



**Literature review on
interventions including
behavioural and human
factors approaches that
reduce the occurrence of
infection-related treatment
injury:
Health Care Acquired
Infections**

Prepared for:

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Chapter 1: Improving Hand Hygiene Compliance

EXECUTIVE SUMMARY

Objective of the Review

The objective of this review is to synthesise the evidence related to the effectiveness of interventions including behavioural and human factors approaches to reduce the occurrence of infection-related treatment injury. This aspect of the review focuses on interventions to improve hand hygiene compliance.

In order to review the evidence this review aims to answer the following research questions

- Which measures are most likely to improve Hand hygiene? What are the success stories?
- Which measures should be prioritised?
- Which measure don't work and why? Have lessons been learned that could make them work?

Whilst a formal critical appraisal was not required as part of this review, however aspects of study quality/External validity will be reported including

- a) Level of evidence – related to study design
- b) What bias needs to be considered within the study populations (e.g. gender, age, socioeconomic background, and severity of condition or complexity of injury / surgical procedure) that may have an impact on the outcome?
- c) Are the conditions and standards reported in the evidence relatable to the New Zealand health system?
- d) What was the comparison group and was the comparison model of care or treatment administered appropriately?
- e) How the outcomes measured and what were was the risk of bias?

Which measures are most likely to improve Hand hygiene? What are the success stories?

Hand hygiene compliance interventions can be presented as programs (involving a suite of interventions) or as individual interventions. The balance of the evidence from systematic reviews suggests that multimodal programs present the best effectiveness in improving Hand Hygiene (HH) compliance than individual interventions.

The following measures have been reported in the literature as being successful in improving HH compliance.

1. Education
2. Monitoring and Feedback
3. Promotion/Reminders of HH
4. Involving patients in the HH program
5. Facilitating access to hand sanitizers
6. Providing incentives/punishments for compliance /non compliance
7. Ensuring a consultative approach
8. Ensuring organizational and administrative support, and use of HH compliance as a key performance indicator.

Most multi-modal programs presented are based on the WHO multimodal hand hygiene improvement strategy, however studies using multimodal approaches not based on this strategy have also shown significant improvements. One Systematic Review reported that the

two bundles with most evidence of efficacy were:

- A) A bundle of measures based on the WHO multimodal hand hygiene improvement strategy, which comprised feedback, education, reminders, access to ABHR and administrative support, and
- B) A bundle that only included feedback, education and reminders.

Two stand-out documents from the Grey literature search which relate to the development of hand hygiene programs are published by the Infection Prevention and Control (IPAC) Canada (<http://www.publichealthontario.ca/en/eRepository/2010-12%20BP%20Hand%20Hygiene.pdf>) and the Public Health Agency Canada (http://publications.gc.ca/collections/collection_2012/aspc-phac/HP40-74-2012-eng.pdf)

As few studies have compared one intervention against another it is not possible, based on the literature reviewed to prioritise one measure over another. As most interventions use bundled approaches it is difficult to identify what measures in the programs worked and which didn't.

The evidence suggests that any intervention should be tailored for the specific ward/hospital involved as interventions do not work equally across different wards and professional groups. This would indicate that a consultative approach should be built into the development of any program where the specific needs of the organization and Health Care Workers (HCW) involved needs to be taken into consideration. Issues such as Motivational factors (social influences, acuity of patient care, perception of self-protection) and perceptions of the work environment (HCW perception of workload and resources, organizational culture) need to be taken into account when implementing a HH program

Factors that may affect the effectiveness of an intervention and that should be taken into account include

- Organisational culture
- Organisational structure
- Professional culture
- Environment

Which measures should be prioritised? Which measure don't work and why? Have lessons been learned that could make them work?



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Chapter 2: Ventilator Acquired Pneumonia

EXECUTIVE SUMMARY

Objective of the Review

The objective of this review is to synthesise the evidence related to the effectiveness of interventions including behavioural and human factors approaches to reduce the occurrence of infection-related treatment injury. This aspect of the review focuses on interventions to reduce the incidence of ventilator associated pneumonia (VAP).

In order to review the evidence this review aims to answer the following research questions

- Which measures are most likely to reduce VAP? What are the success stories?
- Which measures should be prioritised?
- Which measure don't work and why? Have lessons been learned that could make them work?

Whilst a formal critical appraisal was not required as part of this review, aspects of study quality/external validity will be reported including

- f) Level of evidence – related to study design
- g) What bias needs to be considered within the study populations (e.g. gender, age, socioeconomic background, and severity of condition or complexity of injury / surgical procedure) that may have an impact on the outcome?
- h) Are the conditions and standards reported in the evidence relatable to the New Zealand health system?
- i) What was the comparison group and was the comparison model of care or treatment administered appropriately?
- j) How the outcomes measured and what was the risk of bias?

