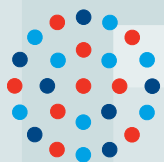




Guidance on Prevention and Control of *Clostridium difficile* Infection (CDI) in Healthcare Settings in Scotland

Health Protection Network
Scottish Guidance

September 2009



Health
Protection
Scotland



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Supported by Health Protection Scotland

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Citation for this document

Health Protection Network. Guidance on Prevention and Control of *Clostridium difficile* Infection (CDI) in Healthcare Settings in Scotland. Health Protection Network Scottish Guidance 6. Health Protection Scotland, Glasgow, 2009.

Published by Health Protection Scotland, Clifton House, Clifton Place, Glasgow G3 7LN. Health Protection Scotland is a division of NHS National Services Scotland.

First published September 2009

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Acknowledgements

Health Protection Scotland (HPS) wish to express their appreciation to all whose efforts made this guidance possible. In particular, to the members of the CDI Guidance Development Group (appendix F) and their constituencies, the Health Protection Network (HPN) Steering Group, the HPN Governance Group, HPS Graphics, and to external reviewers (individuals and organisations) who contributed and reviewed the content of this guidance.

List of Abbreviations

AMT	Antimicrobial management team
b.d.	Twice a day
CDAD	<i>Clostridium difficile</i> Associated Disease
CDC	Centers for Disease Control and Prevention
CDI	<i>Clostridium difficile</i> infection
COSHH	Control of Substances Hazardous to Health
ESCMID	European Society of Clinical Microbiology and Infectious Diseases
ESGCD	European Study Group on <i>Clostridium difficile</i>
HAITF	Healthcare Associated Infection Task Force
HICPAC	Healthcare Infection Control Practices Advisory Committee
HPA	Health Protection Agency
HPN	Health Protection Network
HPS	Health Protection Scotland
HPT	Health Protection Team
IDSA	Infectious Diseases Society of America
ITU	Intensive Treatment/Therapy Unit
i.v.	Intravenous
MHRA	Medicines and Healthcare products Regulatory Agency
NES	National Education for Scotland
NHS QIS	National Health Service Quality Improvement Scotland
OCBD	Occupied bed days
o.d.	Once a day
PCR	Polymerase chain reaction
PMC	Pseudomembranous colitis
PPE	Personal protective equipment
q.d.s	Four times a day
RCA	Root cause analysis
SAPG	Scottish Antimicrobial Prescribing Group
ScotMARAP	Scottish Management of Antimicrobial Resistance Action Plan
SGHD	Scottish Government Health Department
SHEA	Society of Healthcare Epidemiology of America
SICP	Standard Infection Control Precautions
SIGN	Scottish Intercollegiate Guidelines Network
SMC	Scottish Medicines Consortium
t.d.s	Three times a day
TBP	Transmission-Based Precautions
US	United States of America
VRE	Vancomycin resistant Enterococci
WBC	White blood cell count

1. Introduction

Clostridium difficile infection (CDI) is the most common healthcare associated infection in healthcare settings in Scotland [1].

This guidance provides easily accessible advice covering key aspects of prevention and control of CDI. The recommendations in this guidance are based on a systematic literature review produced by the European Study Group on *Clostridium difficile* (ESGCD) in 2008 [2]. This guidance is a revised version of the 'HPS Guidance on Prevention and Control of *Clostridium difficile* Associated Disease (CDAD) in Healthcare Settings in Scotland' issued in October 2008. In areas where insufficient evidence exists, advice is based on expert consensus.

The level of evidence for the key recommendations listed in this guidance was graded in the literature review by the ESGCD and categories for implementation in clinical practice were generated based on the Healthcare Infection Control Practices Advisory Committee (HICPAC) Guidelines (the Centers for Disease Control (CDC)) (appendix A). The recommendations listed in this document (as bullet points) are followed by categories for implementation in clinical practice (IA, IB, IC or II), where IA is the strongest recommendation.

In addition, the guidance contains a section on roles and responsibilities.

This guidance is intended for use **in all healthcare settings in Scotland including acute and non-acute hospitals.**

A new section on '**CDI in the Community**' (see section 2.2.12) has been added to this revised version of the guidance. Advice in this section is **directed primarily at NHS board Health Protection Teams and Infection Control Teams** to enable them to deal with incidents in the community.

Adult care homes and other facilities (outside of the NHS) need only adhere to the recommendations given in section 2.2.12, however this section should not be considered as a comprehensive guidance for these settings.

The guidance is intended for use alongside methods of the Scottish Patient Safety Programme of work, which provide a standardised approach to implementation of the recommendations of this guidance.

The HPS 'Checklists for preventing and controlling CDI' should be used to ensure that recommended practices are implemented:

<http://www.hps.scot.nhs.uk/haic/sshaip/publicationsdetail.aspx?id=38848>

The impact of this and other interventions to contain CDI will be reflected in the national CDI surveillance programme, which is part of the Antimicrobial Prescribing and Resistance Programme outlined in the Scottish Management of Antimicrobial Resistance Action Plan (ScotMARAP).

