were interviewed either at the DHB sites or at other opportunities. While many supported the Programme, some were still uncertain or concerned as to whether the interventions improve the ability of team members to speak up.

- Several noted the differences in team cultures between elective centres and theatres that deal with acute and elective cases. Rostering has an impact on this with elective theatres having a more stable team, and the difficulties of creating a team with continually changing rosters.
- In one case, a surgeon and anaesthetist set up a test to see if anyone would speak up when the surgeon called for the wrong side of the patient – but only the registrar did.
- One surgeon commented that he saw the benefit as mainly improving the communication of the surgeon to the team.
- The Time Out was seen as the most embedded part of the checklist, as there has not been much change from the prior process.

Nurse interviewees generally felt that the checklist had an impact on their ability to speak up and raise issues. Several also commented that it allowed participation by a wider range of colleagues, such as radiographers. Nurse interviewees generally pointed to the Sign Out was being 'the weakest link'.

A common theme among theatre staff interviewed was that the management wanted all of the interventions to be implemented while still pushing for on-time starts and throughput improvements. Some DHBs have attempted to address these issues through changing processes, e.g. getting nurses to start earlier to enable the briefing or starting the list later.

4.3 Improve surgical patient safety

Improved safety for surgical patients is the key intended benefit of the Programme. A comprehensive approach to measuring impacts would, ideally, involve a systematic process for reviewing outcomes (death and complications) from samples of patients before and after systematic use of the checklist, approximating that used by Haynes et al (2009) in their landmark research into the Surgical Safety Checklist.[19] Given the resource available for this evaluation, the approach here is to instead draw on a variety of data sources to build up a composite picture of patient safety outcomes, including:

- the two outcome QSMs for safe surgery monitored by the Commission – i.e. the postoperative sepsis rate and the deep-vein thrombosis/pulmonary embolism (DVT/PE) rate
- other selected adverse surgical events coded on discharge records – i.e. items accidentally left in the patient (retained surgical items) and inappropriate operations, and
- supplementary information, including the number of adverse surgical events reported to the Commission over time, published literature, and qualitative findings from interviews with participants.

[19] Haynes, et al. (2009)

4.3.1 Outcome markers – rates of DVT/PE and sepsis

The Commission monitors complications of surgery via two outcome-focused QSMs: the rates of sepsis and DVT/PE. These complications are believed to be sizeable areas of complication, readily identifiable from routine data sources and amenable to improvement.[20] The Commission has developed logistic regression models for these two outcome measures – to help to understand the factors driving these changes and to provide risk-adjusted outcomes to inform the monitoring and improvement of surgical quality and safety.[21]

The models are used to identify how likely patients being operated on were to develop sepsis or DVT/PE, given risk factors, such as their health and clinical conditions within 12 months prior to the procedure, information about the surgical procedure and patient demographic information (i.e. the independent variables). Based on those risk factors, a predicted probability of sepsis or DVT/PE is calculated for each room procedure (i.e. the dependent variables), which is then summed to give an expected number of sepsis or DVT/PE cases over time.

Figure 14 shows the observed and expected (modelled) numbers of cases of DVT/PE per quarter. The Commission's model finds a statistically significant decrease in the observed number of DVT/PE since the second quarter of 2014, despite there being an increasing number of high-risk patients and more complex surgical procedures being undertaken.

The observed and expected numbers of cases of sepsis per quarter are shown in Figure 15**.** In this case, the Commission's model indicates a statistically significant increase in the observed number of sepsis cases in 2016, even after adjusting for the increasing number of high-risk patients treated by hospitals and more complex surgical procedures undertaken.

These are the initial results of the Commission's modelling and further testing and publications are likely to be forthcoming. We include the results here for completeness, given that the consistent use of the checklist could reasonably be expected to have some impact on these outcomes – given that components of the checklist are aimed at reduce infections and blood clots. However, we note that there are open questions around causality, with respect to attributing impact from the Safe Surgery NZ Programme.

- The finding of there being fewer DVT/PE cases than expected since mid-2014 appears promising. Further investigation is needed to determine whether the checklist has had an impact, e.g. around the consistent of a plan for VTE prophylaxis being carried out.
- The finding of there being more sepsis cases than expected in 2016 is in the context of there being multiple Programmes aimed at preventing infections (e.g. hand hygiene, Surgical Site Infection, and the Safe Surgery NZ Programme). Further data points will help shed light on whether this increase is sustained; in which case, further research may be needed into the drivers of this increase.

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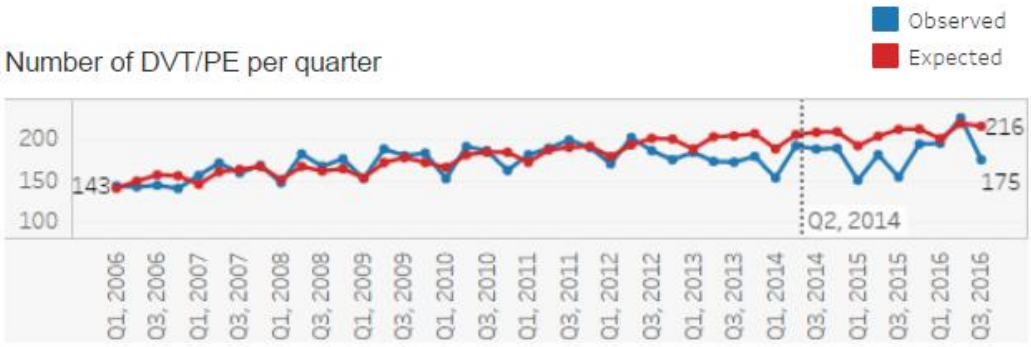
20 See http://www.hqsc.govt.nz/our-programmes/health-quality-evaluation/projects/quality-and-safety-markers/baselines/#[Perioperative]

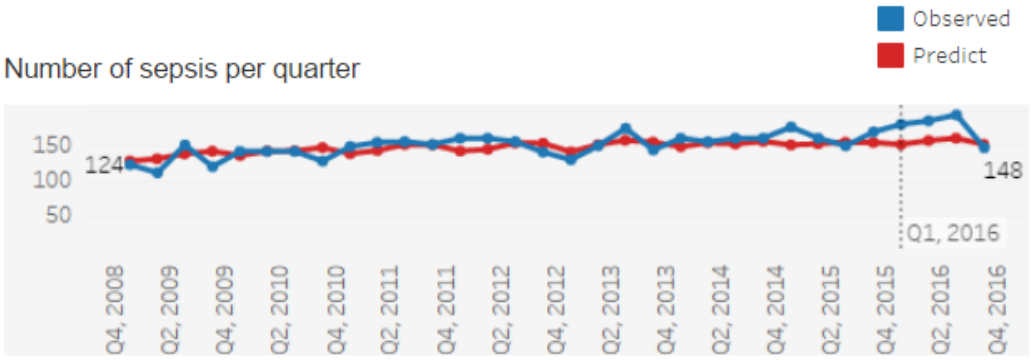
21 See: http://www.hqsc.govt.nz/our-programmes/health-quality-evaluation/projects/quality-and-safety-markers/qsms-october-december-2016/#[REFERENCES]

Figure 14: DVT/PE cases per quarter and expected results in the risk-adjusted model



Source: Health Quality & Safety Commission

Figure 15: Sepsis cases per quarter and expected results in the risk-adjusted model



Source: Health Quality & Safety Commission

4.3.2 Retained surgical items and inappropriate operations

We analysed adverse surgical events coded on discharge records contained in the National Minimum Dataset. The focus here is on two categories of adverse events that are relatively straightforward to identify – items accidentally left in the patient and inappropriate operations, such as a wrong procedure, site or patient. Relevant discharge records were identified using the presence of one of the following external-cause-of-injury codes:

- Y61.0 – *Foreign object accidentally left in body – during a surgical operation*, and
- Y65.5 – *Performance of inappropriate operation*.[22]

[22] Codes are ICD-10-AM 6th edition

Table 6 presents the results for this nine-year period from 2007/08 to 2015/16, with half-year results included for 2016/17 (i.e. July to December 2016). The results are also shown in Figure 16. The number of records with a code of Y61.0 (i.e. a foreign object accidentally left in body during a surgical operation) numbered at least 40 in each year with the exception of 2008/09, which had a low of 17 records. The highest number of records in a single year was 59, recorded in 2015/16.

Discharge records that included a coding of Y65.5 (i.e. the performance of an inappropriate operation) were far fewer in number, ranging from 0 in 2010/11 to 10 in 2014/15 and 8 records in 2015/16. This latter code covers a range of inappropriate operations – which can include a wrong procedure on the correct patient, a procedure on a patient not scheduled for surgery, or a procedure on the wrong side of a patient.

The fairly widespread incidence of these avoidable adverse events among DHBs suggests that the checklist is not yet being used to its full potential. In the two most recent years, 2014/15 and 2015/16, adverse events coded Y61.0 (foreign object accidentally left in body during a surgical operation) occurred at 17 out of 20 DHBs. The equivalent figure for events coded Y65.5 (performance of inappropriate operation) occurred at 11 out of 20 DHBs.