Which measures are most likely to reduce the incidence of VAP? What are the success stories?

Most commonly, the prevention of VAP consists of an array of interventions grouped together to form a ventilator care/prevention bundle. The reviewed literature uncovered 41 separate interventions which were used in varying combinations to form each hospital's ventilator care bundle (VCB). Unfortunately, no study directly compared the effectiveness of one bundle over another nor was there any ability to analyse the implementation of the same VCB across different centres as each study included some interventions whilst excluded others.

However, of the 41 individual interventions, 11 were most commonly used in the VCBs. They were:

1. Head of bed at 30-45°
2. Oral care with Chlorhexidine (CHX)
3. Daily sedation break
4. Extubation assessment
5. Peptic/stress ulcer prophylaxis
6. Subglottic suctioning
7. Endotracheal cuff pressure 20-30cm H₂O
8. Deep vein thrombosis (DVT) prophylaxis
9. Strict hand hygiene
10. Oral hygiene assessment
11. Education

From the nineteen (19) systematic reviews, the following findings were reported:

- Subglottic drainage may reduce the risk of VAP by 50% (Frost et al, 2013).
 - However there was no significant difference in reduction in VAP between continuous subglottic suctioning and intermittent suctioning (Muscedere et al, 2011).
- Chlorhexidine used in oral hygiene appears to be effective in reducing VAP yet there is no consensus on its optimal concentration (Zhang, Tang and Fu 2014; Hillier et al., 2013; Hu et al., 2016 and El-Rabbany et al, 2015).
- Tooth brushing is widely supported as a prevention strategy, yet there is limited supporting evidence (El-Rabbany et al, 2015).
- Silver coated endotracheal tubes (ETTs) may reduce the incidence of VAP by up to 27% (Tokmaji et al, 2015).
- ETTs made from polyurethane should be used instead of polyvinyl chloride tubes as it is more flexible (Fitch and Whitman 2014).
- There was insufficient evidence to support the use of probiotics in reducing VAP (Gu, Wei and Yin 2012).

Appendix 1 details the various primary studies, the interventions they used and the reduction in VAP incidence post VCB. Given the lack of homogeneity between the primary evidence and the impact of the environment on the uptake of a VCB, it is suggested that the evidence is assessed in reference to specific ICU settings in New Zealand. However, the low level of evidence must be acknowledged and we caution the drawing of any concrete conclusions regarding the effect of one intervention over another.

The nature of a bundle of care makes it very difficult to isolate the benefit of one individual intervention over another. Apart from undertaking research using controlled trials to specifically identify beneficial interventions, it may be worthwhile to develop a standard VCB which can then be compared across divergent ICUs. Ethical and medical issues are likely to prevent the exclusion of certain interventions and as such, comparisons of VCBs is likely to be the most realistic future research option.

In addition, a recurring issue in the literature was the uncertainty regarding the uptake of the VCB by ICU staff. Evaluating the success of a VCB relied upon the authors having confidence that there was a high compliance level with the VCB. Factors which may have affected uptake were identified:

- Time poor and as such certain interventions (ie regular subglottic suctioning) were forgotten
- Undervaluation of the importance of certain interventions (ie tooth brushing)
- ICU staff forgetting to document when they provided an intervention (ie regular oral hygiene assessment)
- Cultural issues (organizational, structural and professional)
- Environment (ie ease of access to and use of intervention)

Most authors concluded that any VCB implemented needed an accurate, timely and easy to use method to record when each intervention had been given. Checklists at the end of the patient's bed and online tracking systems which alert nursing staff when an intervention was overdue were suggested as possible methods to counteract the issue of compliance.

**Which measures should be prioritised?
Which measures don't work and why?
Have lessons been learned that could make them work?**

Klompas et al (2014) in their clinical guidelines identified approaches that were not recommended for routine VAP prevention due to not impacting duration of ventilation, length of stay or mortality:

- Kinetic beds
- Prone positioning
- Stress ulcer prophylaxis
- Early tracheotomy
- Monitoring residual gastric volumes
- Early parenteral nutrition
- Closed endotracheal tube suctioning systems



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Chapter 3: Catheter Associated Urinary Tract Infections

EXECUTIVE SUMMARY

Objective of the
Review

The objective of this review is to synthesise the evidence related to the effectiveness of interventions including behavioural and human factors approaches to reduce the occurrence of infection-related treatment injury. This aspect of the review focuses on interventions to reduce the incidence of catheter associated urinary tract infection (CAUTI).