This guidance represents the view of a multidisciplinary group convened in Scotland (appendix F) in 2009 for the purpose of reviewing current guidance. Under the auspices of the Health Protection Network (HPN), the group followed a systematic development framework proposed by the HPN:

<http://www.hps.scot.nhs.uk/about/hpn.aspx>

1.1 Aims and scope

This guidance should be used for developing local policies on prevention and control of CDI in all healthcare settings.

The guidance provides a standardised evidence-based approach to diagnosis, prevention and control, and treatment of CDI to enable staff to deliver safe healthcare and support the reduction of CDI in their organisations.

Professionals who have key roles in preventing and controlling CDI and other healthcare associated infections include:

- Chief Executives/Senior Managers
- Infection Control Teams
- Ward Managers
- Healthcare Workers (including medical staff)
- Consultants in Microbiology
- Antimicrobial Management Teams
- Facilities Managers
- General Practitioners
- Service Managers
- Health Protection Teams

The guidance aims to:

- Outline roles and responsibilities.
- Prevent transmission of *C. difficile* to patients and staff in all healthcare settings.
- Share best practice on antimicrobial treatment of CDI.
- Improve patient safety in relation to the acquisition and management of patients with CDI.

The guidance should be used as a framework to ensure the relevant policies are in place, to examine the currency of policy content where policies are already in place, or to inform local policy development.

- Potential benefits of the guidance include reductions in morbidity, mortality and service disruption as a result of CDI.

Out of scope

This document does not provide guidance for diagnostic laboratories.

1.2 Background

Clinical aspects

CDI is the most common cause of intestinal infections (and diarrhoea) associated with antimicrobial therapy. Clinical disease comprises a range of toxin mediated symptoms from mild diarrhoea, which can resolve without treatment, to severe cases such as pseudomembranous colitis (PMC), toxic megacolon and peritonitis that can lead to death.

For mild disease, diarrhoea is usually the only symptom. Other clinical features consistent with more severe forms of CDI include abdominal cramps, fever and leukocytosis [3].

Symptoms of CDI, and associated immune reactions in children differ from those in adults, but the pathology is not well described. Routine testing in children aged 15 years old and under is not recommended.

Three percent of healthy adults and 20% of hospital patients carry *C. difficile* in their gut [4]. The elderly living in care homes or staying in long-term care facilities are more likely to carry *C. difficile* than other adults. In studies from the US, 20% of care home residents and 50% of patients in long-term care facilities, respectively, were colonised with *C. difficile* [5, 6].

Etiology and risk factors

C. difficile can cause infection when the balance of the normal gut flora (microflora) is disturbed by the use of any type of antimicrobial agent, even in patients exposed to short-term prophylactic antimicrobial courses [4]. The normal gut flora provides resistance against invading pathogens by competing for the same resources (such as amino acids and carbohydrates) and thereby protecting people from gastrointestinal infections. This is also referred to as 'colonisation resistance'.

The *C. difficile* spores must be ingested for a person to become colonised and subsequently develop CDI. When the spores enter the colon they germinate into viable bacteria, and, if the strain is toxigenic, produce toxins (toxins A/B) that interact with the epithelium of the gut, which cause damage to the epithelial cells and inflammation of the gut [4].

Antimicrobial treatment is the risk factor that is most often associated with the development of CDI [7] (see text box Major risk factors for CDI on page 18) . However, gastric acid suppressant agents, chemotherapy and other agents that destroy or modulate the normal gut flora and/or immune functions have also been implicated in the development of CDI. The effects of antimicrobial (and other drug) treatment on the normal gut flora can persist for weeks to months. The onset of diarrhoea is typically during, or shortly after, receipt of a course of antimicrobial treatment but may occur from a few days to as long as 8 weeks after the termination of the therapy [3].

In elderly people, the normal gut flora is less dense and contains fewer bacterial species. This reduces the colonisation resistance to invading pathogens such as *C. difficile*. Although CDI can be treated with certain antimicrobials, immune function is also very important for the individual patient outcome. Healthy people with no underlying diseases and a high serum antibody response to toxin A are less likely to develop CDI after ingestion of *C. difficile* spores [7, 8]. It is recognised that gut immunity declines with increased age [9].

Other patient risk factors for developing CDI include: increased age (over 65 years), prolonged stays in healthcare settings, serious underlying disease, surgical procedures and immunocompromising conditions.

Antimicrobial resistance (typically to cephalosporins, fluoroquinolones and clindamycin) in *C. difficile* strains may be playing an increasingly important role in the development and epidemiology of CDI; when a carrier of a resistant *C. difficile* strain (or infected person) is treated with one of the above antimicrobial drugs, the colonising strain of *C. difficile* is given a growth advantage over the normal gut flora, which enables it to proliferate and reach high densities in the gut and potentially cause infection and transmission to others [10, 11].