Table 6: Selected adverse surgical events in the NMDS, 2007/08 - 2015/16

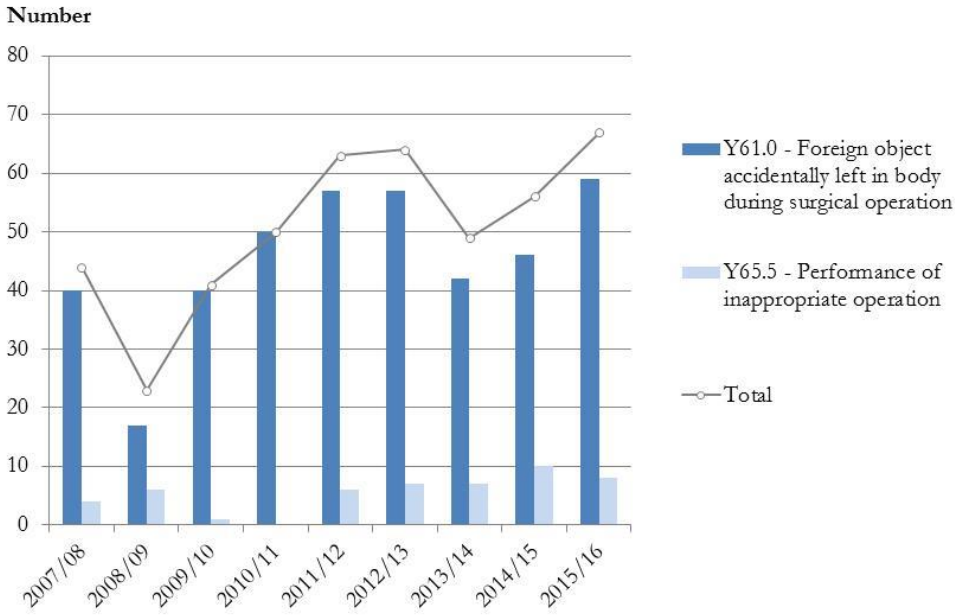
External cause of injury code & label	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17
Y61.0 - Foreign object accidentally left in body during surgical operation	40	17	40	50	57	57	42	46	59	24*
Y65.5 - Performance of inappropriate operation	4	6	1	0	6	7	7	10	8	2*
Total	**44**	**23**	**41**	**50**	**63**	**64**	**49**	**56**	**67**	**26***

*** Note** the results for 2016/17 are for July to December 2016 only and so represent half a year

Source: The National Minimum Dataset; extracted by the Health Quality & Safety Commission, September 2016 and April 2017 [23]

[23] Some figures are lower than reported in our 2012 cost benefit analysis on the Surgical Safety Checklist. This is because the NMDS is a live database and some recoding of records may have occurred after our analysis.

Figure 16: Selected adverse surgical events in the NMDS, 2007/08 - 2015/16



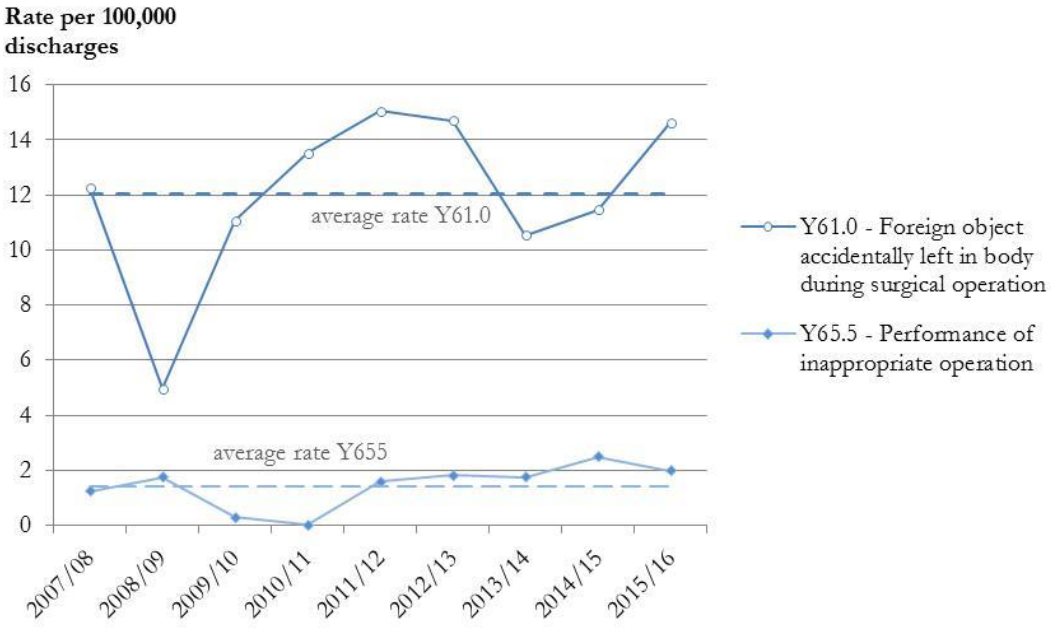
Source: The National Minimum Dataset; extracted by the Health Quality & Safety Commission, 28 September 2016

Converting these adverse events to a rate per 100,000 surgical discharges is a way to control for the increased volume of surgery over this period and to allow any broad trends over time to be better identified. Figure 17 presents the rates for the two external cause codes (Y61.0 and Y65.5) over time alongside the average rate for each code over the period from 2007/08 to 2015/16. The high-level finding is that since the checklist has been taken up – gradually since 2010/11 and with more focus under the Safe Surgery NZ Programme since 2014/15 – there has not been a sustained and material decrease in the rate of adverse surgical events.

- The rate of discharge records with a foreign object accidentally left in the patient (Y61.0) averaged 12.0 per 100,000 surgical discharges over from 2007/08 to 2015/16. The annual rate appeared to decrease from 15.0 in 2011/12 and 14.7 in 2012/13 to 10.5 in 2013/14 and 11.5 in 2014/15 – only to increase to 14.6 per 100,000 in 2015/16.
- The rate of records coded with an inappropriate operation (Y65.5) had an average rate of 1.4 per 100,000 surgical discharges over the period 2007/08 to 2015/16. The rate has been fairly stable over the last five years, ranging from 1.6 in 2011/12 to 2.5 in 2014/15 and 2.0 per 100,000 surgical discharges in 2015/16.
- The combined rate for these two codes varied between 6.7 in 2008/09 and 16.6 per 100,000 surgical discharges in 2011/12 and 2015/16. As a percentage, this combined rate is equivalent to between 0.01 and 0.02 percent of surgical discharges in this period.

This finding – the lack of a sustained and material decrease in the rate of adverse surgical events to date – does not exclude the possibility that use of the checklist to date has had a positive impact in other ways, such as reducing other types of errors (e.g. mislabelling of specimen labels) and avoiding issues with preparedness (e.g. the right equipment being unavailable). Further, it is possible that an impact will become visible over time – once the checklist is being systematically used and fully engaged with across all sites.

Figure 17: Rate of selected adverse surgical events in the NMDS, 2007/08 - 2015/16



Source: The National Minimum Dataset; extracted by the Health Quality & Safety Commission, 28 September 2016

4.3.3 Adverse surgical events reported to the Commission

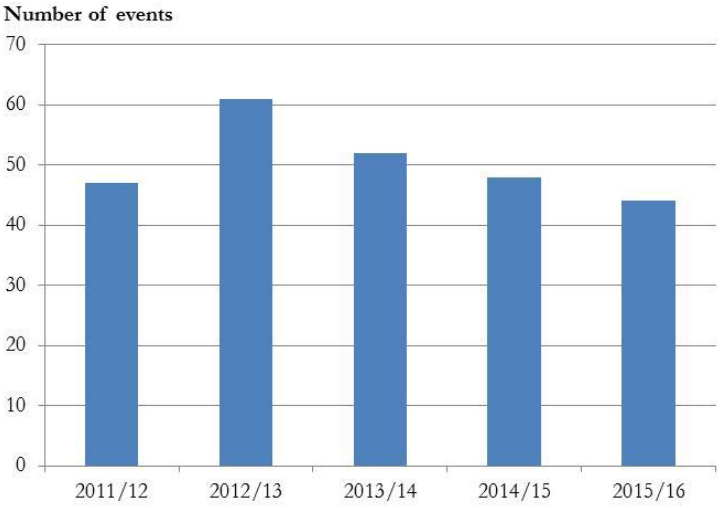
DHBs are required to review adverse events that have resulted in harm to patients and to report them to the Commission.[24] We were provided with an anonymised data set that summarised all adverse perioperative events reported to the Commission in the five years to 2015/16. Figure 18 shows the number of adverse perioperative events reported to the Commission has gradually declined from 61 in 2012/13 to 44 in 2015/16.[25] Some caution is required with respect to attributing this trend to the checklist or in comparing it with the above analysis of adverse events because at least three confounding issues are apparent.