In order to review the evidence this review aims to answer the following research questions

- Which measures are most likely to reduce CAUTI? What are the success stories?
- Which measures should be prioritised?
- Which measure don't work and why? Have lessons been learned that could make them work?

Whilst a formal critical appraisal was not required as part of this review, aspects of study quality/external validity will be reported including:

- k) Level of evidence – related to study design
- l) What bias needs to be considered within the study populations (e.g. gender, age, socioeconomic background, and severity of condition or complexity of injury / surgical procedure) that may have an impact on the outcome?
- m) Are the conditions and standards reported in the evidence relatable to the New Zealand health system?
- n) What was the comparison group and was the comparison model of care or treatment administered appropriately?
- o) How the outcomes measured and what were the risk of bias?

Which measures are
most likely to reduce
the incidence of
CAUTI? What are the
success stories?

Given the nature of the bundle approach to reducing CAUTI it is difficult to identify, with a high level of confidence, specific interventions which are most likely to reduce its incidence. However, there are success stories which should be highlighted:

Nurse driven catheter removal protocol

- **Sheehan et al (2015)** developed a nurse driven protocol to promote the early removal of indwelling urinary catheters (IUCs) and chose to install this intervention independent of additional, new strategies. Over a 12 month period the use of IUCs had dropped by 12% and the incidence of CAUTI was down by 50%.
- **Bernard, Hunter and Moore (2012)** conducted a systematic review of nine (9) studies which also supported the use of a nurse driven protocol to reduce CAUTI.
- **Taylor et al (2016)** reported the 5th highest reduction in CAUTI (77%) of the studies included in this review and was only 1 of 2 studies which included a nurse driven protocol amongst other interventions.

Catheterisation process

- **Breiter et al (2016)** mandated a 2 person catheterization process for all patients who received an IUC when in the Emergency Department (ED). One person performed the technique whilst the other observed to ensure it was performed aseptically. If sterility was compromised the procedure was recommenced. Over a 6 month period 201 patients were catheterized in this manner and no patients developing a CAUTI during their admission.

Specific infection control practices

- **Colon Cabassa (2010)** was the only study to include silver coated catheters as a part of a CAUTI prevention bundle and reported a 76% reduction in CAUTI.

Which measures should be prioritised?

Four studies reported a 100% reduction in the incidence of CAUTI (**Houston et al. 2013; Mace et al. 2012; Sheridan et al. 2014 and Breiter et al. 2016**). Unfortunately there was no distinct relationship between each study which separated them from the less successful studies. This may reflect the low level of evidence (and subsequent rigour) associated with the evidence, as well as the effect of confounders such as interaction of the intervention with the environment (ward type, professionals involved).

Interestingly, none of the six studies with CAUTI reduction between 75-100% employed process surveillance (ie surveillance of how successfully the intervention was performed) and as such there was no feedback given to staff during the trial as to how well the intervention was being implemented. This may suggest that surveillance and feedback to staff may not be a priority in CAUTI prevention.

Eighty six percent (86%) of studies included some form of education and it was the most widely used intervention. It would appear that education is a cornerstone of CAUTI prevention and intuitively it makes sense to increase the knowledge of staff. However, what is unclear is what strategies of providing this education were most successful. Using the example of the top six highest reduction studies (75-100% reduction), five of them provided some form of general education. Only **Mace et al. (2012)** utilised a specific training method: 1 on 1 feedback. Other studies employed more examples of education such as, multi-disciplinary education sessions, online learning modules or employed a designated staff member to champion CAUTI prevention education. The general education used by the majority of higher reduction studies included information in staff rooms, discussion at staff meetings and reiteration of maintenance care practices pertinent to IUCs. The success in CAUTI reduction as demonstrated by those studies with standard, easy to implement education methods may suggest that this is all that is required to result in increased staff knowledge and in turn reduced CAUTIs.

Which measures don't work and why?

It is unclear what interventions are unsuccessful. Neither can it be said that the more interventions employed will lead to more success as there were numerous studies which employed the same type and number of interventions, yet did not result in higher levels of CAUTI reduction.

Below is an example of one specific intervention employed across multiple studies with its accompanying reduction in CAUTI. It demonstrates the difficulty in attributing one intervention as the cause of a specific CAUTI reduction.

Which measures should be prioritised?
Which measures don't work and why?
Have lessons been learned that could make them work?