Transmission

Since *C. difficile* is an anaerobic bacterium, viable bacteria will quickly die when exposed to air. However, *C. difficile* produces hardy spores that can tolerate air, heat and resist various detergents and disinfectants, and are able to survive for extended periods in the environment.

C. difficile is transmitted between people via spores that are picked up either by direct contact with an infected (or contaminated) person or by indirect contact with a contaminated surface. The ability of these spores to survive in the environment, even when disinfectants are used, has contributed to the wide spread of *C. difficile* in healthcare facilities.

Direct and indirect contact represent the main routes of transmission of *C. difficile*.

Symptomatic CDI patients shed spores via their faeces into the environment at a high rate. Symptomatic CDI patients are considered the main source of contamination of the environment of healthcare facilities [12].

Toilets, commodes and the environment of CDI patients (including frequently touched surfaces around toilets and beds) are likely to be contaminated. The hands of healthcare workers are also likely to be contaminated, and if hand hygiene is not optimal *C. difficile* will spread to other patients or the environment. Alcohol-based hand rubs are not effective in removing *C. difficile* spores from hands – additional hand washing with liquid soap and water is therefore necessary to prevent the spread of the spores.

As mentioned above, some people carry *C. difficile* in their gut without having any symptoms. Sometimes people who have been treated and recovered from CDI will still be carrying *C. difficile* in their gut.

In a recent study in the US, it was found that up to 50% of patients in a long-term care facility were asymptomatic carriers of *C. difficile* [6]. These carriers were shedding spores into the environment although at lower concentrations than observed from patients with diarrhoea. However, no studies to date have shown that asymptomatic carriers have been involved in transmitting *C. difficile* to other patients. Special contact precautions (or other interventions) are not recommended for asymptomatic carriers.

Prevention and control of CDI

There is evidence that a range of infection prevention and control measures are essential to limiting the spread of *C. difficile* in the healthcare setting. HPS has produced a range of model policies in relation to this. These need to be implemented in conjunction with effective antimicrobial stewardship programmes.

Epidemiology of CDI in Scotland

In Scotland, a significant increase in the number of reported cases of CDI was observed in the period 1995-2005. In 2006, a mandatory surveillance programme monitoring CDI in persons over 65 years was introduced in all healthcare settings (including acute and non-acute hospitals and primary care) in Scotland.

The first annual report (October 2006 - September 2007) showed that more than 6000 patients, aged 65 years and older, had acquired CDI in Scotland while receiving healthcare, and that all NHS boards had a high incidence of CDI [13]. Recently, many of the elements of this guidance have been implemented. This has resulted in a sustained decrease in incidence throughout 2008 and the first quarter of 2009 (see Figure 1) [14].

Figure 1: Overall quarterly CDI rates for Scotland (per 1000 total OCBDs) for ten quarters of mandatory surveillance covering the period October 2006-March 2009.



Hypervirulent strains of *C. difficile*

A rapid change in the epidemiology of CDI has been reported in many European countries and North America, probably due to the spread of a new hypervirulent strain known as polymerase chain reaction (PCR) ribotype 027 [15]. This strain of *C. difficile* has recently been associated with outbreaks in hospitals in Scotland. The hypervirulence of ribotype 027 is believed to be associated with its ability to produce high concentrations of toxins and high transmissibility.

Anecdotal evidence and observational epidemiological studies suggest that infections with ribotype 027 cause more severe disease and excess mortality relative to other strains [15, 16]. However, a recent case review study showed that there was no statistically significant difference in severity of disease or in 30-day all-cause mortality between patients infected with ribotype 027 and patients infected with other strains [17].

Importantly, other strains of *C. difficile* (including PCR ribotype 078) may have similar molecular mechanisms that result in hypervirulence and high transmissibility.

CDI caused by any strain (of any ribotype) should be considered potentially hypervirulent; therefore all recommended infection prevention and control measures should be applied.

2. Recommendations

This part of the guidance presents key recommendations on how to prevent and control CDI in the healthcare setting. Throughout the text references are made to existing documents including the mandatory surveillance protocol, model policies on Standard Infection Control Precautions (SICPs) and Transmission-Based Precautions (TBP), CDI care bundle and CDI infection control checklist - see appendix C for the full list of associated documents.

An overview of the recommendations of this guidance can be found in appendix B (Quick Reference Guide (QRG) to managing CDI in healthcare settings/in the community).

2.1 Roles and responsibilities

The recommendations set out in this document are based on the assumption that healthcare settings have infection prevention and control systems in place in line with existing guidance (see appendix C and links throughout this document).

It is also assumed that all NHS boards are working towards meeting the NHS QIS Standards on Healthcare Associated Infection [18], and that all adult care homes are working towards meeting the Regulation of Care (Scotland) Act 2001 and the National Care Standards produced by the Scottish Government and used by the Care Commission during regulatory activity. All adult care homes should also work towards the Scottish Government Infection Control Standards in Adult Care Homes: Final Standards.

