Health Protection Scotland

NHS National Services Scotland

Targeted literature review:

What are the key infection prevention and control recommendations to inform a *Clostridium difficile* infection (CDI) cross transmission prevention quality improvement tool?

Part of HAI Delivery Plan 2014-2015:

Task 6.1: Review of existing infection prevention and control care bundles to ensure ongoing need and fitness for purpose

V2.0 May 2015

HPS ICT Document Information Grid	
Purpose:	To present a review of the evidence to inform the content of HAI related quality improvement tools for NHSScotland. This supports the functions of HPS in developing effective guidance, good practice and a competent workforce and translating knowledge to improve health outcomes.
Target audience:	All NHSScotland staff involved in patient care activities where interventions can lead to HAI. Infection prevention and control teams in NHS boards and other settings. Partner organisations particularly Healthcare Improvement Scotland and National Education for Scotland to ensure consistent information across similar improvement documentation.
Description:	Literature critique summary and presentation of key recommendations to inform HAI quality improvement tools, based around a framework that evaluates these against the health impact contribution and expert opinion/practical application.
Update/review schedule:	Every three years; however if significant new evidence or other implications for practice are published updates will be undertaken.
Cross reference:	Standard Infection Control Precautions and Transmission Based Precautions in the National Infection Prevention and Control Manual. http://www.hps.scot.nhs.uk/haiic/ic/nationalinfectionpreventioncontrolmanual.aspx Data on HAI incidence and prevalence and process compliance data. http://www.hps.scot.nhs.uk/haiic/sshaip/index.aspx Implementation support from Healthcare Improvement Scotland and/or others, education and training support from National Education Scotland. http://www.nes.scot.nhs.uk/education-and-training.aspx Toolkits to assist in the control of CDI outbreaks http://www.hps.scot.nhs.uk/haiic/ic/toolkits.aspx For additional information on CDI refer to - HPS Guidance on Prevention and Control of CDI in Healthcare Settings in Scotland (2014).

Contents

1. Executive summary

Clostridium difficile is the most common cause of intestinal infections associated with antimicrobial treatments and is recognised as an important cause of HAI[1-4]. *Clostridium difficile* was reported to be one of the most frequently occurring causative agents of healthcare associated infection (HAI) in acute settings in NHSScotland within the HAI Prevalence Survey 2007.[5]

Overall incidence rates of CDI in Scotland remain at low levels, but there is a continued need to prevent and control this disease. Underlying risk factors associated with development of CDI include increased age and length of stay in healthcare settings.[2-4] The *C. difficile* organism produces spores which are able to survive in the environment for long periods of time and are resistant to routine environmental cleaning with detergents.[6] Additional aspects of concern within healthcare include: use of antimicrobial agents and poor infection prevention and control practices which can lead to cross transmission.[3;3;7]

Key interventions for infection prevention and control focus on isolation of symptomatic patients, use of personal protective equipment (PPE), environmental cleaning and decontamination, effective hand hygiene and use of dedicated communal care equipment where possible. In addition, the patient's antimicrobial therapy must be reviewed, this includes ensuring the use of broad spectrum antibiotics is minimised and that antibiotic prescribing policies are adhered to.[1;2;8;9] This literature review aims to focus on the key interventions which will prevent or minimise cross transmission of CDI.

The key recommendations are a result of CDI intelligence from HPS colleagues on this topic; a review of the scientific evidence; scoring the resulting recommendations using a health impact and expert opinion framework; and a process of consultation. The key recommendations for the prevention of CDI cross transmission are:

- Ensure that patients with CDI are isolated in a single room with en suite facilities or an allocated commode, until they are at least 48 hours symptom free and bowel movements have returned to patient's normal (Category 1B/ Category II).
- Ensure that unnecessary antimicrobial treatments are stopped where this is indicated by local antimicrobial policy and that the antimicrobial treatment regimens of the patient with CDI are reviewed on a daily basis (Category 1B).
- Ensure that PPE (i.e. gloves and aprons) is donned prior to, and subsequently removed, following each period of care activity with a patient with CDI (Category 1B).
- Ensure that the immediate environment of the patient with CDI has been cleaned at least daily using neutral detergent followed by a disinfectant containing 1000 parts per million (ppm) available chlorine (av cl) or a combined detergent/disinfectant (1000ppm av cl) (Category 1B).
- Ensure that hand washing is performed after body fluid exposure during patient care and after touching a patient's surroundings following a period of care activity (WHO Moments 3 and 5) (Category 1A).

- Ensure that patients have access to hand washing facilities and promote hand washing after patient uses toileting facilities and before eating (Category II).
- Ensure that care equipment, e.g. blood pressure cuffs, thermometers and stethoscopes, is dedicated to a single patient with CDI whenever possible (Category 1B).

To find out more information on the categories of these recommendations see Appendix 2

Note: this review identifies the resulting key evidence-based recommendations and does not aim to identify all the elements of a checklist or standard operating procedure covering management of patients with CDI.

In conclusion: the key recommendations listed here and summarised in Appendix 4 should be considered for application into practice as supported by quality improvement tools including care bundles. These activities can also be supported by national patient safety/quality improvement work (as directed by Healthcare Improvement Scotland).

2. Aim of the review

To review the evidence base to ensure that the key recommendations are still the most critical for preventing cross transmission of CDI and therefore protecting the safety of patients. The evidence base for these recommendations was last reviewed in 2011.

3. Background

3.1 The problem

Clostridium difficile is the most common cause of intestinal infections associated with antimicrobial treatments and is recognised as an important cause of HAI.[1;2] CDI presentation ranges in severity from mild diarrhoea to pseudomembranous colitis and toxic megacolon and can result in death.[2]

Overall incidence rates of CDI in Scotland have remained at low levels since 2011, but there is a continued need to prevent and control this disease.[3;4] Despite the levelling of the overall incidence rates in recent time, the occurrence of localised outbreaks show that CDI remains a burden of disease within NHSScotland and has the potential to re-emerge within vulnerable patient groups if vigilance is not maintained.