1 on 1 staff education

- **Mace et al. (2012)** 100%
- **Andrioli et al. (2016)** 60%
- **Coddington et al. (2012)** 50%
- **Staubli et al. (2015)** 30%
- **Jerningan et al. (2013)** no significant change
- **Olsen Scribner et al. (2014)** no significant change

Multi-site hospital training

Sixteen (16) hospitals participated in a year-long collaborative education CAUTI prevention program. Across the hospitals there was on average a 21% increase in daily assessment of ongoing need for IUC, a 28% increase in number of staff who provided education to their peers and a 28% increase in the use of external catheters instead of ICDs. However, the rate of CAUTI remained constant throughout.

Chapter 4: Catheter Associated Blood Stream Infection



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EXECUTIVE SUMMARY

Objective of the Review

The objective of this review is to synthesise the evidence related to the effectiveness of interventions including behavioural and human factors approaches to reduce the occurrence of infection-related treatment injury. This aspect of the review focuses on interventions to reduce the incidence of catheter related blood stream infection (CRBSI).

In order to review the evidence this review aims to answer the following research questions

- Which measures are most likely to reduce CRBSI? What are the success stories?
- Which measures should be prioritised?
- Which measure don't work and why? Have lessons been learned that could make them work?

Whilst a formal critical appraisal was not required as part of this review, aspects of study quality/external validity will be reported including:

- p) Level of evidence – related to study design
- q) What bias needs to be considered within the study populations (e.g. gender, age, socioeconomic background, and severity of condition or complexity of injury / surgical procedure) that may have an impact on the outcome?
- r) Are the conditions and standards reported in the evidence relatable to the New Zealand health system?
- s) What was the comparison group and was the comparison model of care or treatment administered appropriately?
- t) How were the outcomes measured and what was the risk of bias?

Which measures are most likely to reduce the incidence of CRBSI? What are the success stories?

What are the success stories?

Eleven (11) primary research articles reported a 100% reduction in CRBSI (see Appendix 1a). Due to significant clinical heterogeneity there was no attempt to statistically pool the data but Appendix 1a presents the interventions commonly used in the studies with the greatest CRBSI reduction. This table indicates no obvious relationship between the number of prevention measures and 100% CRBSI reduction. For instance, Krishnareddy et al. (2012) employed eleven of the twelve interventions but still recorded the same reduction as Remington et al. (2015) which only used two listed strategies. The differences in bundles used and their effects, most likely highlights the variability in study design, population and other confounding factors which were not adjusted for in the studies.

Studies that only evaluated the effect of one intervention brought allow greater insight into the effectiveness of each intervention on reducing CRBSI incidence.

1. Reinforcement of hand hygiene practices alone (no other intervention was implemented) resulted in an 83% reduction in CRBSI (Johnson et al. 2013).
2. The Institute of Healthcare Improvement (IHI) CRBSI prevention bundle alone reduced CRBSI by 75% compared to baseline and with the addition of Chlorhexidine (CHX) impregnated dressings this reduction again improved by 6% to 81% (Chang et al. 2014).
3. Implementation of a dedicated central line maintenance kit completely eliminated CRBSI:

100% reduction (Drews et al. 2017).

4. In a paediatric population, an alcohol impregnated, disinfection cap was used to seal the catheter port when not in use. This intervention alone reduced CRBSI by 54.7% (Pavia and Painter 2012).
5. Cleaning all surfaces of the body with a 2% CHX solution or wipe reduced the rate of CRBSI by 43% compared to soap and water alone (Karki and Cheng 2012).

Appendix 1c presents the studies that used all five elements of the IHI prevention bundle (i.e. 1: proper hand hygiene before contact with a blood catheter, 2: maximal barrier precautions upon catheter insertion, 3: CHX skin antiseptics, 4: optimal catheter site selection and 5: daily review of line necessity with prompt removal of unnecessary central lines) and suggests a trend. The table suggests that the use of a checklist to ensure adherence to the IHI bundle with accompanying education of CRBSI prevention strategies, were more commonly associated with higher reductions in CRBSI. The differences in the study restrict direct comparability, but the evidence suggests that the implementation of a checklist and providing education may result in consistently higher CRBSI reduction when paired with the IHI bundle.

Which measures should be prioritised?

Based on trends observed in the data tables and total CRBSI reduction rates, the following measures should be prioritised.

- Hand hygiene education (Johnson et al. 2013)
- The IHI CRBSI prevention bundle (Chang et al. 2014)
- Checklists to monitor compliance with prevention measures

Which measures don't work and why?

- Taking probiotics prophylactically, does not reduce the incidence of CRBSI (Gu, Chun-Yin, and Yin 2012)
- There is no statistical difference in the incidence of CRBSI if Chlorhexidine–silver sulfadiazine (C-SS) catheters are used instead of standard, non-coated catheters (Cherry-Bukowiec et al. 2011).