- **Causality** – the Commission relies on DHBs to identify and report on events that could, or did, cause harm to a patient. Trends in reported events may be driven by changes in the culture around reporting as much as by the incidence of adverse events.
- **Amenability** – further analysis is required – beyond that possible here – to categorise the types of events included in the perioperative event data held by the Commission and the extent to which these may be avoided by systematic use of the checklist.
- **Comparability** – the NMDS-based analysis is focused on discharge records with codes relating to a retained item or an inappropriate operation whereas events reported to the Commission appear to reflect a wider set of adverse perioperative events.

[24] The national reportable event policy includes a standardised form, known as a reportable event brief, which is used as a basis for reporting events and advising the Commission of the outcome of the review. http://www.hqsc.govt.nz/our-programmes/adverse-events/serious-adverse-events-reports/

[25] Data was provided slightly prior to finalisation of data reconciliation for 2015/16 reporting.

Figure 18: Adverse events (perioperative) reported to the Commission



Source: Health Quality & Safety Commission

4.3.4 Other insights into patient safety outcomes

Further insights into the impacts of the Programme on patient safety can be gleaned from interviews with participants and a recently published study from Auckland Hospital. Our interviews with participants at eight DHBs identified examples where the use of the checklist had identified 'near misses' that would otherwise have occurred. These include

- consent form checks identified issues such as illegible writing and a surgeon planning for two procedures when patient consent had been agreed for only one procedure;
- the right equipment not being readily available, with the impacts including time delays in theatre and, in one case, a patient being anaesthetised for an hour longer than needed;
- identifying a patient needing INR monitoring ('International Normalized Ratio' – too high an INR puts an individual at risk for bleeding and too low at risk for clotting); and
- incorrect labelling of surgical specimens (the potential impacts are discussed below).

Recently published research by Martis et al (2016) found that improved compliance with the Sign Out stage of the checklist was associated with a statistically significant reduction in errors in the labelling of surgical specimens. The study was conducted at Auckland Hospital in 2014/15 to examine the impact of a new approach to the checklist that was more focused on engaging staff (i.e. forgoing paper checklists in favour of wall-mounted posters and giving responsibility for leading each stage to anaesthesia, surgery and nursing, respectively). The study found that the rate of specimen labelling errors more than halved in the six months following the intervention, from 3.99 to 1.58 errors per 1,000 specimens. The study noted this finding matters because such errors can have serious consequences in the provision of care, including "…the potential to delay, impede and/or misdirect management options".[26]

[26] Martis, W.R., J.A. Hannan, T. Lee, A.F. Merry and S.J. Mitchell (2016) *New Zealand Medial Journal*, 9 September 2016, Vol. 129, No. 1441

4.4 Summary of findings

All interventions being implemented – the focus here is on the QSM process measures where there is extensive data on the use of the three parts of the Surgical Safety Checklist and the levels of team engagement.

- Uptake of the checklist – while the average uptake for the three parts of the checklist has been stable at around 90 percent, only a few DHBs have been able to reach the target of all three parts of the checklist being used in 100 percent of surgical procedures. This shows there is material room for improvement for all checklist components to be followed – although the extent of this differs among DHBs.
- Team engagement – where the checklist has been completed, the level of engagement has been improving for the health system as a whole, with an increasing proportion of audits being rated at 5 or above (high engagement). However the number of DHBs reaching the target of 95 percent of high engagement remains low, with fewer than half attaining this target for any part of the checklist by the first quarter of 2017.
- The Sign Out stage appears slightly less likely to be observed and rated as part of the audit process, with a noticeably lower number of moments being submitted by DHBs. This is consistent with our interview findings that the Sign Out stage can be difficult for an auditor to observe because the timing of the end of a surgery is uncertain and / or the team is busy waking and transferring the patient and / or the team is dispersing.

Improving surgical safety for patients – the evidence on whether the use of the checklist under the Safe Surgery NZ Programme is resulting in safety benefits for patients is incomplete and somewhat mixed. There are some positive examples provided in participant interviews at DHBs that we have engaged with, although this evidence is not systematic.

- There have been fewer DVT/PE cases than expected since mid-2014. Further investigation is needed to determine whether the checklist has had an impact, e.g. around the consistent of a plan for VTE prophylaxis being carried out.
- There have been more sepsis cases than expected in 2016, despite the efforts of multiple Programmes aimed at preventing infections. Further data points will help shed light on whether this increase is sustained; in which case, further research may be needed into the drivers of this increase.
- Since the checklist has been taken up, there has not been a sustained and material decrease in the rate of the selected adverse surgical events of retained surgical items and inappropriate operations being carried out – although these numbers are not high.

This might be expected, given that the Programme is still to have its full impact – the room to improve in the measured level of staff engagement is evidence of this. In terms of **improving the teamwork and communication** – the findings from the surveys and interviews appear to be fairly consistent. While the interventions are being implemented and there have been improvements in adherence and communication, occurring there is still a way to go until they become embedded and embraced by all team members to the extent that it permanently shifts the culture of the operating theatres.

This finding does not exclude the possibility that the use of the checklist to date has had a positive impact in other ways that are not measured here, such as reducing other types of errors (e.g. the mislabelling of specimen labels) and avoiding glitches (e.g. the right equipment being unavailable in a timely manner).

5. Strategic fit of the Programme

The Safe Surgery NZ Programme has evolved along with the Commission since its inception in 2010. The Reducing Perioperative Harm programme was transferred from the previous Quality Improvement Committee when the Health Quality & Safety Commission was established. The health sector as a whole committed to the triple aim and so is an overarching strategic priority that the entire sector aligns to. However each component also has its own focus as well.

5.1 The health sector's triple aim

As part of its establishment the Commission consulted with the wider health and disability sector to understand what was already being done in the sector around quality improvement.[27] As a result of this the New Zealand Triple Aim was developed, based on the Institute of Healthcare Improvement's triple aim (see below)[28]. Both the Commission and the 20 DHBs have adopted the New Zealand triple aim as a strategic framework which guides efforts to common goals across the health sector to simultaneously achieve its three aims.

- Improved quality, safety and experience of care
- Improved health and equity for all populations
- Best value for public health system resources.

Figure 19: The New Zealand Triple Aim

Source: http://www.hqsc.govt.nz/news-and-events/news/126/

[27] http://mauriora.co.nz/wp-content/uploads/2015/03/Shuker1.pdf

[28] http://www.nzma.org.nz/journal/read-the-journal/all-issues/2010-2019/2015/vol-128-no-1408/6419

As explored in the previous sections ensuring that the interventions are used correctly for every operation in every DHB ensures an improved quality, safety and experience of care, ensuring equity and by reducing errors improving safety and reducing adverse events and readmissions. By aligning all programmes that the Commission implements to the triple aim it should also align to the DHB's priorities as they also committed to it.

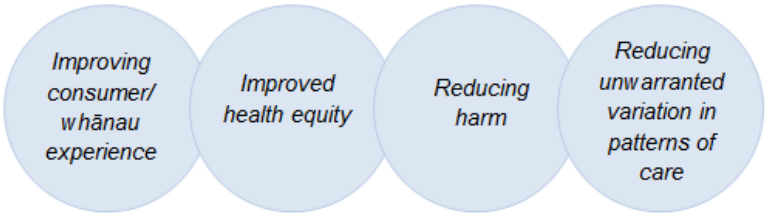
5.2 The Commission's strategic priorities

In the Commission's Statement of Intent 2014–2018 there were three strategic priorities articulated;

1. Identification of areas for quality and safety improvement
2. Advice and comment
3. Assistance to the sector to effect change

Improving equity was also noted to be an important focus for the Commission, and the plan included strategic activities and focus areas to support the strategic priorities. This has simplified over time and in the latest Statement of Intent is now proposed to focus on four strategic priorities; see Figure 20 below.