C. difficile is an anaerobic bacterium that exists in both a vegetative (active growth) and spore (resting) form. The spore form is highly resistant to environmental stresses such as oxygen, UV light, destruction by chemicals (such as detergents) and high temperatures, spores are known to survive for extended periods of time (months or years).[2;3;6] *C. difficile* is found in the intestines of approximately 3% of healthy adults, with this figure increasing to approximately 20% of hospital patients; with figures of up to 50% of residents in long term care facilities reported.[2;3] Infection can occur after courses of antimicrobial treatment, even following prophylactic or short term doses in individuals already colonised with *C. difficile*. CDI can also occur following ingestion of *C. difficile* spores, leading to germination of the spores within the intestine and ultimately disease.[2;3;10] CDI is spread by the faecal-oral route; transmission in healthcare settings can occur by direct (e.g. physical contact with an infected patient or their body fluids) or indirect (e.g. contact with contaminated objects or surfaces) contact routes during the provision of care.

3.2 How cross transmission of CDI can be prevented

Strategies for preventing cross transmission of CDI are based on instigation of contact precautions. Contact precautions are implemented in addition to standard infection control precautions (SICPs) and aim to control transmission of microorganisms via direct and indirect contact routes during provision of care. See National Infection Prevention & Control Manual, Chapter 2 – Transmission Based Precautions. http://www.hps.scot.nhs.uk/haiic/ic/nationalinfectionpreventionandcontrolmanual.aspx

The key interventions focus on isolation of the symptomatic patient, effective hand washing, use of PPE, environmental cleaning and decontamination and the use of dedicated communal care equipment where possible. In addition, the patient's antimicrobial therapy is reviewed, this includes ensuring the use of broad spectrum antibiotics is minimised and that antibiotic prescribing policies are adhered to.[1-3;8;9]

3.3 Out of scope for this review

This literature review does not address any issues specific to:

- Paediatric settings
- Outbreaks of CDI
- Clinical management of patients with CDI
- Items of equipment within the wider patient area not classed as care equipment.

3.4 Assumptions – to ensure successful application of recommendations into practice

- Staff are trained and competent in all aspects of the management of CDI, preferably using an approved educational package. http://www.nes.scot.nhs.uk/education-and-training.aspx.
- The overall approach to the delivery of healthcare is supported by patient safety and improvement approaches and organisational readiness.

4. Results

The recommendations presented are based on a review of the current evidence. All the recommendations resulting from the review of the evidence were assessed using the 'health impact and expert opinion framework' seen in Appendix 1. The final key recommendations were identified as a result of this evaluation as well as being informed by a process of wider consultation.

The methodology for this is described within Appendix 2; the specific search strategy in Appendix 3 and finally a summary page of the resulting recommendations can be found in Appendix 4.

4.1 Review of the evidence base

4.1.1 Final recommendation - Ensure that patients with *Clostridium difficile* Infection (CDI) are isolated in a single room with en suite facilities or an allocated commode, until they are at least 48 hours symptom free and bowel movements have returned to patient's normal (Category 1B/Category II)

Once patients are symptomatic, i.e. have diarrhoea, spores can be disseminated in large numbers and can result in high levels of environmental contamination particularly in toilets, commodes and frequently touched surfaces such as toilet handles and bed rails, which can result in cross transmission.[1-3;10]

It is recommended that patients with diarrhoea who are known or suspected to be infected with an infectious agent such as *C. difficile* should be isolated. Physically separating infectious patients from others using isolation may limit environmental contamination of communal areas and equipment (indirect contact) and reduce patient to patient transmission (direct contact). Isolation measures form part of contact precautions and should be used in addition to standard infection control precautions (SICPs). Refer to the National Infection Prevention and Control Manual for further detail: http://www.hps.scot.nhs.uk/haiic/ic/nationalinfectionpreventionandcontrolmanual.aspx

There is a considerable consensus of evidence to recommend isolating CDI patients in a single room with en suite facilities or with an allocated commode.[1-3;9;10]

There is limited evidence to quantify the optimum duration of contact precautions, including isolation; however, there is broad consensus of expert opinion within existing evidence-based guidance that patients should remain in isolation until they are at least 48 hours symptom free.[1-3;10]

Many current evidence-based guidelines include further detail that bowel movements should be back to normal, i.e. as referred to in the Bristol Stool Chart.[1-3] Therefore the inclusion of such a phrase may help to guide practice although it must be considered against clinical judgement and practicalities.

4.1.2 Final recommendation - Ensure that unnecessary antimicrobial treatments are stopped where this is indicated by local antimicrobial policy and that the antibiotic regimens of the patient with *Clostridium difficile* Infection (CDI) are reviewed on a daily basis (Category 1B)

Evidence shows that the greatest risk factor for the development of CDI is exposure to antimicrobials.[2;3;11-14] Antimicrobial therapy can form a crucial part of patient treatment, however, antimicrobial use can lead to disruption of the gut microflora creating ideal conditions for *C. difficile* to proliferate and cause CDI[1;2] Prudent antimicrobial stewardship is therefore a key infection prevention and control measure.[1-3;8;10;15] The Department of Health (DH) guidelines[1] recommend that 'all antibiotics that are clearly not required should be stopped, as should other drugs that might cause diarrhoea'. The need to review antibiotic regimens is a key evidence-based and good clinical practice activity. As such national and local antimicrobial prescribing policies should be referred to, including advice to avoid broad spectrum antibiotics and long duration of treatment where possible.[9] Interventions aimed at methods of improving prescribing practice within acute settings have been shown to be successful in reducing antimicrobial resistance and HAIs such as CDI.[15-17] This has been further emphasised in a DH best practice statement which states the importance of embedding a culture of daily antibiotic review with the aim to move from intravenous to oral therapy if possible and a recommendation to look at setting a maximum duration of treatment unless there is a specific clinical indication.[8]