Have lessons been learned that could make them work?

Apart from some of the study limitations listed above, no study reported specific measures they could do differently to produce a more favourable reduction in CRBSI. Better designed and controlled studies are needed to identify which aspects of prevention bundles are most effective. Further research could be aimed at comparing near identical bundles that only differ on one measure, which would allow for a more accurate picture of what does and what does not work. Large, multi-centre trials are needed to allow for generalisability of results.

From the grey literature the Agency for Healthcare Research and Quality presented a report in 2015 from a national patient safety project into eliminating CLABSI. They reported 5 key lessons learnt from the process.

1. Have Well-Defined, Evidence-Based Interventions
2. Build a Solid Implementation Structure and Project Plan
3. Collect and Use Timely, Accurate, and Actionable Data to Improve Performance

**Which measures should be prioritised?
Which measures don't work and why?
Have lessons been learned that could make them work?**



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Chapter 5: Surgical Site Infections

EXECUTIVE SUMMARY

Objective of the Review

The objective of this review is to synthesise the evidence related to the effectiveness of interventions including behavioural and human factors approaches to reduce the occurrence of infection-related treatment injury. This aspect of the review focuses on interventions to reduce the incidence of surgical site infections (SSIs).

In order to review the evidence this review aims to answer the following research questions

- Which measures are most likely to reduce SSIs? What are the success stories?
- Which measures should be prioritised?
- Which measure don't work and why? Have lessons been learned that could make them work?

Whilst a formal critical appraisal was not required as part of this review, aspects of study quality/external validity will be reported including:

- u) Level of evidence – related to study design
- v) What bias needs to be considered within the study populations (e.g. gender, age, socioeconomic background, and severity of condition or complexity of injury / surgical procedure) that may have an impact on the outcome?
- w) Are the conditions and standards reported in the evidence relatable to the New Zealand health system?
- x) What was the comparison group and was the comparison model of care or treatment administered appropriately?
- y) How were the outcomes measured and what was the risk of bias?

Which measures are most likely to reduce the incidence of SSIs? What are the success stories?

What are the success stories?

Of the included studies (N=50), three studies reported a 100% reduction in SSI incidence. However, the implementation of various prevention measures simultaneously, prevents the ability to quantify the effect of one intervention over another.

- **Fornwalt, Ennis and Stibich (2016)** implemented a bundle of care in a total hip or knee arthroplasty population over a twelve month period and completely eliminated their reported incidence of SSI. During the twelve months prior to the intervention, there were seven recorded SSIs from 544 surgical procedures, compared to zero SSIs out of 585 procedures during the study period.
- **Hennessey and Kiernan (2012)** conducted a four year, prospective study which implemented a SSI prevention bundle of care. By the end of the fourth year of the study, SSI incidence was zero and this 100% reduction was maintained for 12 months post study.
- **Andrews, Sutton and Grayson (2014)** reported a 100% reduction in SSI incidence in a caesarean section population over a 12 month period. Increased compliance with an existing bundle of prevention strategies was applied during the study period.
- **Hsu, Cohn and Caban (2016)** implemented a SSI prevention bundle in a caesarean section

population over a six year period. A total of 3,334 caesarean deliveries were performed. SSI incidence post caesarean was 6.2% at baseline, and 0.1% at the end of the study period, which represented a 98.4% reduction in the total incidence of SSI.

Which measures should be prioritised?

Unfortunately, none of the success stories provided insight as to the effectiveness of specific interventions and as such it is difficult to recommend certain strategies. Likewise, no study implemented the same bundle, nor were there any strategies implemented across all highly successful studies. Appendix 1, depicts in table form, the separate interventions employed by the various studies as well as the study's accompanying reduction in SSI. As the table indicates the most commonly included intervention strategies were preoperative bathing with an antiseptic and the use of disinfectant as a surgical site preparation.

Which measures don't work and why?

A few studies assessed only one intervention and recorded its effect on SSI incidence. These studies provided insight into measures which do not work.

- **Toon et al. (2015)** conducted a Cochrane SR (involving 1 study (Heal 2006)) into the effect of timing of postoperative shower and SSI incidence. There was no difference in rate of SSIs if patients showered 12 hours after their minor skin operation, or left the dressing on for 48 hours post-operation before bathing.
- **Xu et al. (2015)** showed that routine, preoperative prophylactic antibiotics did not reduce the incidence of SSI in low-risk, open reduction internal fixation, orthopaedic patients.
- **Güngördük et al. (2010)** found no statistically significant difference in the rate of SSI for caesarean section wounds washed with saline prior to closure, compared to those that were not washed.
- **Anthony et al. (2011)** implemented a bundle of prevention measures in a colorectal surgical population via a randomized controlled trial (RCT), and found that the incidence of SSI remained unchanged over the 3 year study period. Compared to the bundles of care administered by the other colorectal surgical studies (see Table 3), Anthony et al. (2011) was the only study not to administer preoperative antibiotics and was the only study to perform the surgery transabdominal, rather than laparoscopically.