Healthcare Associated Infection (HAI) Standards report:

<http://www.nhshealthquality.org/nhsqis/4099.html>

Regulation of Care (Scotland) Act 2001:

http://www.opsi.gov.uk/legislation/scotland/acts2001/asp_20010008_en_1

Scotland's National Care Standards:

<http://www.infoscotland.com/nationalcarestandards/52.html>

Infection Control Standards for Adult Care Homes:

<http://www.scotland.gov.uk/Publications/2005/03/19927/42762>

The recommended practices in this guidance should be integrated with existing infection prevention and control systems and be a part of a **comprehensive organisation-wide effort to maintain acceptable standards for infection prevention and control.**

The HPS 'Checklists for Preventing and Controlling CDI', should be used by all Senior Management and Infection Control Teams to ensure that recommended practices are implemented. This should be done on a daily, weekly or as identified basis.

The HPS 'Checklists' can be accessed at:

<http://www.hps.scot.nhs.uk/haic/sshaip/publicationsdetail.aspx?id=38848>

Chief Executives/Senior Managers:

- Ensure adherence to the recommendations of this guidance.
- Ensure an action plan and systems are in place to help staff implementing the recommended CDI prevention and control practices, including education of all medical and non-medical staff (see section 2.2.3).
- Ensure resources are sufficient to achieve infection prevention and control standards supporting the reduction of CDI throughout the organisation. This includes adequate staffing levels within infection control, surveillance and antimicrobial management teams and within ward areas; and availability of single rooms, commodes, personal protective equipment (PPE), hand washing facilities, consumables, care equipment, decontamination equipment and chlorine based solutions.
- Ensure that effective local surveillance systems are in place that allow timeous collection and feedback of data to key clinical groups that leads to early detection of rising trends, investigation of cases, and rapid implementation of interventions to reduce numbers of episodes and serious consequences due to CDI.
- Ensure systems are in place to carry out root cause analysis of severe cases of CDI and deaths using the 'CDI Severe Case Investigation Tool' (see section 2.2.2).
- Ensure reporting systems are in place to alert senior management to specific CDI issues. Reports of increased incidence/outbreak and the causes of these should be reviewed at senior management meetings. Add CDI to the risk register in ward/clinical areas where CDI occurs.
- Ensure information on adherence to antimicrobial prescribing policies and infection prevention and control measures (including audits) is reviewed at senior management meetings.
- Facilitate and support cross-representation between the Infection Control Committee and Antimicrobial Management Team.
- Facilitate and support cross-representation between infection control and bed management.

Infection Control Team (including nurses, managers, doctors, support staff and infection control key workers):

- Develop and support the implementation of local policies based on recommendations in this guidance.
- Support the implementation of Standard Infection Control Precautions and specific infection control measures, e.g. contact precautions, by all staff groups.

- Support participation in the national mandatory CDI surveillance programme in each ward.
- Support the implementation and operation of effective local surveillance systems to detect cases of CDI and changes in numbers of cases in each ward. The surveillance systems should include 'triggers for action' to prompt further investigations and interventions when situations change.
- Inform senior management when increased numbers of cases or outbreaks of CDI are occurring in ward areas – and provide information on investigations including causes of increasing numbers and non-adherence to antimicrobial prescribing and infection prevention and control practices.
- Ensure an effective communication system is in place through existing local governance and risk procedures, including reporting systems to Senior Managers and clinical staff.
- Provide expert support when introducing changes in practice as a result of new guidance and identification of CDI cases.
- Provide delivery of education on CDI prevention and control practices for all staff groups.

Ward Managers should ensure that there are safe systems in place to enable and prompt:

- All staff to follow Standard Infection Control Precautions at all times, and put in place recommended additional infection control measures (i.e. contact precautions) when CDI is suspected (or detected).
- All staff to be aware of major risk factors (see text box section 2.2.1) and symptoms of CDI.
- Stool specimens to be obtained from all patients with diarrhoea, aged 15 and over, requesting testing for *C. difficile* toxin as soon as possible, and reporting cases or suspicion of CDI to Infection Control Team as early as possible.
- The prompt isolation of patients with diarrhoea. Cooperation with the Infection Control Team to achieve effective local surveillance. The surveillance systems should detect cases of CDI and changes in the numbers of cases/incidence in the ward and have set 'triggers for action' to prompt further investigations and interventions when the situation changes.
- Investigation of all cases of CDI that result in severe disease (such as PMC, toxic megacolon or admission to ITU or deaths) by root cause analysis (RCA) using the 'CDI Severe Case Investigation Tool'.