The current recommendation does not specifically include a timeframe for review of antibiotic therapy however DH best practice document for antimicrobial prescribing recommends that this review be carried out daily.[8;10]

4.1.3 Final recommendation - Ensure that personal protective equipment (PPE) (i.e. gloves and aprons) is donned prior to, and subsequently removed, following each period of care activity for a patient with *Clostridium difficile* Infection (CDI) (Category 1B)

The use of PPE forms part of standard infection control precautions and also contact precautions.[18] PPE is used as a barrier to prevent exposure to potentially hazardous microorganisms and is designed to protect both the healthcare worker and patient.[19] Contamination of Healthcare Workers (HCWs) hands with spores is significantly increased when patient contact occurs without glove use[20]. The DH guidelines recommend that all staff in an isolation room should use disposable gloves and aprons for all contact with the patient and the patient's environment[21].

PPE such as gloves and aprons can become a vector in the transmission of infectious agents if not properly changed and disposed of between patient care activities.[19] Microorganisms have been shown to survive on the surface of gloves and aprons, and although there is no definitive evidence that this has contributed to an outbreak of infection, it should be considered as a potential route of transmission.[19]

Therefore in order to prevent or minimise potential cross transmission of CDI the key action is that PPE is removed and disposed of after each patient care activity.[22]

4.1.4 Final recommendation - Ensure that the immediate environment of the patient with CDI has been cleaned at least daily using neutral detergent followed by a disinfectant containing 1000 parts per million (ppm) available chlorine (av cl) or a combined detergent/disinfectant (1000ppm av cl) (Category 1B)

CDI in an individual with symptoms can result in widespread environmental contamination with spores. This is particularly notable in the areas near the toilet and on commodes as well as generally on the floor and bed frames. [1-3] Standard environmental cleaning methods using neutral detergent alone are known to be relatively effective for general cleaning of the patient environment, however there is a consensus of evidence that chlorine containing agents at a concentration of at least 1,000 parts-per-million (ppm) available chlorine (1000ppm av cl) are required when there is environmental contamination in order to inactivate *C. difficile* spores.[1-3;9] This is consistent with EPIC3 which recommends consideration of the use of detergent and hypochlorite in outbreaks of infection when 'the pathogen concerned survives in the environment and environmental contamination may be contributing to spread.'[23] The Centers for Disease Control and prevention (CDC) isolation guidelines[19] recommend that 'rooms of patients on Contact Precautions are prioritized for frequent cleaning and disinfection (e.g. at least daily) with a focus on frequently-touched surfaces (e.g. bed rails, over bed table, bedside commode, lavatory surfaces in patient bathrooms, doorknobs) and equipment in the immediate vicinity of the patient.' Further elaboration has been provided by the DH to include 'environmental cleaning of rooms, bed spaces, commodes, bedpans, slipper pans and disposable bedpan holders, toilets and bathroom areas of patients with CDI'. [1;9] The World Health Organization (WHO) defines the 'patient zone' as including all 'inanimate surfaces touched by or in direct physical contact with the patient such as the bed rails, bedside table, bed linen and infusion tubing and other medical equipment. It also contains surfaces frequently touched by HCWs while caring for the patient such as monitors, knobs and buttons, and other "high frequency" touch surfaces within the patient zone.'[24]

It is therefore recommended that cleaning using neutral detergent followed by a chlorine-based disinfectant (1000ppm av cl), or using a combined detergent/disinfectant (1000ppm av cl), is performed at least daily.

4.1.5 Final recommendation - Ensure that hand washing is performed after body fluid exposure during patient care and after touching a patient's surroundings following a period of care activity (WHO Moments 3 and 5) (Category 1A)

The CDC Isolation guidelines and the WHO Guidelines on Hand Hygiene in Health Care (2009) both recommend that if exposure to potential spore-forming pathogens is suspected or proven then hand washing with soap and water should be undertaken.[19;25]

One study has found that up to 24% of HCWs hands may become contaminated with clostridial spores after caring for a CDI patient (with the use of gloves), therefore effective hand hygiene is necessary to avoid cross-transmission of spores to the environment or other patients[20]. Clostridial spores are resistant to the action of alcohols and all current evidence-based guidelines recommend that hand washing using soap and water should be performed in situations where CDI is known or suspected. The physical action of rubbing and rinsing the hands removes contaminating spores. The type of soap to use (i.e. non-antimicrobial/antimicrobial) is an unresolved issue in relation to the prevention of CDI with many guidelines

recommending either can be used.[2] Hand rubbing using alcohol based hand rub (ABHR) will not remove or kill clostridial spores and should not be used as the primary source of hand hygiene or as an alternative to soap.[1-3;9;10]

The WHO Guidelines clearly describe the indications for hand hygiene and present these within the WHO 'My 5 Moments for Hand Hygiene' approach. These 5 Moments have been widely promoted within NHSScotland for a number of years and hand hygiene performance is measured against these Moments. The WHO Guidelines emphasise the importance of performing hand hygiene after body fluid exposure and after touching patient surroundings to prevent HAI, which aligns with the times when the spread of *C. difficile* spores might be of greatest concern.[25] Therefore, in relation to the risk associated with cross transmission of CDI, the clearest indications for hand washing are Moment 3 'after body fluid exposure' and Moment 5 'after touching patient's surroundings.'