Have lessons been learned that could make them work?

Most studies acknowledged the limitations of bundled interventions and recommended future RCTs of bundles which differed by only one aspect, so as to adhere to ethical standards and also provide empirical evidence on intervention effectiveness. Andrews, Sutton and Grayson (2014) identified the need for hospital leadership to support an intervention, where likewise Harris and Hickson (2012) acknowledged the crucial need of patient involvement in preventing SSI.

Which measures should be prioritised?
Which measures don't work and why?
Have lessons been learned that could make them work?

Grey Literature

Search of the grey literature revealed a number of SSI prevention guidelines that have been developed by governments or health care associations. The following guidelines provide the most practical recommendations and have a strong evidence base:

- World Health Organisation 2016: Global guidelines for the prevention of surgical site infection
- National Health and Medical Research Council 2010: Australian Guidelines for the Prevention of infection in Healthcare
- Canadian Patient Safety Institute 2014: Surgical Site Infection (SSI)
- SA Health, Government of South Australia 2017: Surgical Antimicrobial Prophylaxis Clinical Guideline
- Scottish Intercollegiate Guidelines Network 2014: Antibiotic prophylaxis in surgery



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Chapter 6: Multi Drug Resistant Organisms

EXECUTIVE SUMMARY

Objective of the Review

The objective of this review is to synthesise the evidence related to the effectiveness of interventions including behavioural and human factors approaches to reduce the occurrence of infection-related treatment injury. This aspect of the review focuses on interventions to reduce the incidence of multi drug resistant organisms (MDROs).

In order to review the evidence this review aims to answer the following research questions

- Which measures are most likely to reduce MDROs? What are the success stories?
- Which measures should be prioritised?
- Which measure don't work and why? Have lessons been learned that could make them work?

Whilst a formal critical appraisal was not required as part of this review, aspects of study quality/external validity will be reported including:

- z) Level of evidence – related to study design
- aa) What bias needs to be considered within the study populations (e.g. gender, age, socioeconomic background, and severity of condition or complexity of injury / surgical procedure) that may have an impact on the outcome?
- bb) Are the conditions and standards reported in the evidence relatable to the New Zealand health system?
- cc) What was the comparison group and was the comparison model of care or treatment administered appropriately?
- dd) How were the outcomes measured and what was the risk of bias?

Which measures are most likely to reduce the incidence of MDRO infections? What are the success stories?

What are the success stories?

Whilst most studies involved a bundle of interventions, those studies which investigated a single intervention, often gave a clearer picture of effectiveness of specific strategies. The following studies reported successful outcomes:

- Chlorhexidine (CHX) antiseptic protocol to disinfect surfaces and decrease bioburden on the patient's skin reduced MRSA transmission by 70% (Batra et al. 2010).
- A twice daily CHX surface clean, twice daily CHX patient bathing cleanse and four times daily oral hygiene with CHX decreased MDRO transmission rates by 84% within 6 months. This further decreased to 94% at 12 month follow up (Apisarnthanarak et al. 2014).
- Face to face education for patients colonised with MRSA reduced its transmission by 75% (Bailey et al. 2012).

Which measures should be prioritised?
Which measures don't work and why? Have lessons been learned that could make them work?

Which measures should be prioritised?

Two studies (Batra et al. 2010 and Apisarnthanarak et al. 2014) found strongly in favour for the use of CHX as a surface disinfectant to reduce MDRO transmission and it should therefore be strongly considered.

Which measures don't work and why?

Contact precautions (gloves and gowns) were shown to be ineffective in reducing the transmission of MDROs in multiple studies (Bessesen et al. 2013; Bryce et al. 2015 and Kullar et al. 2016) and their omission may offer a significant cost saving, without significantly increasing the risk.

Have lessons been learned that could make them work?

No study referred to improvements that could be made to their specific prevention bundle nor identified aspects of any bundle's implementation which could be improved. McMicken (2017) was the only study to report a strong adverse effect in the form of an extended hospital stay and deteriorated patient condition related to isolation, and concluded that isolation to try to prevent the transmission of MRSA jeopardised the welfare of a psychiatrically ill patient.