- Feedback to senior management when increased numbers of cases or outbreaks of CDI are occurring in ward areas, and the provision of information on investigations including causes of increasing numbers and non-adherence to antimicrobial prescribing and infection prevention and control practices.
- Feedback to senior management of any specific issue that hinders the implementation of the recommendations of this guidance, including problems with facilities, equipment, resources and staffing.
- Effective antimicrobial stewardship (including stopping any non-Clostridial antimicrobial treatment, reviewing frequency and antimicrobial used for therapy and prophylaxis) is in place in conjunction with the Antimicrobial Management Team.
- Antimicrobials to be administered as prescribed following local policy.
- The maintenance of a clean ward by having cleaning schedules in place that comply with national cleaning standards (including frequency of cleaning).
- The maintenance of adequate supplies of equipment including consumables, personal protective equipment (PPE) and care equipment.
- The clean and intact maintenance of fabric and equipment, and that a programme of planned preventative maintenance is followed.
- The maintenance of adequate hand washing facilities and resources, and to communicate with senior management when these are inadequate.
- Staff to act in support for changes in practice where necessary and act on any feedback from audits and reports etc.
- Staff to use educational tools (e.g. computer based learning), or to attend educational sessions on measures to prevent and control CDI.
- Members of staff with diarrhoea or confirmed CDI to stay away from work and liaise with Occupational Health – following standard sick leave policies (see section 2.4).
- Staff to aid patients and relatives to undertake correct hand hygiene procedures, and that patients and relatives are given oral and written information about *C. difficile*.

Healthcare Workers (including medical staff):

- Should follow all policies associated with and generated on the basis of this guidance.
- Should adhere to Standard Infection Control Precautions and contact preventions as per local policy.
- Should be aware of major risk factors (see text box section 2.2.1) and symptoms of CDI in patients.
- Should obtain stool specimens for patients with diarrhoea, aged 15 years old and over, requesting testing for *C. difficile* toxin as soon as possible.
- Have the responsibility to be up to date in aspects of symptoms, management and control of CDI relevant to their position.
- Staff authorised to prescribe antimicrobial agents should adhere to local antimicrobial prescribing policy.
- Staff should not attend work if they have diarrhoea (see section 2.4 for details).

Consultants in Microbiology:

- Participate in the national mandatory CDI surveillance programme.
- Ensure that laboratory antimicrobial reporting procedures support local antimicrobial policy and stewardship.
- Ensure that diarrhoeal stool samples are tested and the results interpreted according to the national guidance on diagnosis of CDI. Ensure that stool specimens from all CDI cases are stored at -20°C for a period of three months to enable further investigations.
- Support and advise clinical staff and General Practitioners on testing, interpretation of results and treatment of CDI.
- Provide and interpret laboratory data to inform the Infection Control Team and Antimicrobial Management Team.
- Support Infection Control Teams in relation to specific CDI issues, e.g. increased number of cases/incidence, outbreaks, changes in practice.
- Support and advise Antimicrobial Management Teams on antimicrobial prescribing and implementation of stewardship.
- Feedback to senior management any issues that hinder the implementation of the recommendations of this guidance.

Antimicrobial Management Teams (AMTs):

- Ensure implementation, regular review and measurement of compliance through audit of local antimicrobial prescribing policy that minimises the use of agents associated with CDI.
- Ensure implementation and audit of policy for treatment of CDI.
- Ensure that reports on adherence to antimicrobial prescribing policies are fed back to all relevant levels within the organisation including the senior management, and to clinical staff in primary and secondary care.
- Undertake local surveillance of antimicrobial usage of key agents at hospital, directorate and ward level.
- Interpret national surveillance information on antimicrobial resistance and usage.
- Support and advise clinical staff on antimicrobial prescribing.
- Support and advise clinical staff in all wards on carrying out antimicrobial stewardship, including stopping any non-Clostridial antimicrobial treatment, reviewing frequency and antimicrobial used for therapy and prophylaxis.
- Support primary care prescribing advisers in communicating data on antimicrobial prescribing to prescribers.
- Ensure implementation of multidisciplinary educational programmes on antimicrobial stewardship and antimicrobial prescribing.

Facilities Managers:

- Ensure resources are in place to maintain equipment and fabric of buildings to meet agreed standards. Ensure programme of planned preventative maintenance is in place.
- Ensure that existing and new buildings, furniture and equipment can be easily cleaned and withstand decontamination.
- Ensure adequate and intact hand hygiene and toilet facilities are available.
- Ensure there is a safe environment to allow infection prevention and control precautions to be applied, for example intact environments and compliance with Control of Substances Hazardous to Health (COSHH) Legislation.
- Ensure systems are in place to respond promptly to defects of buildings and equipment when identified by staff or through environmental audits.
- Ensure cleaning schedules complying with national cleaning standards are in place; including frequency of cleaning.

- Ensure defined terminal cleaning protocols in place, briefed to staff and implemented when required (on a 24/7 basis).
- Feedback to senior management any issues that hinder the implementation of the recommendations of this guidance.