This recommendation, and the importance of hand hygiene performance, is consistent with all current evidence, guidelines and the Department of Health (DH) high impact intervention.[1;9;22;25]

4.1.6 Final recommendation - Ensure that patients have access to hand washing facilities and promote hand washing after patient uses toileting facilities and before eating (Category II)

The EPIC3 guidelines (2014) contained new recommendations for patient hand hygiene; these recommendations acknowledge the importance of disrupting the faecal-oral transmission route. The guidance stated that "Patients and relatives should be provided with information about the need for hand hygiene and how to keep their own hands clean" and that "Patients should be offered the opportunity to clean their hands before meals; after using the toilet, commode or bedpan/urinal; and at other times as appropriate. Products available should be tailored to patient needs and may include alcohol-based hand rub, hand wipes and access to hand wash basins".[23] Similar recommendations are made in other CDI prevention guidance including the recommendation that HCWs assist patients who are unable to perform hand hygiene independently.[2;3;26] Patients who require assistance with daily hygiene have a higher risk of contracting CDI and interventions that promote patient hand hygiene have been shown to significantly reduce incidence of CDI.[20;27]

There are few studies in the literature examining the impact of patient hand hygiene programmes on CDI incidence and those that have been published are weak; however, there is a strong scientific rationale for implementing such programmes as they may prevent or reduce cases of CDI caused by ingestion of spores from contaminated hands.

4.1.7 Final recommendation - Ensure that care equipment e.g. blood pressure cuffs, thermometers and stethoscopes, is dedicated to a single patient with *Clostridium difficile* infection (CDI) whenever possible (Category1B)

Contaminated care equipment, e.g. blood pressure cuffs and stethoscopes, has been implicated in cross transmission of CDI.[3] There is a consensus among published guidance that dedicated or single use care

equipment should be used for each CDI patient.[1-3;9;10;19] If this is not possible then adequate decontamination of reusable care equipment between uses should be undertaken (HPS' National Infection Prevention and Control Manual and local policies should be referred to for further guidance).

4.2 Review of additional evidence

4.2.1 Additional consideration: Cohorting (Category II)

Patient cohorting is defined as the grouping of patients in the same bay/ward that have the same infection.[19] The effectiveness of the use of cohorting as opposed to isolation is difficult to fully evaluate as the evidence tends to come from outbreak reports where multifactorial interventions have been instigated.[2;19;28-34] This method of isolating infectious patients is normally used if single rooms are in short supply.[2;19;35;36] Cohorting can form part of an effective control measure so long as it is combined with other infection control measures such as hand hygiene and appropriate PPE usage.[2;3;19;28-31]

A number of studies have reported that on comparison of the use of isolating in single rooms and cohorting, there was a significant difference in the infection rates for specific organisms with cohorting showing higher infection rates. Despite this all the authors concluded that large scale studies on which to firmly base a recommendation were required.[37-39]

Isolating patients with CDI in a single room remains the gold standard. Factors such as the prevalence of CDI within a healthcare facility can affect the decision making with regards to isolation. During an outbreak, cohorting may be considered the best option available, however outbreaks are not included within this review. Despite the lack of evidence there is some information that cohorting is effective, however it should not be considered initially and should not be considered at this stage as a key recommendation for a quality improvement tool.

In summary, it is concluded that this should **not** be included as a key recommendation however this should be included within the supporting documentation, e.g. cause and effect chart, to guide when single rooms are not yet available.

4.2.2 Additional consideration: Terminal cleaning (Category II)

The following definition is included in the NHSScotland cleaning specification, 'a terminal clean is defined as a procedure required to ensure that an area has been cleaned/decontaminated following discharge of a patient with an infection (i.e. alert organism or communicable disease) in order to ensure a safe environment for the next patient', this specification is mandatory in NHSScotland.[40]

The use of terminal cleaning to reduce the risk of further infection is not included within the current quality improvement tool key recommendations, however there is some evidence that this is an important factor in reducing the cross transmission of CDI.[1-3;9;19] Despite this, it would be difficult to measure as part of the daily actions for all patients with CDI as it would only be applicable on discharge of the patient. Therefore, despite the evidence base and the importance of cleaning in healthcare, it is concluded that a description of the requirement for terminal cleaning would fit more within supporting documentation.

In summary, it is concluded that this should **not** be included as a key recommendation but it should be included within the supporting documentation, e.g. cause and effect chart.

In conclusion: It is now advised that the key recommendations listed as a result of this review here and summarised in Appendix 4 are considered for application into practice as supported by quality improvement tools including care bundles. These activities can also be supported by national patient safety /quality improvement work (as directed by Healthcare Improvement Scotland).

5. Implications for research

A number of gaps in current evidence have been identified as a result of this review, which may have implications for future research priorities. Further research is needed to;

- compare the effectiveness of non-microbial versus antimicrobial soap used for hand washing for the prevention of CDI.
- analyse the effectiveness of assisted patient hand hygiene on CDI incidence.
- compare the effectiveness of single rooms versus cohorting.

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(41) The AGREE Collaboration. Appraisal of Guidelines For Research & Evaluation (AGREE) Instrument. 2001.

(42) Umscheid CA, Agarwal RK, Brennan PJ. Updating the guideline development methodology of the Healthcare Infection Control Practices Advisory Committee (HICPAC). Am J Infect Control 2010 May;38(4):264-73.

(43) IHI, Institute of Healthcare Improvement. Institute of Healthcare Improvement 2011 [cited 2012 Mar 30];Available from: URL: www.ihi.org

(44) Sax H, Allegranzi B, Uckay I, Larson E, Boyce J, Pittet D. 'My five moments for hand hygiene': a user-centred design approach to understand, train, monitor and report hand hygiene. J Hosp Infect 2007 Sep;67(1):9-21.

(45) Weiser TG, Haynes AB, Lashoher A, Dziekan G, Boorman DJ, Berry WR, et al. Perspectives in quality: designing the WHO Surgical Safety Checklist. Int J Qual Health Care 2010 Oct;22(5):365-70.