Grey Literature

From the grey literature a number of guidelines have been developed and published by Government authorities presenting comprehensive guidelines on the implementation of preventative programs for MDROs;

- World health Organisation 2017: Guidelines for the prevention and control of carbapenem-resistant Enterobacteriaceae, Acinetobacter baumannii and Pseudomonas aeruginosa in health care facilities
<http://apps.who.int/iris/bitstream/handle/10665/259462/9789241550178-eng.pdf;jsessionid=D086CBA35BEEC6590A5CB0B52988238D?sequence=1>
- Agency for Healthcare Research and Quality 2014: Carbapenem-Resistant Enterobacteriaceae (CRE) Control and Prevention Toolkit 2014
<https://www.ahrq.gov/professionals/quality-patient-safety/patient-safety-resources/resources/cretoolkit/index.html>
- CDC 2006: Management of Multidrug-Resistant Organisms In Healthcare Settings
<https://www.cdc.gov/mrsa/pdf/mdroGuideline2006.pdf>
- SA Health 2017: Multi-resistant Gram-negative micro-organisms (MRGN): Infection prevention and control Clinical Guideline 2017
<https://www.sahealth.sa.gov.au/wps/wcm/connect/708ee2004d51df0784f3ff4c56539eed/>
- JBI 2017: The infection control management of MRSA in acute care
https://journals.lww.com/jbisir/Abstract/2008/06020/The_infection_control_management_of_MRSA_in_acute.1.aspx



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Chapter 7: Clostridium difficile

EXECUTIVE SUMMARY

Objective of the Review

The objective of this review is to synthesise the evidence related to the effectiveness of interventions including behavioural and human factors approaches to reduce the occurrence of infection-related treatment injury. This aspect of the review focuses on interventions to reduce the incidence of clostridium difficile infection (CDI).

In order to review the evidence this review aims to answer the following research questions

- Which measures are most likely to reduce CDIs? What are the success stories?
- Which measures should be prioritised?
- Which measure don't work and why? Have lessons been learned that could make them work?

Whilst a formal critical appraisal was not required as part of this review, aspects of study quality/external validity will be reported including:

- ee) Level of evidence – related to study design
- ff) What bias needs to be considered within the study populations (e.g. gender, age, socioeconomic background, and severity of condition or complexity of injury / surgical procedure) that may have an impact on the outcome?
- gg) Are the conditions and standards reported in the evidence relatable to the New Zealand health system?
- hh) What was the comparison group and was the comparison model of care or treatment administered appropriately?
- ii) How were the outcomes measured and what was the risk of bias?

Which measures are most likely to reduce the incidence of CDIs? What are the success stories?

What are the success stories?

Out of the eleven reviewed articles, the use of probiotics stood out as a particularly successful intervention.

- **Lau & Chamberlain (2016)** reviewed twenty six RCTs with a probiotic intervention, which on aggregate returned a 60.5% reduction in the risk of developing clostridium difficile associated diarrhea when taken concurrently with antibiotics.
- **Pattani et al. (2013)** returned an aggregate 63% reduction in the risk of developing a CDI when probiotics were taken simultaneously with antibiotics.
- **McFarland (2015)** demonstrated significant reductions in the risk of developing CDI for all four different probiotics assessed. A 93% reduction in CDI risk was demonstrated when *Lactobaccillus casei DN114001* was taken.

Which measures should be prioritised?

The routine administration of probiotics should be considered for all patients taking antibiotics who are at risk of developing CDI. Three of the four systematic reviews (total number of reviewed primary studies = 67) which evaluated the effect of probiotics on CDI found strongly in favour for its widespread use, whereas the only study in opposition reported conflicting results

Which measures should be prioritised?
Which measures don't work and why?
Have lessons been learned that could make them work?

from the five (5) primary studies contained in their review.

One study alluded to the inexpensiveness of probiotic use (Lau and Chamberlain 2016), but further cost benefit analysis may further strengthen the argument for widespread administration of probiotics to prevent CDI.

Which measures don't work and why?

No assessed measures were found to consistently not work.

Have lessons been learned that could make them work?

Studies that reviewed cleaning practices acknowledged that consistency in technique and method is highly correlated with the effectiveness of environmental cleaning. Specific changes were not suggested except more stringent auditing processes (such as checklists) and further training may be required to improve the effectiveness of cleaning interventions (such as surface cleans).

Grey Literature

Search of the grey literature revealed a number of CDI prevention guidelines that have been developed by governments or health care associations. The following guidelines provide the most practical recommendations and they are underpinned by a strong evidence base (i.e findings extracted from SRs, RCTs etc., not anecdotal experience).