Figure 20: The Health Quality & Safety Commission strategic priorities 2017-2021



Source: Health Quality & Safety Commission (June 2017) DRAFT Statement of Intent 2017–2021. Wellington

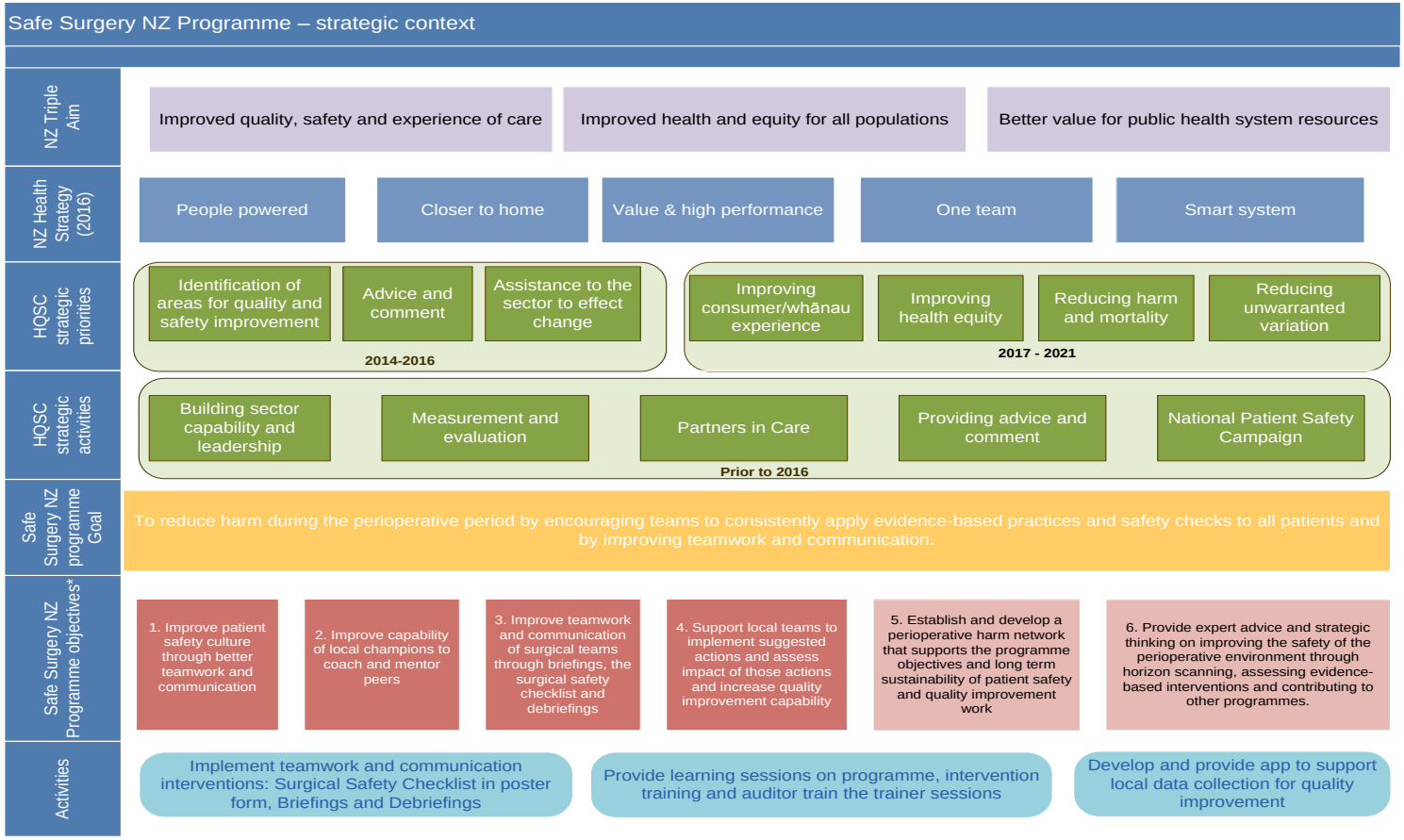
In Figure 21 overleaf we have produced an overview of how the strategic priorities across the Commission and the health sector fit together, and how the Programme activities support them. As the new strategic priorities have been agreed, and a new programme plan developed it will see a focus on 'improving consumer/whānau experience in the future' and consideration of how the Programme has potential to improve health equity. The current focus of the Programme is on reducing harm, and reducing unwarranted variation as has been explored in considering if the benefits of the Programme have been realised. It is worth considering whether the Commission requires strategic priorities over and above the New Zealand triple aim it helped the sector agree to. Its activities and how what it does translates to the priorities is important, however the triple aim does not include the consumer and whānau experience as a strategic priority. Increasingly DHBs are considering how they can have greater involvement of consumers in their programmes but this is only just starting to occur and is focused on more direct patient facing services. To that end consumer engagement has not been a priority as the patient is considered as a passive recipient. But as the process of the checklist shows the patient can be an important active participant in the process, confirming their identity and procedure in the Sign In.

"Harms caused by indignities and inequities in health care are just as preventable, and just as unacceptable, as wrong-site surgeries and medication errors."(Feeley, D. (2017, February 17). Six Resolutions to Reboot Patient Safety [Blog post])

Table 7: Overview of the Programme to previous Commission strategic priorities

Period	Strategic priorities	Programme contribution
2014-18	Identification of areas for quality and safety improvement	The initial identification of the potential for perioperative harm, and subsequently identifying issues within the old programme which was not delivering the desired change The QSM monitors areas for improvement at a DHB level
	Advice and comment	Internal Commission resources have been available to support DHBs in implementation including quality, project, nursing and medical leads
	Assistance to the sector to effect change	The programme was developed and resourced to ensure all DHBs had access to training, materials and support to deliver the programme
2017-21	Improving consumer/whānau experience	This has not been an area explicitly focused on for this programme by the DHBs or the Commission at this stage. Feedback has suggested that by gaining greater direct consumer input into the programme design may have helped shift resistance by surgeons. See further detail in the following section.
	Improved health equity	Equity although an area of importance it was not a focus for the evaluation, or the programme historically. In the future applying an equity lens to the outcomes data may help highlight areas for focus. Equally by increasing consumer and whānau engagement with a focus on Māori and Pacific populations could strengthen this area of the programme.
	Reducing harm	This has been the enduring focus of the programme - see the benefits realisation section for the outcomes of this.
	Reducing unwarranted variation in patterns of care	By continuing to progress the uptake and engagement with the interventions, and the means by which this is measured should support more consistent application and therefore reduce unwarranted variation.

Figure 21: Strategic overview of Safe Surgery NZ Programme



Source: Sapere developed from Commission provided documents

*Objectives 5-6 excluded from evaluation

5.3 New Zealand Health Strategy

The New Zealand Health Strategy was published in 2016 and at its core has five strategic themes:

- People powered
- Closer to home
- Value and high performance
- One team
- Smart system.

'People powered' and 'closer to home' are both consumer centric themes, while having a 'smart system', and 'value and high performance' aligns with the Commission's focus on reducing harm and unwarranted variation, and in turn is core to the Safe Surgery programme objectives. In the context of the Safe Surgery NZ Programme focus is on creating a single surgical team working for the patient which supports these themes as well. DHB priorities.

Most importantly the Programme must align to the priorities of the DHBs who deliver the majority of health care in New Zealand. As noted above aligning under the sector agreed triple aim means that at a foundation level the sector are agreed about the priorities, however there are many other drivers of DHB strategy. Each year DHBs must produce district annual plans that show how they are aligning to the New Zealand health strategy and how they plan to achieve national targets.

The national health target of 'improved access to elective surgery' is of most relevance to this Programme. While improving the safety of surgery would seem to be a fundamental principle that the whole sector can agree on, most of the resistance to the changes has cited a perception that the process slows down the surgical throughput. Throughout the course of the evaluation it has been evident that while most see the value in the Programme and interventions, that it is 'common sense' and a 'no brainer' there is still the operational push and pull of delivering increased volumes of surgery, improving on time starts and implementing the initiative. This was especially prevalent in the early site visits where briefings were being introduced. Some nurses commented that they had to do the briefings and drive it to happen, but then also got 'pulled up to the theatre manager' if surgery didn't start on time. However, in the final round of interviews most DHBs reported that despite initial resistance due to a perception that it would impact on start times and throughput, once the interventions were introduced and the processes amended to accommodate them there has been surprisingly little ongoing resistance.

Elective services patient flow indicators (ESPIs) are a new set of targets that are again focused on patient throughput, however they are cognisant of the patient experience of the system with six indicators focussing on the patient journey. It acknowledges the interlinking components of the system rather than just the churn of procedures. The Programme may in the long term improve patient flow as patients experience less complications and should not have to return to hospital and therefore potentially improving throughput.

5.4 Wider sector priorities

Harm caused by surgical intervention falls under the treatment injury category under the ACC and the other health, social and disability providers are also part of the system picture impacted on by the Programme.

The Safe Surgery NZ Programme also aligns to the RACS current work programme on bullying and harassment. It aims to improve workplace culture through mandatory training on what appropriate and inappropriate conduct is, and ensure that the correct behaviour is role modelled through to registrars with further training requirements.

5.5 Summary of findings

The Safe Surgery NZ Programme is a strategic fit for the Commission both from a historic point of view, and has the ability to do so into the future. Consumer engagement is a key area for future development, both for the Commission and for the DHBs and so opportunities to develop this in relation to the Programme should be further explored.

The Programme is also an important focus for the DHBs in terms of improving patient safety. There has to be strong managerial and clinical support to enable to staff to implement the interventions and to give them the time and resources to do so. Once fully embedded it can foster improved teamwork and communication, improve workplace culture and of most important improve patient safety.

By the programme strategically aligning through the Commission as quality lead, the DHBs as surgical team employers and the professional body it is creating the new culture of what is acceptable practice.