Note: A number of references listed above are cited within the literature review methodology which has been placed in Appendix 2 for ease of reading of this document.

Appendix 1: Framework – tool to evaluate evidence-based recommendations alongside the health impact contribution & expert opinion (based on the target group covered by this review)

Recommendation for review	Ensure that patients with *Clostridium difficile* Infection (CDI) are isolated in a single room with en suite facilities or an allocated commode, until they are at least 48 hours symptom free and bowel movements have returned to patient's normal.								
Grade of recommendation	Isolation in single room (Category 1B) At least 48 hour symptom free (Category II)								
Health impact contribution (based on Healthcare Quality Strategy for NHSScotland)	**Safe:** Not implementing this may result in cross transmission of *C difficile* to other patients								
	Effective: This recommendation reduces the risk of cross transmission to other patients								
	Efficient: This recommendation reduces the risk of onward transmission and therefore associated patient and NHS cost								
	Equitable: This recommendation promotes a standard of care for all patients, that may result in a reduction in avoidable personal and NHS costs, which is beneficial for all								
	Timely: This recommendation should form an integral part of infection control precautions								
	Person Centred: This recommendation is intended to reduce risk to other patients. However the potential effect of isolation of the CDI patient should be considered and action taken to prevent unintended psychological consequences and should allow for targeted communications regarding this action								
Expert opinion/consultation and practical considerations	**Measurement and feedback (Y/N/?)**	**Feasibility and sustainability (Y/N/?)**				**Applicability and reach (Y/N/?)**			**Training and informing (Y/N/?)**
	Potential for measurement through e.g. observation	Easily implemented within current culture and will improve the quality of care now	Potential for consistent delivery	Easily implemented based on reliably available resources/products/prompts	Stealth integration into natural workflow/logical clarity of concept (also see Cause & Effect Chart)	Unambiguous	Potential for applicability to a wide range of settings	Avoids unintended consequences/perverse behaviour	Potential for congruency in design and meaning, with HCW, trainer and observer training and education
	Y	**Y**	**N**	**?**	**Y**	**?**	**N**	**?**	**Y**
Is this a key recommendation?	Yes								

<table>
<tr><td>Recommendation for review</td><td colspan="9">Ensure that unnecessary antibiotics are stopped where this is indicated by local antimicrobial policy and that the antibiotic regimens of the patient with Clostridium difficile Infection (CDI) are reviewed on a daily basis</td></tr>
<tr><td>Grade of recommendation</td><td colspan="9">Category 1B</td></tr>
<tr><td colspan="10"></td></tr>
<tr><td rowspan="6">Health impact contribution (based on Healthcare Quality Strategy for NHSScotland)</td><td colspan="9">Safe: Not implementing this recommendation may put the patient at risk of harm and may increase the risk of cross transmission</td></tr>
<tr><td colspan="9">Effective: This recommendation is an evidence-based measure which may reduces the risk of cross transmission to other patients</td></tr>
<tr><td colspan="9">Efficient: This recommendation reduces the risk of onward transmission and therefore associated patient and NHS cost.</td></tr>
<tr><td colspan="9">Equitable: This recommendation promotes a standard of care for all patients, that may result in a reduction in avoidable personal and NHS costs, which is beneficial for all</td></tr>
<tr><td colspan="9">Timely: This recommendation combines both infection prevention and control strategies, patient and clinical management and therefore will fit well with the patient care routine and should facilitate efficient use of time</td></tr>
<tr><td colspan="9">Person Centred: This is a patient centred action to reduce harm caused in every patient with CDI</td></tr>
<tr><td colspan="10"></td></tr>
<tr><td rowspan="3">Expert opinion/consultation and practical considerations</td><td>Measurement and feedback (Y/N/?)</td><td colspan="4">Feasibility and sustainability (Y/N/?)</td><td colspan="3">Applicability and reach (Y/N/?)</td><td>Training and informing (Y/N/?)</td></tr>
<tr><td>Potential for measurement through e.g. observation</td><td>Easily implemented within current culture and will improve the quality of care now</td><td>Potential for consistent delivery</td><td>Easily implemented based on reliably available resources/products/prompts</td><td>Stealth integration into natural workflow/logical clarity of concept (also see Cause & Effect Chart)</td><td>Unambiguous</td><td>Potential for applicability to a wide range of settings</td><td>Avoids unintended consequences/perverse behaviour</td><td>Potential for congruency in design and meaning, with HCW, trainer and observer training and education</td></tr>
<tr><td>Y</td><td>Y</td><td>N</td><td>?</td><td>Y</td><td>?</td><td>N</td><td>?</td><td>Y</td></tr>
<tr><td colspan="10"></td></tr>
<tr><td>Is this a key recommendation?</td><td colspan="9">Yes</td></tr>
</table>

Recommendation for review	Ensure that personal protective equipment (PPE) (i.e. gloves and aprons) is donned prior to, and subsequently removed, following each period of care activity for a patient with *Clostridium difficile* Infection (CDI)								
Grade of recommendation	Category 1B								
Health impact contribution (based on Healthcare Quality Strategy for NHSScotland)	**Safe:** Not implementing this recommendation may put the patient at risk of harm and may increase the risk of cross transmission								
	Effective: This recommendation is an evidence-based measure which may reduce the risk of cross transmission to other patients								
	Efficient: This recommendation reduces the risk of onward transmission and therefore associated patient and NHS cost.								
	Equitable: This recommendation promotes a standard of care for all patients, that may result in a reduction in avoidable personal and NHS costs, which is beneficial for all								
	Timely: This recommendation should form an integral part of infection control precautions.								
	Person Centred: This is a patient centred action to reduce harm caused in every patient with CDI and allows for targeted communication / explanation with /to the patient								
Expert opinion/consultation and practical considerations	**Measurement and feedback (Y/N/?)**	**Feasibility and sustainability (Y/N/?)**				**Applicability and reach (Y/N/?)**			**Training and informing (Y/N/?)**
	Potential for measurement through e.g. observation	Easily implemented within current culture and will improve the quality of care now	Potential for consistent delivery	Easily implemented based on reliably available resources/products/prompts	Stealth integration into natural workflow/logical clarity of concept (also see Cause & Effect Chart)	Unambiguous	Potential for applicability to a wide range of settings	Avoids unintended consequences/perverse behaviour	Potential for congruency in design and meaning, with HCW, trainer and observer training and education
	Y	**Y**	**N**	**Y**	**Y**	**?**	**N**	**?**	**Y**
Is this a key recommendation?	Yes								