- Australian Commission on Safety and Quality in Health Care 2018: Clostridium difficile infection A model to improve the management and control of Clostridium difficile in Australia <https://www.safetyandquality.gov.au/wp-content/uploads/2015/05/Model-to-improve-prevention-and-control-of-CDI-in-Australia.pdf>
- Nova Scotia Health and Wellness 2013: Best Practice Guidelines for the Prevention & Management of Clostridium difficile Infection In Prehospital, Acute & Continuing Care <https://ipc.gov.ns.ca/sites/default/files/CDIBestPracticesGuidelinesFinal2013.pdf>
- Centers for Disease Control and Prevention 2016: CDI Prevention Primer <https://www.cdc.gov/hai/pdfs/toolkits/CDI-Primer-2-2016.pdf>
- Scottish Health Protection Network 2017: Guidance on Prevention and Control of *Clostridium difficile* Infection (CDI) in health and social care settings in Scotland <http://www.hps.scot.nhs.uk/resourcedocument.aspx?id=6188>



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Chapter 8:

Hospital Acquired Infections

EXECUTIVE SUMMARY

Objective of the Review

The objective of this review is to synthesise the evidence related to the effectiveness of interventions including behavioural and human factors approaches to reduce the occurrence of infection-related treatment injury. To avoid replication of previously covered primary research, this review only focuses on secondary research evidence (e.g. systematic reviews, meta-analyses) relative to hospital acquired infections (HAIs) not already covered by this investigation (e.g. ventilator associated pneumonia, surgical site infections etc).

In order to review the evidence this review aims to answer the following research questions

- Which measures are most likely to reduce HAIs? What are the success stories?
- Which measures should be prioritised?
- Which measure don't work and why? Have lessons been learned that could make them work?

Whilst a formal critical appraisal was not required as part of this review, aspects of study quality/external validity will be reported including:

- jj) Level of evidence – related to study design
- kk) What bias needs to be considered within the study populations (e.g. gender, age, socioeconomic background, and severity of condition or complexity of injury / surgical procedure) that may have an impact on the outcome?
- ll) Are the conditions and standards reported in the evidence relatable to the New Zealand health system?
- mm) What was the comparison group and was the comparison model of care or treatment administered appropriately?
- nn) How were the outcomes measured and what was the risk of bias?

Which measures are most likely to reduce the incidence of HAIs? What are the success stories?

What are the success stories?

Out of the five reviewed articles, the following showed favourable results.

- **Bin-Reza et al. (2011)** demonstrated that wearing a standard surgical mask or a N95 respirator decreased the likelihood of hospital acquired respiratory illness by as much as 67%. No demonstrable difference in the incidence of infection between wearing a surgical mask or a N95 respirator.
- **Frost et al. (2016)** showed that daily chlorhexidine bathing (wipe down or bath with solution) reduced the incidence of HAI in the intensive care unit.
- **Edwards et al. (2012)** found that increasing hospital staff compliance with existing infection prevention measures resulted in a reduction in HAIs.

Which measures should be prioritised?

No study provided a cost-benefit analysis and given the limited number of studies for each intervention, it is difficult to say with certainty which infection prevention measure should be prioritised. Instead, the information from this report could be used in conjunction with the findings from the previous reports to strengthen the case for implementation of a given measure.

Which measures should be prioritised?
Which measures don't work and why?
Have lessons been learned that could make them work?

Which measures don't work and why?

No assessed measures were found to consistently not work.

Have lessons been learned that could make them work?

No study reported on measures to improve their intervention strategy.

Grey Literature

Search of the grey literature revealed forty nine (49) documents that discussed interventions for preventing HAIs. The following references provide the most practical recommendations and have a strong evidence base:

- The National Institute for Health and Care Excellence (NICE) 2017: Healthcare-associated infections: prevention and control in primary and community care <https://www.nice.org.uk/guidance/CG139>
- Health Protection Scotland 2018: Compendium of HAI Guidance <http://www.hps.scot.nhs.uk/resourcedocument.aspx?id=6509>
- Provincial Infectious Diseases Advisory Committee (PIDAC) 2012: Best Practices for Infection Prevention and Control Programs in Ontario http://www.publichealthontario.ca/en/eRepository/BP_IPAC_Ontario_HCSettings_2012.pdf
- World Health Organization 2016: Guidelines on Core components of Infection Prevention and Control Programmes at the National and Acute Health Care Facility Level <http://apps.who.int/iris/bitstream/handle/10665/251730/9789241549929-eng.pdf;jsessionid=69161287EEF4ECA81BA2C260E8E4A470?sequence=1>
- Agency for Healthcare Research and Quality 2018: AHRQ's Healthcare-Associated Infections Program <https://www.ahrq.gov/professionals/quality-patient-safety/hais/index.html>

1. Background