6. Value for money – prospective

Our assessment of the value for money of the Programme is based on the cost benefit analysis of the checklist produced for the Commission in 2012. That earlier work was necessarily prospective in nature as it focused on the potential gains if a programme were rolled out and if the checklist were fully adopted. As such, it drew on credible literature and local data to estimate the costs and benefits. The approach here is to update the model to reflect the actual costs incurred in delivering the Programme. In the absence of systematic evidence about Programme impacts we rely on the literature to model expected benefits.

6.1 Estimating the costs

The costs used in the earlier cost benefit analysis were a high-level estimate of the resources needed over ten years, based on published research adapted to the New Zealand context. This work can be updated by drawing on the emerging picture of the Programme costs incurred so far. Table 8 shows how the cost items in the analysis are allocated across a start-up phase of three years (Years 1-3) and an ongoing steady-state phase for Years 4-10.

- **Programme costs** – the annual budget set by the Commission (Years 1-3).
- **Start-up training** – the value of staff time spent participating in the Programme launch and intervention training (Year 1) and audit training (Years 1-3).
- **Site costs** – time from clinical champions and administrators during the start-up phase to promote and monitor checklist use within DHBs. These costs, estimated at $16,400 per year per DHB, are assumed to decrease by 25 percent from Year 4 as the Programme moves beyond the start-up phase and into business as usual.[29]
- **Per use costs** – additional prophylactic antibiotics used as a result of the checklist. [30]

Table 8: Programme costs estimated for the model

Cost element (nominal amounts)	Start-up phase Year 1	Start-up phase Years 2-3	Annual ongoing costs Years 4-10
Programme costs – Commission budget	$494,000	$410,000	-
Training – intervention, auditor training; launch	$253,000	$21,000	-
Site costs (i.e. 20 DHBs)	$329,000	$329,00	$246,000
Per use – additional prophylactic antibiotics	215,000	215,000	215,000
Total	**1,291,000**	**1,207,000**	**461,000**

[29] Costs adapted from Semel, et al. (2010)
[30] Ibid.

6.2 Estimating the benefits

In the absence of systematic evidence being captured about the benefits of the Programme, the model retains the approach of the earlier analysis. This involves drawing on literature and New Zealand data to model the potential benefits from systematic use of the checklist. The assumptions used in the earlier work are outlined below and summarised in Table 9.

- [A] *A rate of complications from surgery of 13.5 percent* – evidence suggests the rate of potentially avoidable complications from surgery likely lies between 10 and 15 percent. The figure used is from research at Auckland Hospital by Mitchell et al (2011).[31]
- [B] *A reduction in surgical complications of 28.1 percent* – this is the potential reduction in surgical complications from systematic use of the checklist. The figure is taken from the Auckland Hospital component of the multi-country study by Haynes et al (2009).[32] We prefer this New Zealand figure, noting the effect in De Vries et al (2011) was higher at 31.2 percent while the multi-country average in Haynes et al (2009) was 36.4 percent.[33]
- [C] *The average additional cost of a surgical complication being 17.3 percent* – the additional cost, on average, compared with an equivalent discharge without a complication. This figure was derived from the study by Jackson et al (2011) which looked at the marginal costs of hospital-acquired conditions in all inpatient discharges in Queensland and Victoria.[34]

The modelled annual benefit is therefore a function of annual surgical discharges multiplied by [A] the rate of complications and [B] the rate of reduction in complications (i.e. avoided). The monetary value is from [C] the marginal cost above the national case weight price.

The 2012 work assumed that some of the benefits were already being captured by ad hoc uptake of the checklist among DHBs. To account for this, the modelled annual benefits were discounted by 50 percent. This assumption is retained as the audit results point to theatre team engagement with the checklist as being relatively high in some DHBs while there is still some room to improve the level of engagement overall.

Table 9: Benefit assumptions included in the model

Assumption (nominal amounts)	Value	Source
Rate of complications from surgery	*13.5%*	Mitchell et al (2011), Auckland Hospital
Reduction achievable by the checklist	*-28.1%*	Mitchell et al (2011), Auckland Hospital
Average additional cost of a complication	*17.3%*	Jackson et al (2011)
Discount to recognise some current use	*50.0%*	assumption

31 Mitchell, S. et al (2011) "Potential Benefits of a Surgical Safety Checklist in a NZ Tertiary Hospital"

32 Haynes A.B. et al (2009) in *New England Journal of Medicine,* 29 January 2009

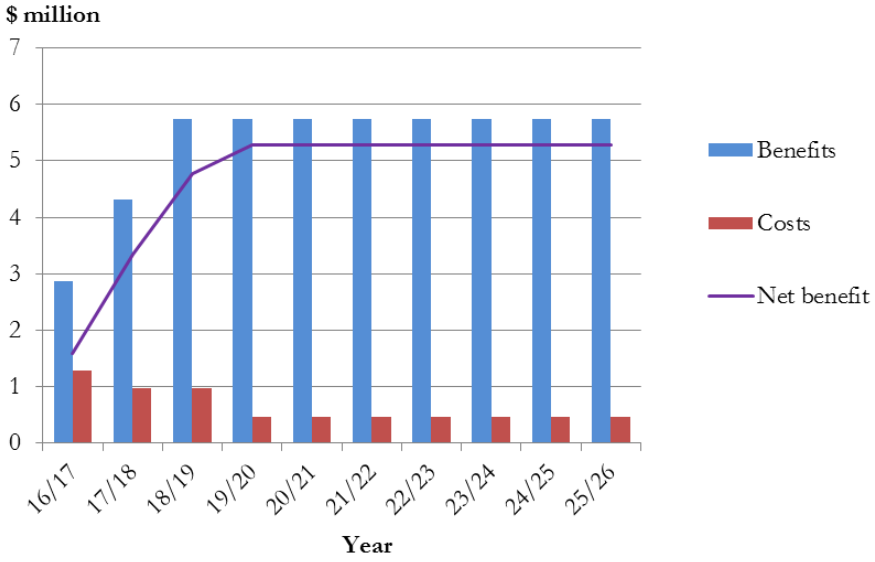
33 De Vries E.N. et al, (2010) in *New England Journal of Medicine*, 11 November 2010

34 Jackson T. et al (2011) in *Journal of Health Services Research and Policy,* Vol. 6 No. 13

6.3 Summary of results

Figure 22 shows the time profile of the costs, benefits and net benefit being modelled over ten years, from the current financial year of 2016/17. Our updated model suggests that the successful implementation of the Programme, that realises the potential benefits suggested by the literature, would mean a steady state net benefit of $5.3 million per year for the public health system.

Figure 22: Modelled programme costs, benefits and net benefit over 10 years



The key results from this updated cost benefit analysis are also shown in Table 10 and compared with the results obtained in 2012, prior to the launch of the Programme. Several points are worth stating here.

- **Costs** – the revised costs partly informed by Programme costs incurred to date, are modelled as being $5.8 million per year compared with the high-level ex-ante estimate of $2.0 million in the earlier work. These figures are on a present value basis. The main reason for this difference is that the national coordination costs, training costs and audit costs are all higher than was estimated in the earlier work.
- **Benefits** – in this base case scenario, the benefits are unchanged from those modelled in the earlier work –$45.0 million, on a present value basis.
- **Net benefit** – as a result of the incorporation of information about Programme costs, the revised model has a net benefit of $39.2 million – somewhat lower than the net benefit of $43.0 million obtained in 2012 (both figures are on a present value basis).
- **Benefit-cost ratio** – the ratio of benefits to costs is 7.8 which shows that the benefits to the health sector still would outweigh the costs significantly, being nearly eight times higher than the costs over a ten-year period (in present value terms).

We also developed a further scenario to test the sensitivity of the results to the speed of uptake of the checklist. The base case here assumed a gradual take-up over three years. Increasing the take-up phase to eight years, to reflect a scenario where the sector is slower to fully adopt the checklist, reduces the net benefit to $22.5 million with a benefit-cost ratio being 4.9. The key finding here is that after incorporating actual Programme costs and factoring in a potentially slower uptake across the sector, the results still point to the Programme having a material net benefit for the health sector.

Table 10: Key results – net benefit and benefit-cost ratio (2012 and 2016)

Measure (present value)	2012 CBA of the checklist (prospective)	2016 CBA scenarios for the Safe Surgery NZ Programme (prospective)	
Scenario	*base case*	*base case with updated costs*	*base case with updated costs, slower uptake*
Costs	$2.0 m	$5.8 m	$5.8 m
Benefits	$45.0 m	$45.0 m	$28.3 m
Net benefit	**$43.0 m**	**$39.2 m**	**$22.5 m**
Benefit-cost ratio	22.9	7.8	4.9

6.4 Limitations of this approach

This approach to considering the value for money of the Programme has several limitations that must be kept in mind when considering the results presented here.

- Firstly, these results are prospective, or forward-looking. As such, they represent what the Programme could reasonably be expected to achieve in future if successfully implemented, rather than what has been achieved to date.
- While the modelled benefits are based on credible literature, much of the research was conducted overseas in other health systems some years ago. This may limit the application to the New Zealand setting. A key limitation is the lack of data on the incidence of avoidable adverse surgical events across the New Zealand public health system. A further limitation is the lack of comprehensive data on the marginal cost of adverse surgical events in New Zealand.
- The modelling assumes that the Programme interventions will be fully taken up in time.