Recommendation for review	Ensure that the immediate environment of the patient with *Clostridium difficile* infection (CDI) has been cleaned at least daily using neutral detergent followed by a disinfectant containing 1000 parts per million (ppm) available chlorine (av cl) (or a combined detergent/disinfectant (1000ppm av cl)								
Grade of recommendation	Category 1B								
Health impact contribution (based on Healthcare Quality Strategy for NHSScotland)	**Safe:** Not implementing this recommendation may put the patient at risk of harm and may increase the risk of cross transmission								
	Effective: This recommendation is an evidence-based measure which may reduce the risk of cross transmission to other patients								
	Efficient: This recommendation reduces the risk of onward transmission and therefore associated patient and NHS cost.								
	Equitable: This recommendation promotes a standard of care for all patients, that may result in a reduction in avoidable personal and NHS costs, which is beneficial for all								
	Timely: This recommendation should form an integral part of infection control precautions.								
	Person Centred: This is a patient centred action to reduce harm caused in every patient with CDI								
Expert opinion/consultation and practical considerations	**Measurement and feedback (Y/N/?)**	**Feasibility and sustainability (Y/N/?)**				**Applicability and reach (Y/N/?)**			**Training and informing (Y/N/?)**
	Potential for measurement through e.g. observation	Easily implemented within current culture and will improve the quality of care now	Potential for consistent delivery	Easily implemented based on reliably available resources/products/prompts	Stealth integration into natural workflow/logical clarity of concept (also see Cause & Effect Chart)	Unambiguous	Potential for applicability to a wide range of settings	Avoids unintended consequences/perverse behaviour	Potential for congruency in design and meaning, with HCW, trainer and observer training and education
	Y	**Y**	**N**	**?**	**?**	**?**	**N**	**?**	**Y**
Is this a key recommendation?	Yes								

Recommendation for review	Ensure that hand washing is performed after body fluid exposure during patient care and after touching a patient's surroundings following a period of care activity (WHO Moments 3 and 5)								
Grade of recommendation	Category 1A								
Health impact contribution (based on Healthcare Quality Strategy for NHSScotland)	**Safe:** Not implementing this recommendation may put the patient at risk of harm and may increase the risk of cross transmission								
	Effective: This recommendation is an evidence-based measure to reduce the risk of cross transmission to other patients								
	Efficient: This recommendation reduces the risk of onward transmission and therefore associated patient and NHS cost.								
	Equitable: This recommendation promotes a standard of care for all patients, that may result in a reduction in avoidable personal and NHS costs, which is beneficial for all								
	Timely: This recommendation should form an integral part of infection control precautions								
	Person Centred: This is a patient centred action to reduce harm in every patient with CDI and allows for patients/individuals to be aware of the importance of hand hygiene and their role in this								
Expert opinion/consultation and practical considerations	**Measurement and feedback (Y/N/?)**	**Feasibility and sustainability (Y/N/?)**				**Applicability and reach (Y/N/?)**			**Training and informing (Y/N/?)**
	Potential for measurement through e.g. observation	Easily implemented within current culture and will improve the quality of care now	Potential for consistent delivery	Easily implemented based on reliably available resources/products/prompts	Stealth integration into natural workflow/logical clarity of concept (also see Cause & Effect Chart)	Unambiguous	Potential for applicability to a wide range of settings	Avoids unintended consequences/perverse behaviour	Potential for congruency in design and meaning, with HCW, trainer and observer training and education
	Y	**Y**	**Y**	**Y**	**Y**	**?**	**Y**	**Y**	**Y**
Is this a key recommendation?	Yes								

Recommendation for review	Ensure that patients have access to hand washing facilities and promote hand washing after patient uses toileting facilities and before eating								
Grade of recommendation	Category II								
Health impact contribution (based on Healthcare Quality Strategy for NHSScotland)	**Safe:** Not implementing this recommendation may increase the risk of cross transmission								
	Effective: This recommendation is based on weak evidence but with a strong scientific rationale								
	Efficient: This recommendation reduces the risk of onward transmission and therefore associated patient and NHS cost.								
	Equitable: This recommendation promotes a standard of care for all patients, that may result in a reduction in avoidable personal and NHS costs, which is beneficial for all								
	Timely: This recommendation should form an integral part of infection control precautions								
	Person Centred: This is a patient centred action to reduce harm in every patient with CDI and allows for patients/individuals to be aware of the importance of hand hygiene and their role in this								
Expert opinion/consultation and practical considerations	**Measurement and feedback (Y/N/?)**	**Feasibility and sustainability (Y/N/?)**				**Applicability and reach (Y/N/?)**			**Training and informing (Y/N/?)**
	Potential for measurement through e.g. observation	Easily implemented within current culture and will improve the quality of care now	Potential for consistent delivery	Easily implemented based on reliably available resources/products/prompts	Stealth integration into natural workflow/logical clarity of concept (also see Cause & Effect Chart)	Unambiguous	Potential for applicability to a wide range of settings	Avoids unintended consequences/perverse behaviour	Potential for congruency in design and meaning, with HCW, trainer and observer training and education
	Y	**Y**	**Y**	**?**	**Y**	**Y**	**Y**	**Y**	**Y**
Is this a key recommendation?	Yes								