General Practitioners:

- Should be aware of and follow local antimicrobial guidelines for primary care in the NHS board.
- Should be aware of major risk factors (see text box on page 18) and symptoms of CDI.
- Should obtain stool specimens from any patient with diarrhoea, aged 15 years and over, in the community as early as possible and send the specimen to the local Microbiology Laboratory requesting testing for *C. difficile* toxin.
- If cases occur within an adult care home for which clinical care is provided, ensure the local management team have alerted the Health Protection Team (or Infection Control Team) within the NHS board.
- Ensure advice is sought on appropriate infection prevention and control precautions from the Health Protection Team within the NHS board.
- Within Health Centres, use appropriate infection prevention and control measures, PPE and cleaning procedures (as set out in this document) in treatment rooms and other areas when dealing with patients with diarrhoea of possibly infective cause.
- Follow the CDI treatment protocols outlined in sections 2.3.2 and 2.3.3, and seek advice from the local medical microbiologist if unsure of appropriate steps.
- Ensure that all cases of CDI that result in severe disease (such as PMC, toxic megacolon or admission to ITU or deaths) are fully investigated (by root cause analysis) using the 'CDI Severe Case Investigation Tool'.

Service Managers in adult care homes should ensure that there are safe systems in place to enable and prompt:

- All staff to follow Standard Infection Control Precautions at all times.
- The isolation of residents with sudden onset diarrhoea without delay.
- Staff to report diarrhoeal illness in residents to the manager promptly.
- Staff to put in place recommended additional infection control measures (i.e. contact precautions) when residents have a sudden onset diarrhoeal illness.

- The early detection of an increase in the number of residents with diarrhoeal illness (see section 2.2.12).
- The early provision of infection control advice from the Health Protection Team/Care Home Infection Control Advisor when local monitoring identifies an increased number of residents with diarrhoeal illness or infection control advice is required regarding sporadic cases (2.2.12).
- Managers/senior staff to be aware of major risk factors (see text box section 2.2.1) and symptoms of CDI.
- The maintenance of adequate hand washing facilities and resources, and to communicate with senior management when inadequate.
- Staff to aid residents and relatives to undertake correct hand hygiene procedures.
- Antimicrobials to be administered as prescribed following local policy.
- The maintenance of adequate supplies of equipment including consumables, personal protective equipment (PPE) and care equipment.
- Provision of a clean and safe environment which includes following cleaning schedules and a programme of planned preventative maintenance.
- Staff to use educational tools (e.g. computer based learning), or to attend educational sessions on infection control.
- Provide active support for changes in practice where necessary and action on any feedback from audits and reports etc.
- Staff awareness of absence policies including that they should not attend work with a sudden onset diarrhoeal illness (diarrhoea is defined as the passage of 3 or more loose or liquid stools per day, or more frequently than is normal for the individual (see section 2.2.4)).

Health Protection Teams:

- Provide infection control advice to community facilities as required.
- Develop and support the implementation of local policies.
- When alerted to an increased number of cases of CDI in adult care homes the Health Protection Team (HPT) should initiate further investigations in collaboration with the residential facility/primary care staff and General Practitioner (see section 2.2.12).

2.2 Prevention and control of CDI

2.2.1 Early diagnosis

Early diagnosis is essential for preventing and controlling CDI in the healthcare setting.

This guidance does not provide guidance for diagnostic laboratories. Details on laboratory testing can be obtained in the protocol for the Scottish CDI surveillance programme:

<http://www.hps.scot.nhs.uk/haic/ssaip/guidelinedetail.aspx?id=40899>

Below are listed key measures that should be in place in all settings.

Case definition of CDI (as in the Scottish CDI Surveillance protocol):

Someone in whose stool **C. difficile** toxin has been identified at the same time as they have experienced diarrhoea not attributable to any other cause, or someone from whose stool *C. difficile* has been cultured at the same time as they have been diagnosed with PMC (pseudomembranous colitis).

Diarrhoea is defined as the passage of 3 or more loose or liquid stools per day, or more frequently than is normal for the individual.

(NB: the frequent passing of formed stools is not diarrhoea.)

Guidance on how to take faecal samples can be accessed from:

<http://www.hps.scot.nhs.uk/haic/ic/guidelinedetail.aspx?id=40364>

- Stool specimens should be obtained as soon as possible after onset of symptoms (i.e. diarrhoea) from patients in healthcare settings and from patients admitted to healthcare settings with diarrhoea (IB). Laboratory testing should be available 7 days a week.
- Toxin testing should only be performed on diarrhoeal stool specimens (a diarrhoeal specimen is a specimen of faeces that conforms to the shape of its container) (IB).
- Exclude other causes of diarrhoea before giving the diagnosis CDI (following the case definition of CDI). Seek advice from the infectious disease doctor or consultant microbiologist.

- Norovirus infection is not a reason to exclude CDI as diagnosis, as co-infection with norovirus and *C. difficile* is possible [19, 20]. Norovirus infection may predispose the patient for developing CDI as the normal gut flora is disturbed by the norovirus infection. When a patient has tested positive for both *C. difficile* toxin and norovirus a clinical assessment is required to determine the most likely diagnosis.
- Stop repeated testing as soon as CDI has been diagnosed. Only when a recurrence of CDI is suspected, repeat the toxin testing and exclude other potential causes of diarrhoea (IB).
- Clearance testing (i.e. test of cure) should not be performed (IA).