7. Sustainability of the Programme

The Safe Surgery NZ Programme was designed to run over three years from July 2015 to June 2018. At this point, two years into the Programme, it had been assumed that the programme would have been established within DHBs as business as usual. The initial plan as described in the 2015 – 2018 programme plan signalled the intention for the DHB regional quality and safety steering groups to support regional networks and the long term sustainability of the programme. There was also a proposal that at this juncture the programme would transition internally to the stewardship of the Perioperative Mortality Review Committee (POMRC). This would be for the governance of a much reduced team providing oversight and support for the remaining programme activities.

The programme roll out premise was 'to build capability within the sector through the quality improvement methodology, training and implementation of briefing, Surgical Safety Checklist, debriefing and four communication tools'.[35] At this juncture there is not a consistent picture of implementation of all the interventions.

7.1 Regional support

As a national programme with centrally reported measures, with data input form observational audits at the local DHB level., creating an intermediary layer at a regional layer would not seem to add any value. The majority of the DHBs felt that the programme did not create any new relationships between them, or promote regional collaboration. A few did comment that it gave an opportunity to improve relationships between public and private where they embraced the idea of using the same processes across the two.

The four regional patient safety networks are at different stages of maturity nationally having changed their name and focus in 2016. Part of this change of name is to reflect a more collegial than authoritative role, and the networks will look for opportunities for regional initiatives that will make a difference, which is not local or national. It is not intended to be another layer of bureaucracy but developing common projects where working regionally makes sense. The networks can also include different levels of contributors, for example the Northern Region is mainly clinical quality representatives from the DHBs and wider sector such as primary care. Therefore the regional approach may have added benefit if the programme was seeking wider engagement from primary or community care, potentially if involving greater consumer input. There could also be potential gains from including private representation at this regional level for local initiatives, as discussed throughout the report the relationships vary between DHBs and private facilities so this may create an opportunity to develop those relationships around a common theme: patient safety.

Therefore from a sustainability point of view the regional level can progress the concept of surgical patient safety from a regional view point, and in particular may be useful to support greater consumer involvement, particularly where there are tertiary providers within regions

[35] P.11 Health Quality & Safety Commission (2015)

to align messages and practices. However from a Programme oversight point of view there is little additional benefit to a regional approach.

7.2 National governance

The Mortality Review Committees were established under Section 59E the New Zealand Public Health and Disability Act 2000; which outlined a requirement for the Health Quality & Safety Commission to establish committees:

> *"to review and report to HQSC on specified classes of deaths of persons, or deaths of persons of specified classes, with a view to reducing the numbers of deaths of those classes or persons, and to continuous quality improvement through the promotion of ongoing quality assurance programmes".*

While the Safe Surgery NZ Programme could result in a reduction of adverse events and potentially deaths, it is not the primary objective of the Programme. As explored in the benefits realisation factor, there is not yet a sustained and material decrease in the rate of adverse surgical events. Further exploration by the Commission and the POMRC has concluded that it is not the right fit for the programme at this stage.

7.3 MORSim

As discussed throughout the report in parallel to the Safe Surgery NZ Programme, the MORSim programme was being developed by the University of Auckland. ACC agreed to fund the programme and national roll-out began in February 2017. The Programme will develop and enhance the key messages that were delivered to throughout the Safe Surgery NZ Programme and provide structured on site opportunities for multi-disciplinary training. As this is a long running programme it was cited as an opportunity for the sustainability of Safe Surgery NZ Programme through the continuation of aligned messages and practical application.

7.4 Programme extension

The Commission has extended the programme until 2020 supported by additional funds but with a scaled down team. This is reflective of the mixed status of implementation at this point in time. The QSM has been signalled as one of the key elements for the DHBs to sustain focus and momentum on the programme. It has also been signalled that there will be a process measure added to the QSM for briefing from 1 July 2017, which will just be to monitor compliance and whether the briefing was done. This supports the DHBs with progressing implementation, without creating an additional burden in terms of resource. However, if the auditor is going to be present for part of the briefing, for them to enter who led the briefing and whether the whole team were present would not create an additional burden, but would give a sense of the how it is being implemented. As long as whatever measures are recorded can be done in a snapshot and not require any ongoing attendance at the briefing. Otherwise it will be difficult to ascertain the value of the interventions based on the QSM, the QSM may be of value in increasing engagement in sign-out (with a focus on "ongoing VTE prophylaxis") and briefing/debriefing.

7.5 Summary of findings

The Programme is not yet sufficiently embedded to consider its transition to sustainability mode just yet. While as explored in the other chapters the paperless Surgical Safety Checklist has been implemented in all DHBs, for most it has not been in place a year yet. Other early adopter DHBs expressed it took at least a year to embed the changes fully. Two thirds of the DHBs have implemented briefings, and only a handful debriefings. There is at least another one to two years before it can be said that the interventions should be embedded across the 20 DHBs. Once these physical practices have been adopted, it is hoped that the culture change it requires will improve teamwork and communication, which should be reflected in the bi-annual surgical safety culture survey.

The QSM and bi-annual surgical safety culture survey will continue to monitor progress and provide periodic feedback to the DHBs. The observational audit provides an ongoing focus to ensure the interventions are implemented, and more importantly are being used appropriately and engaged with. The bi-annual surgical safety culture survey monitors the extent to which they have improved teamwork and communication in theatres.

The programme roll out premise was 'to build capability within the sector through the quality improvement methodology, training and implementation of briefing, Surgical Safety Checklist, debriefing and four communication tools'.[36] The Programme design was intended to give the tools and support to the DHBs, in particular theatre teams to implement the programme in a sustainable way.

As well as these tools at the operational level, conversations need to continue at the leadership levels so that the interventions are continued to be supported, and resourced. Other pressures on the DHBs such as elective surgery targets and the new elective patient flow put pressure on the finite resources in the surgical theatres.

[36] P.11 Health Quality & Safety Commission (2015)

8. Conclusions

The Safe Surgery NZ Programme has now reached the end of its second year. It has had a full first year of implementation rolling out training and support to the DHBs, and to a lesser extent to private facilities, where they have been included by their local DHB. At this point all of the DHBs have implemented the paperless checklist. However there are a couple of DHBs where there are variances as to how the checklist is implemented across multiple sites, and the leadership of the different stages of the checklist – which may not always be evident in the QSM results.

Briefings and debriefings are still variable across the DHBs. Briefings have been cited as one of the most beneficial interventions, setting the tone and culture for the day and all DHBs are planning to implement it if they have not already done so. Debriefings have not been a high priority for any to implement who are new to it, but those who do use it adapt to the needs of the day and find it useful. Essential to debriefing is the ability to action any issues raised and close the loop, or it will stop being used. This finding was repeated in the surgical safety culture survey where only 58 percent of equipment issues or other problems discussed in the post op debriefing were addressed in a timely manner. At this stage not all DHBs are planning to implement debriefings, and others are intending to leave it up to individual surgeons to adopt.

Therefore at this critical juncture of the Programme there is still some work to be done to ensure consistent application of the interventions across all sites for all specialities; for briefings and debriefings in particular, but also the paperless checklist to a lesser extent. During the course of this final report the Commission has decided to implement a new process measure to the QSM from 1 July 2017 which will require the auditors to confirm whether a briefing has occurred at the start of the list. The focus is on measuring compliance rather than any levels of engagement. While this is a useful tool to ensure DHBs continue to implement and develop the Programme locally, there is a risk that it could become a compliance exercise, as tended to be the case with the initial set of QSMs in 2012. There is potential to capture some additional information about the briefings in the new process measure which may help inform the nature of its use without creating too much additional burden. Or continual messaging and communications to the DHBs, as well as checking in through tools such as the surgical safety culture survey, will be vital to ensure it is resulting in improved teamwork and communication.

There are opportunities to further support the uptake of the interventions through DHBs surgical teams and associated specialities such as interventional cardiology and radiology which has started to pick up the work in some DHBs. There also is a willingness within private facilities to progress the implementation where this has not already occurred, including participating in observational audits and QSMs. The more that the interventions are embedded, becoming standard practice over multiple disciplines and settings, the greater the likelihood of their sustainability.

Consistent messaging to the whole sector will be an important factor for the continued development of the Programme and its sustainability. Professional bodies, DHBs, private facilities, and consumers must be aligned in their expectations of surgical practice, including safety checks and teamwork and communication. MORSim will have a visible presence in the DHBs over the next few years reinforcing those messages, influencing the current

workforce and culture. The ethos of the Programmes will need to be developed into other medical training programmes to inform and influence the future clinical workforce.