Recommendation for review	Ensure that care equipment e.g. blood pressure cuffs, thermometers and stethoscopes is dedicated to a single patient with *Clostridium difficile* infection (CDI) whenever possible								
Grade of recommendation	Category 1B								
Health impact contribution (based on Healthcare Quality Strategy for NHSScotland)	**Safe:** Not implementing this recommendation may put the patient at risk of harm and may increase the risk of cross transmission								
	Effective: This recommendation is an evidence-based measure which may reduce the risk of cross transmission to other patients								
	Efficient: This recommendation reduces the risk of onward transmission and therefore associated patient and NHS cost.								
	Equitable: This recommendation promotes a standard of care for all patients, that may result in a reduction in avoidable personal and NHS costs, which is beneficial for all								
	Timely: This recommendation should form an integral part of infection control precautions.								
	Person Centred: This is a patient centred action to reduce harm in every patient with CDI								
Expert opinion/consultation and practical considerations	**Measurement and feedback (Y/N/?)**	**Feasibility and sustainability (Y/N/?)**				**Applicability and reach (Y/N/?)**			**Training and informing (Y/N/?)**
	Potential for measurement through e.g. observation	Easily implemented within current culture and will improve the quality of care now	Potential for consistent delivery	Easily implemented based on reliably available resources/products/prompts	Stealth integration into natural workflow/logical clarity of concept (also see Cause & Effect Chart)	Unambiguous	Potential for applicability to a wide range of settings	Avoids unintended consequences/perverse behaviour	Potential for congruency in design and meaning, with HCW, trainer and observer training and education
	Y	**Y**	**Y**	**?**	**Y**	**?**	**Y**	**?**	**Y**
Is this a key recommendation?	Yes								

<table>
<tr><td>Recommendation for review</td><td colspan="9">Patient cohorting</td></tr>
<tr><td>Grade of recommendation</td><td colspan="9">Category II</td></tr>
<tr><td colspan="10"></td></tr>
<tr><td rowspan="5">Health impact contribution (based on Healthcare Quality Strategy for NHSScotland)</td><td colspan="9">Safe: There is some evidence available which supports the benefits of cohorting but the gold standard in terms of infection prevention and control remains isolation.</td></tr>
<tr><td colspan="9">Effective: If a ward has several patients with CDI this may be an effective way to manage patients and reduce the risk of cross contamination to others.</td></tr>
<tr><td colspan="9">Efficient: This recommendation may prove more efficient in the circumstances of an outbreak of CDI however this review does not cover outbreaks.</td></tr>
<tr><td colspan="9">Equitable: N/A</td></tr>
<tr><td colspan="9">Timely: N/A</td></tr>
<tr><td colspan="10"></td></tr>
<tr><td rowspan="3">Expert opinion/consultation and practical considerations</td><td>Measurement and feedback (Y/N/?)</td><td colspan="4">Feasibility and sustainability (Y/N/?)</td><td colspan="3">Applicability and reach (Y/N/?)</td><td>Training and informing (Y/N/?)</td></tr>
<tr><td>Potential for measurement through e.g. observation</td><td>Easily implemented within current culture and will improve the quality of care now</td><td>Potential for consistent delivery</td><td>Easily implemented based on reliably available resources/products/prompts</td><td>Stealth integration into natural workflow/logical clarity of concept (also see Cause & Effect Chart)</td><td>Unambiguous</td><td>Potential for applicability to a wide range of settings</td><td>Avoids unintended consequences/perverse behaviour</td><td>Potential for congruency in design and meaning, with HCW, trainer and observer training and education</td></tr>
<tr><td>?</td><td>?</td><td>N</td><td>N</td><td>N</td><td>N</td><td>?</td><td>?</td><td>?</td></tr>
<tr><td colspan="10"></td></tr>
<tr><td>Is this a key recommendation?</td><td colspan="9">No but could form part of other supporting tools</td></tr>
</table>

Recommendation for review	Terminal cleaning								
Grade of recommendation	Category 1B								
Health impact contribution (based on Healthcare Quality Strategy for NHSScotland)	**Safe:** Not implementing this would put the patient at risk of harm								
	Effective: There is substantial consensus of evidence to support the efficacy of terminal cleaning before placement of another patient in the area.								
	Efficient: Effective terminal cleaning of a patient area following discharge with reduce NHS costs associated with HAI and reduce cross transmission.								
	Equitable: All adults receiving care can have safer care supported by this recommendation.								
	Timely: This recommendation should form an integral part of discharge of a patient								
	Person Centred: This action may reduce the risk of cross transmission.								
Expert opinion/consultation and practical considerations	**Measurement and feedback (Y/N/?)**	**Feasibility and sustainability (Y/N/?)**				**Applicability and reach (Y/N/?)**			**Training and informing (Y/N/?)**
	Potential for measurement through e.g. observation	Easily implemented within current culture and will improve the quality of care now	Potential for consistent delivery	Easily implemented based on reliably available resources/products/prompts	Stealth integration into natural workflow/logical clarity of concept (also see Cause & Effect Chart)	Unambiguous	Potential for applicability to a wide range of settings	Avoids unintended consequences/perverse behaviour	Potential for congruency in design and meaning, with HCW, trainer and observer training and education
	N	**N**	**N**	**Y**	**N**	**N**	**Y**	**?**	**Y**
Is this a key recommendation?	No but could form part of other supporting tools								

Appendix 2: Literature review methodology

The evidence underpinning the criteria for a quality improvement tool was reviewed using a targeted systematic approach to enable input and resource to be concentrated where needed. This methodology is fully described within a separate HPS paper '*Rapid method for development of evidence-based/expert opinion key recommendations, based on health protection network guidelines'.*

Initial rapid search and review

The initial search rapid literature search was carried out to identify mandatory guidance, or recent national or international evidence-based guidance which either agrees or refutes that the current key recommendations are the most important to ensure optimal PVC care:

- The main public health websites were searched to source any existing quality improvement tools
- Relevant guidance and quality improvement tools e.g. Department of Health (DH), Centers for Disease Control and Prevention (CDC) etc were reviewed
- Additional literature identified and sourced e.g. from the relevant Cochrane reviews.