Please note that a toxin testing result in itself cannot be interpreted without simultaneous assessment of patient symptoms (as per case definition above).

- Stool specimens from all CDI cases should be stored by the laboratory at -20°C for a period of three months; in particular, from those with a) severe CDI, or b) in suspected outbreak situations so that culture and typing can be performed retrospectively, if necessary (IB).

Major risk factors for CDI:

Certain patients are at increased risk of acquiring CDI. The possibility of CDI should be considered when patients with diarrhoea also have:

- Current or recent use of antimicrobial agents
- Increased age
- Prolonged hospital stay
- Serious underlying diseases
- Surgical procedures (in particular bowel procedures)
- Immunocompromising conditions
- Use of proton pump inhibitors

Symptomatic CDI patients are believed to be the major source of *C. difficile* transmission and are associated with high rates of environmental contamination.

- Testing of stool specimens from asymptomatic patients is not recommended (IB).
- Screening is not recommended (no evidence supports screening).

For initiation of treatment for CDI see section 2.3.

2.2.2 Surveillance

Surveillance is strongly recommended as a tool for monitoring, preventing and controlling CDI. Surveillance is used to identify increases in CDI incidence and/or severity at an early stage.

In an endemic situation, surveillance data may reveal elevated baseline rates in a ward or unit of a healthcare setting, or significant variation between wards or units. This requires investigation and change in practise to reduce the numbers of cases.

Since October 2006, surveillance has been mandatory in Scotland in persons aged 65 years and over, presenting with diarrhoea in the healthcare setting. From April 2009, this has been extended to include all persons aged 15 years and over. Data from the mandatory surveillance should be reported to Health Protection Scotland (HPS) by the diagnostic laboratories.

The Scottish protocol for CDI surveillance is a supplement to this guidance:

<http://www.hps.scot.nhs.uk/haic/sshaip/guidelinedetail.aspx?id=40899>

National and local surveillance serve different purposes

The national surveillance identifies overall trends for the 14 Scottish NHS boards and for Scotland overall, and is intended to support the long-term planning and implementation of interventions and monitor their impact.

Local surveillance is intended to monitor the specific number of cases by ward, unit or facility, and disease severity in real-time (i.e. daily or weekly at least) to prompt immediate action when an increased number of cases or increased disease severity has been observed.

Specific recommendations on surveillance are:

- All healthcare facilities should have local surveillance systems in place and participate in the national surveillance programme (IB).
- Ensure appropriate prompt diagnostic testing of patients with an acute diarrhoeal illness not otherwise explained (IB).
- Determine the ward-, unit- or facility-specific baseline incidence of CDI by reviewing cases of recent and previous periods (IB).
- Define a threshold incidence (or frequency) of CDI cases that would trigger implementation of additional infection control measures (interventions) (IB).
- Be alert to changes in the incidence (or frequency), complications (including recurrences) or severity that may indicate the introduction of new strains.

Local surveillance systems

From the above recommendations it follows that local surveillance systems should have the following elements :

- a) The incidence (or frequency) of CDI should be monitored in all 'clinical areas' clearly defined by ward, unit or facility (or other meaningful clinical divisions). The baseline incidence should be available for each clinical area.
- b) Denominators should be defined as all patients at risk of CDI at any given time in each clinical area.
- c) The severity of each case of CDI should be monitored (see guidance on severity below).
- d) Risk factors should be identified for each case of CDI.
- e) Deaths in which CDI is either the primary cause or contributory factor should be monitored.
- f) A 'trigger for action' (see definition below) should be set for each clinical area.
- g) Each case of CDI should be assessed with regards to acquisition of disease (i.e. was CDI acquired in the community or in this/other healthcare facility) (see section 2.2.12 Figure 2).

Feedback of surveillance data and its interpretations to all relevant persons in the healthcare organisation via the established communication system is essential to preventing and controlling CDI.

Triggers for action at local level

The local surveillance system should have a trigger (i.e. a threshold) that prompts immediate actions and interventions to control CDI. The trigger should contain the incidence and severity of CDI.

Definition of 'triggers for action':

When cases occur at a rate exceeding the normal **number of cases** for the unit, ward or facility during a specified period of time, or when disease occurs at increased severity, **immediate actions and interventions should be introduced.**

There is not one trigger that will fit all healthcare settings. For smaller hospitals/healthcare facilities, it may be appropriate to set triggers based on the number of cases within a set time-period. For larger institutions, statistical process control (SPC) charts may form the basis of a trigger, particularly for wards and specialties with high numbers.

The HPS 'Information on SPC charts' provides information on how to construct and use SPC charts.

<http://www.hps.scot.nhs.uk/haaic/ic/publicationsdetail.aspx?id=42507>

When a trigger has been breached, this may indicate either natural variation in the number of cases or that there may be a developing problem within the healthcare facility. An investigation should be initiated including assessment of patients and their management, infection control and antimicrobial prescribing to establish the cause.