Learnings for other programmes

The Safe Surgery NZ programme was modelled on the outcomes of a proof of concept. The proof of concept approach allowed the Commission an opportunity to clarify the detail of the programme design (e.g. the choice of communication tools), but does not seem to have provided new insights to DHB participants. In fact it seems to have hindered the implementation in one of the participating DHBs. Adopting a collaborative model or undertaking some research at the local level to directly linking the interventions to improvements in outcomes may have been more useful in laying groundwork for the Programme roll out among DHBs. For example testing hypothesis around the reduction of specimen errors through the sign out, or testing other potential benefits.

The design of the Programme was intended to allow DHBs to progress with implementation at their own pace and to provide networks and leadership within cohorts. However, there were no mechanisms for cross-cohort communication from those at more advanced stages of implementation to support others, and the QSM has driven effort to focus on one of the three interventions.

In hindsight, the Programme could have been more focused in rolling out the interventions over multiple years, rather than all three interventions at once. Most DHBs generally took the opportunity to focus on the checklist and the observational audit process, as a resource intensive activity. The checklist QSM became the focus, although some DHBs have pushed forward with briefings and debriefings, depending on their starting point.

Some tools such as the shared workspace and webinars, introduced in the early stages of the Programme, are less useful now that more resources are accessible online. Adopting a variety of mediums to reach a wide audience going forward will help the sustainability of the Programme within theatres and related discipline such as interventional radiology and cardiology, as well as the private sector.

At the outset there was a view that the private sector was outside of the scope of a publicly funded programme, with the focus being on working through DHBs. However the volumes of surgery being undertaken in private settings and the shared workforce mean that the participation of private surgical facilities is vital if there is to be a permanent, system-wide shift in teamwork and communication. Effective engagement with the private sector would ideally begin at the programme planning stage.

Finally, the outcome measures from the Programme could possibly have been more embedded, so as demonstrate any gains to participants.

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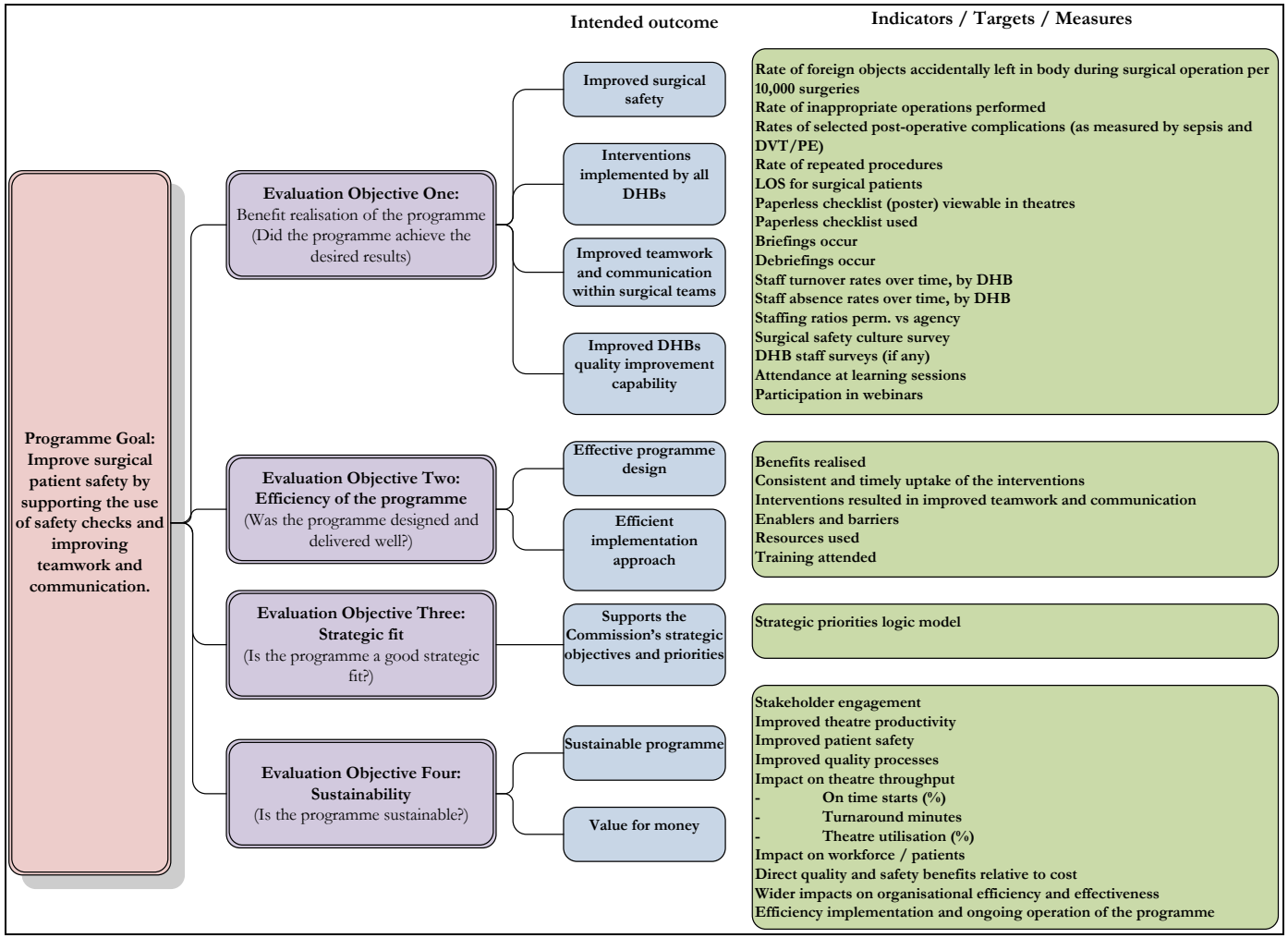
Appendix 1: Evaluation framework



The evaluation used a mixed methods approach which included qualitative research consisting of telephone interviews with each of the 20 DHBs at least once but the optimum was three interviews at planning, implementation and post auditing phases. Three site visits were also included in the fieldwork two visits to cohort one DHBs and one cohort two DHB. The site visits would have probably been better placed later in the evaluation to reflect on findings but the earlier input was used to formatively feedback on the programme. Interviewees included:

- 13 Surgeons
- 6 Anaesthetists
- 73 Nurses
- 7 Anaesthetist technicians
- 24 Managers, quality and project staff.

Evaluation objectives	Research questions – original from RFP
Efficiency of the programme	How well was the programme implemented by the Commission and the DHBs? Were the programme's supporting structures fit-for-purpose? Were the roll-out times achievable? How effective were the programme's training and learning sessions? Did project DHB teams receive the support they needed to implement the programme locally? What were the barriers and enablers to implementation at a local level? To what extent was the local programme implementation informed by consumer (patient) engagement? What was the extent of stakeholder engagement within the DHBs, for example, were senior DHB staff (e.g. Directors of Nursing, Chief Medical Officers) and internal governance groups (e.g. Board Hospital Advisory Committees) informed about the programme and its progress? What are the overall learnings from the programme which could add to the state of the evidence, or inform other quality improvement programmes? Did the programme result in any unintended consequences? What are the process recommendations to improve on future Commission-led quality improvement programmes?

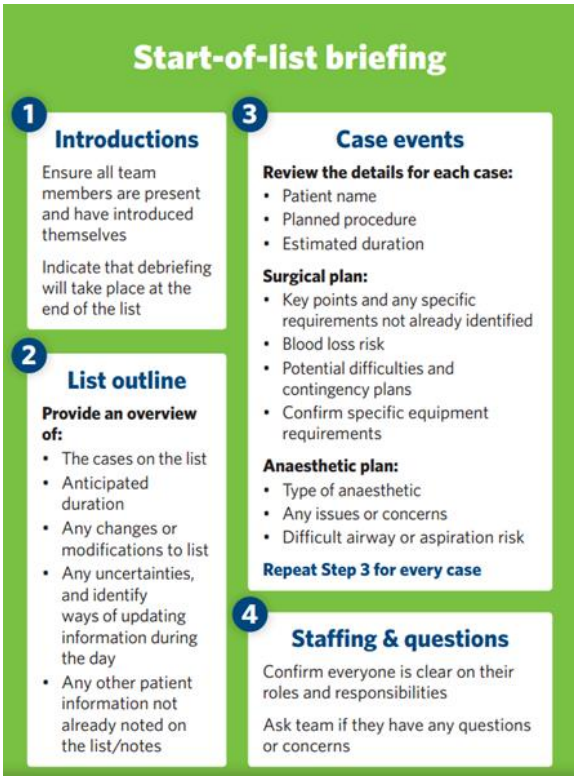
Evaluation objectives	Research questions – original from RFP
Benefits realisation	To what extent did the programme contribute towards reducing perioperative harm? To what extent did the programme contribute towards improvements in teamwork and communication among surgical teams? How well did the programme deliver on its key objectives (refer back to the programme plan) To what extent did the programme represent good value for money?
Strategic Fit	To what extent did the programme develop and deliver on the Commission's strategic priorities (consumer engagement; building leadership and capability for improvement; and measurement and evaluation)?
Sustainability	How sustainable is the programme likely to be over time? Are any networks that have been established by the programme well developed, useful and sustainable? What were the costs of the programme, both for the Commission and participating DHBs?