The quality of evidence-based guidance was assessed using the AGREE instrument[41] and only guidance which achieved either a strongly recommend or recommend rating was included.

Targeted systematic review

As a result of initial rapid search and review, recommendations requiring a more in depth review were identified. This involved searching of relevant databases including OVID Medline, CINAHL, EMBASE. All literature pertaining to recommendations where evidence was either conflicting or where new evidence was available were critically appraised using SIGN checklists and a 'considered judgement' process used to formulate recommendations based on the current evidence for presentation and discussion with the National HAI Quality Improvement Tools Group in Scotland.

Grading of recommendations

Grading of the evidence is using the Healthcare Infection Control Practices Advisory Committee (HICPAC) method.[42] In addition to the overall assessment of the evidence underpinning the recommendation, other factors are considered which affect the overall strength of the recommendation such as the health impact and expert opinion on the potential critical outcomes.

The HICPAC categories are as follows:

Category 1A – strong recommendation based on high to moderate quality evidence
Category 1B – strong recommendation based on low quality of evidence which suggest net clinical benefits or harms or an accepted practice (e.g. aseptic technique)
Category 1C – a mandatory recommendation

Category II – a weak recommendation which shows evidence of clinical benefit over harm
No recommendation – not sufficient evidence to recommend one way or another

Framework for identifying final key recommendations

One way of improving implementation of evidence-based guidance is by the identification of key recommendations which if applied will improve practice and outcome.[36-42] This is the foundation of 'care bundles' and other quality improvement tools which rely on the identification of key evidence-based recommendations to ensure application in practice.[43]

A method has been developed which aims to reflect graded recommendations in line with ensuring healthcare quality, attention to cost and practical application. It combines approaches used by the Institute of Healthcare Improvement (IHI) and World Health Organisation, among others, in identifying the critical factors from the evidence to ensure patient safety in a range of fields.[44;45] The method considers the current NHSScotland Quality Strategy dimensions and finally expert opinion applied within a formal framework. This framework includes a range of practical considerations under the headings measurement and feedback, feasibility and sustainability, applicability and reach, training and informing.

Ultimately, HPS key recommendations are presented taking all of these factors into account, with the aim of improving practice and outcome.

Appendix 3: Search Strategy

Database: Ovid MEDLINE(R) 1946 to Present with Daily Update

Search Strategy:

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1 exp clostridium difficile/ or exp clostridium infections/ or exp spores, bacterial/ or diarrhea.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier] (109562)

2 exp patient isolation/ or exp hospitals, isolation/ (3324)

3 exp disinfection/ or exp decontamination/ (13820)

4 exp anti-bacterial agents/ (547198)

5 exp protective clothing/ or exp infection control/ (60890)

6 exp chlorine compounds/ or exp disinfectants/ or exp disinfection/ (235770)

7 2 or 3 or 4 or 5 or 6 (821583)

8 exp cross infection/ (48903)

9 1 and 7 and 8 (885)

10 limit 9 to (english language and humans and yr="2011 -Current") (171)

****

Appendix 4: Summary of key recommendations for prevention of *Clostridium difficile* infection (CDI) cross transmission

Health Protection Scotland

Preventing cross transmission when an individual has known or suspected CDI

NHS National Services Scotland

Patient with *Clostridium difficile* infection (CDI)

If a patient* has a known or suspected CDI

Ensure that:

- patients with CDI are isolated in a single room with en suite facilities or an allocated commode, until they are at least 48 hours symptom free and bowel movements have returned to patient's normal
- unnecessary antimicrobial treatment are stopped where this is indicated by local antimicrobial policy and that the antibiotic regimens of the patient with CDI is reviewed on a daily basis
- personal protective equipment (PPE) (i.e. gloves and aprons) is donned prior to, and subsequently removed, following each period of care activity for a patient with CDI
- the patient with CDI's immediate environment is cleaned at least daily using neutral detergent followed by a disinfectant containing 1000 parts per million (ppm) available chlorine(av cl) (or a combined detergent/disinfectant (1000ppm av cl))
- hand washing is performed after body fluid exposure during patient care and after touching a patient's surroundings following a period of care activity (WHO Moments 3 and 5)
- ensure that patients have access to handwashing facilities and promote hand washing after patient uses toileting facilities and before eating
- care equipment e.g. blood pressure cuffs, thermometers and stethoscopes is dedicated to a single patient with CDI whenever possible

*The use of the word 'Persons' can be used instead of 'Patient' when using this document in non-hospital settings

Practice points

The use of personal protective equipment (PPE) including gloves is important in all procedures where blood and body fluid risk exists.

The featured recommendation on hand hygiene does not detract from other times when hand hygiene is recommended and will be monitored against (namely the 5 Moments for Hand Hygiene).

The featured recommendations do not aim to cover emergency situations, which require clinical judgement for patient care actions.

For further information on the background to these recommendations and the literature reviews that informed these please visit http://www.hps.scot.nhs.uk as well as referring to your local teams and policies.

Also see NHS Education for Scotland http://www.nes.scot.nhs.uk and Healthcare Improvement Scotland http://www.healthcareimprovementscotland.org/home.aspx for additional information on education and patient safety improvement. Also refer to the Standard Infection Control Precautions Section of the National Infection Prevention and Control Manual http://www.hps.scot.nhs.uk/haiic/ic/nationalinfectionpreventionandcontrolmanual.aspx.