Appendix 2: Proof of concept

Table 11: Proof of concept recommendations and the Programme approach

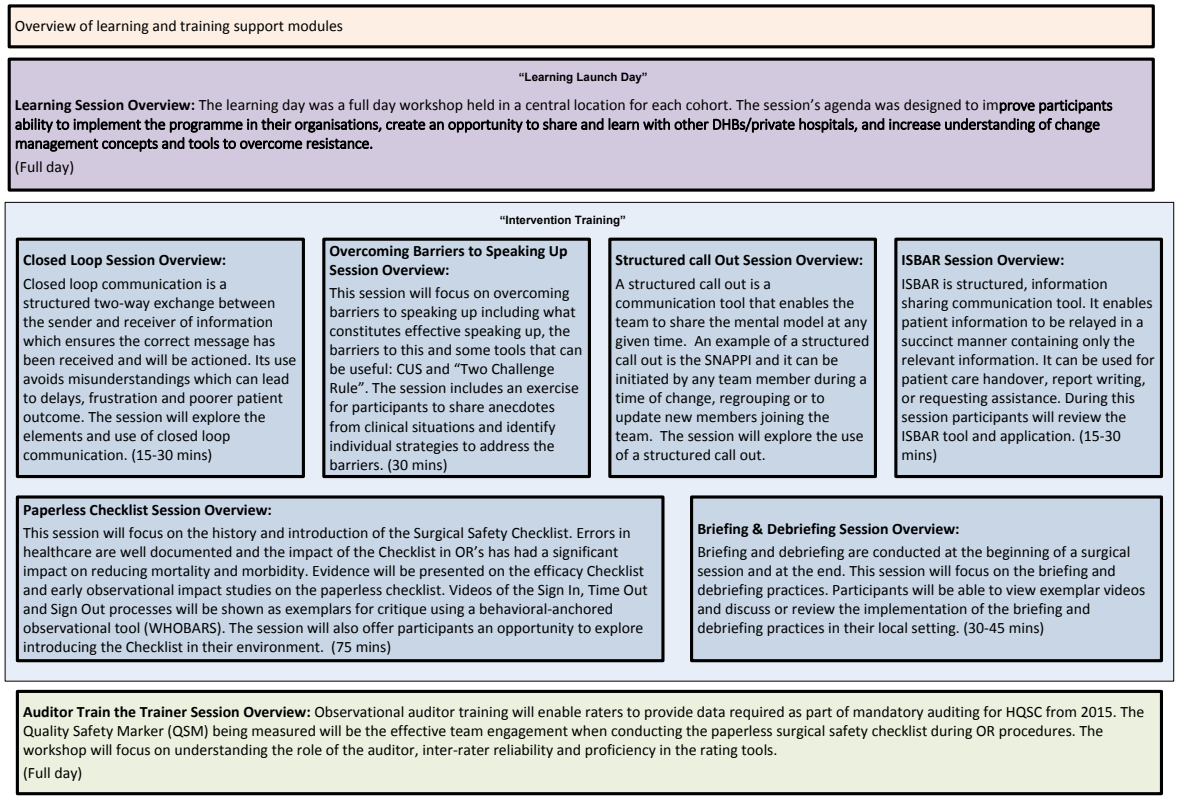
Proof of concept recommendations	Safe Surgery NZ Programme approach
I. Confirm the programme goal to improve teamwork and communication	The programme goal as articulated in early programme plans was to: "To reduce harm during the perioperative period by encouraging teams to consistently apply evidence-based practices and safety checks to all patients and by improving teamwork and communication."
III. Develop a robust 6 month mobilisation plan IV. Develop a 2 stage high level 18 month programme plan	The timeframe was agreed to be 12 months from preparation, to implementation and transition to business as usual, with a new QSM being established for July 2016
VI. Revise QSM VIII. Document technology requirements XIII-XV. Revise and document all agreed processes and guidelines for all interventions, tools, and measurement and reporting activity XVI. Prepare all training and knowledge transfer content	Supporting documents were produced such as evidence summaries and how to guides for implementation A reporting tool was developed QSM revised Surgical safety culture survey implemented
Allocate buddies to sites to enable peer to peer sharing	DHBs were split into three cohorts to be agreed with the DHB but to be cognisant of readiness, and intended to provide peer support within the cohort
Develop organisation specific deployment and project management approach Create change management and communications plan with each DHB	The project documentation was to be developed at a local level but shared between cohorts / nationally through a shared workspace

Appendix 3: The interventions



http://www.hqsc.govt.nz/our-programmes/safe-surgery-nz/publications-and-resources/publication/2565/

Appendix 4: Training modules and duration



Appendix 5: Surgical Safety Culture Survey

Below is an extract summary of the 2015 survey results which were summarised in the interim findings report, (p.25) for more detailed findings please refer to the original Mobius report from 2015.

Surgical Safety Culture

To assess the impact of the interventions behaviours and cultures of the workplace a number of studies have utilised surveys. Allard et al (2011) conducted a study over 4 years in the 2000's and found that there was a link between briefings and attitudes of safety, but also state that they needed to be accompanied by team-based patient safety education and changing incumbent attitudes.

Bohmer et al (2011) conducted a survey on staff attitudes to safety aspects of the perioperative period, work processes, and the quality of inter-professional communication. It found that many critical components covered by the checklist such as who the team members were and their roles, communication, patient's consent processes and removal of surgical items were all rated more positively three months after the checklist implementation.[37]

In 2015 the Commission undertook a surgical safety culture survey based on the Harvard University of Public Health to establish a baseline of surgical safety culture prior to the implementation of the Programme. An online survey was distributed to all DHBs via their safe surgery champions in 2015. Two DHBs did not participate in the survey and a total of 843 responses to the survey were included. The responses ranged from one to 169 responses per organisation.

The key findings were that there were issues with communication in New Zealand operating theatres, with over 30 percent stating that all team members did not share information when it was known, and that not all staff members ensured their comments or instructions were heard. However over 80 percent of respondents felt that:

- Plans for patient care are adapted as needed and surgeons and anaesthetist work together as a coordinated team
- Do not think that team members are unwilling to ask for help
- That they are encouraged to report patient safety concerns
- Decision making is shared between disciplines in response to issues that arise during operations.

It also gave a slightly different view of implementation than has been heard through the evaluation interviews such as half said briefings and debriefings were common practice. However nearly half of the respondents (48%) stated that these do not always discuss the operative plan before incision or that debriefs include key concerns for patient recovery or post-operative complications (47%). However 96 percent agreed that if they were having an operation they would want a surgical safety checklist to be used.

[37] Böhmer, A. B., Wappler, F., Tinschmann, T., Kindermann, P., Rixen, D., Bellendir, M. et al. (2012). The implementation of a perioperative checklist increases patients' perioperative safety and staff satisfaction. *Acta anaesthesiologica Scandinavica, 56*(3), 332-338.

Appendix 6: QSM engagement ratings

Stage	Low engagement (1)	High engagement (7)
Sign In	**Not supportive** Anaesthetist says something unsupportive like "how long is this going to take? I need to get on with some real work." **Not engaged** A key team member is absent from the room during Sign In (e.g. Anaesthetist). Anaesthetist and/or nurse continue doing their work, attempting to multi-task. Any person in the room conducting conversations, speaking on the phone, hooking up equipment and so on instead of concentrating on Sign in.	**Supportive** Anaesthetist says something supportive like "thank you, Jane (To checklist reader), could everyone pay attention please? This is important." **Engaged** All team members stop other activities and concentrate on the checklist. Surgeon, if present, participates at least by listening and by supportive body language. Patient, if not too sedated, has process explained and is invited to confirm key points.
Time Out	**Not supportive** Someone says something like "This is a waste of time." **Not engaged** Key members talk on the phone or to each other during time out. The surgeon says something like "Let's get on with the checklist," but then walks out of the room while it is being administered. Key members continue with preoperative tasks during the checklist, attempting to multi-task. The registrar occupies self with other activities instead of paying attention.	**Supportive** Surgeon or anaesthetist says something like "Thank you, Jane [to checklist reader]. Could everyone pay attention please? This is important." **Engaged** All team members stop other activities and concentrate on the checklist. Someone asks a question about something that he or she did not understand. Anaesthetist refers to patient chart to verify critical patient information as it is read out.
Sign Out	**Not engaged** Surgeon has already left theatre. Surgeon says "You guys take care of this" and walks out. Scrub nurse continues to tidy instruments and ignores process. Anaesthetist and/or nurse continue doing their work, attempting to multi-task.	**Supportive** The surgeon says something like "I am going to let the resident close. Would it be OK to do the sign out now and then I can go and see the next patient while the rest of you finish off?" **Engaged** All team members stop other activities and concentrate on the checklist. Scrub nurse stops all other activity and says something like "Are we all sure this patient's coags are okay? He still looks pretty wet to me." Anyone asks a question about some aspect of the patient's care.