The HPS 'CDI Trigger Tool' can assist in this process.

<http://www.hps.scot.nhs.uk/haaic/ic/publicationsdetail.aspx?id=42508>

Severe CDI and death associated with CDI

When severe CDI or deaths associated with CDI occur:

A single case of severe CDI or a single death due to CDI should always prompt further investigations.

The clinical team responsible for the care of the patient should carry out an investigation into the reasons leading up to the infection, using root cause analysis as outlined in the HPS/QIS 'CDI Severe Case Investigation Tool'.

Severe CDI, and deaths associated with CDI, should be included as part of all morbidity and mortality conferences and other case review conferences, held by clinicians on a regular basis as a means of sharing lessons learned, to reduce the risk of patients acquiring CDI in the future.

When assessing the severity of individual CDI cases it is recommended that the following guidance is adhered to (see box below):

Guidance on severity of CDI

Mild CDI is not associated with a raised white blood cell count (WBC); it is typically associated with mild diarrhoea (3 loose or liquid stools per day or more frequently than is normal for the person) and no systemic symptoms.

Moderate CDI is associated with a raised WBC that is <15 cell/mm³; it is typically associated with moderate diarrhoea (typically 3 or more loose or liquid stools per day or more frequently than is normal for the person) and some systemic symptoms.

Severe CDI is when a patient has two or more severity markers, e.g., temperature $> 38.5^{\circ}\text{C}$, WBC > 15 cells/mm³, creatinine > 1.5 x baseline, etc. For further guidance on severity see algorithm 1 on pg 43.

Life-threatening CDI includes hypotension, partial or complete ileus or toxic megacolon, or CT evidence of severe disease.

Healthcare staff may find it useful to use the Bristol Stool Chart [21] to assess the severity of diarrhoea (see appendix D).

Laboratories should culture *C. difficile* from all severe cases and submit isolates to the reference laboratory.

Escalation of reporting

Once a hospital infection incident related to CDI has been identified (i.e. trigger has been exceeded), it should be assessed by a member of the Infection Control Team using the Watt Risk Matrix [22] (currently under review). If this assessment identifies that the incident is higher than Green, then the incident should be reported to the Scottish Government Health Department (SGHD), by a member of the Infection Control Team.

The healthcare associated infection (HAI) outbreak/incident risk matrix can be accessed at (on page 73):

<http://www.scotland.gov.uk/Resource/Doc/47021/0013914.pdf>

If during investigation of CDI incident it is found that one or more patient meets the definition of a severe case then the HPS/QIS 'CDI Severe Case Investigation Tool' should be completed. No link is currently available for this document, it has been distributed by the Healthcare Associated Infections Task Force (HAI Task Force) to the NHS boards.

2.2.3 Education

Education of healthcare staff is one of the most effective measures to limit the spread of *C. difficile* [2].

All medical staff including physicians, nurses, healthcare professionals in primary and community based teams, support and auxiliary and also non-medical staff, in particular those involved in cleaning, must receive education on all aspects of CDI.

The education should include information on:

- Basic pathogenic mechanisms of *C. difficile*.
- Potential reservoirs.
- Route of transmission.
- Contamination of the environment.
- Decontamination of surfaces and equipment.
- Hand hygiene.
- Use of personal protective equipment.

Undertaking the NES Cleanliness Champions Programme covers the underpinning elements of infection prevention and control:

<http://www.nes.scot.nhs.uk/hai/champions/>

The single recommendation on education is:

- Everyone, including healthcare workers and visitors, who enters a symptomatic CDI patient's environment should be educated about the clinical features of transmission and epidemiology of CDI (IA).

The Royal Environmental Health Institute of Scotland (REHIS) provides courses on control of infection. Information can be accessed at:

http://www.rehis.org/uploads/attachments/1248786636__REHIS21-1Spring2009WebVersion.pdf

For visitors and patients, this means basic information on what CDI is and what measures should be taken by them to prevent the spread of *C. difficile*.

HPS information leaflets on *Clostridium difficile* infection for hospital patients and visitors; clients and visitors of care homes; and home laundering of patient items can be accessed at:

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=38654>

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=39108>

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=39120>

2.2.4 Isolation precautions

The spread of hardy spores of *C. difficile* via contact plays an important role in the transmission of CDI in healthcare facilities. Isolation of symptomatic CDI patients is a key step in preventing the transmission of *C. difficile* within healthcare facilities.

Isolation should be implemented in conjunction with the infection prevention and control measures to minimise the risk of spread to other vulnerable groups.

Existing model policies on Standard Infection Control Precautions (SICPs) and contact precautions (as part of Transmission-Based Precautions policies) should be followed to prevent the transmission of *C. difficile*.

HPS model policies on SICPs are available at:

<http://www.hps.scot.nhs.uk/haiic/ic/standardinfectioncontrolprecautions-sicps.aspx>

HPS contact precaution policy and procedure - Transmission-Based Precautions (TBP) is available at:

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=37303>

Specific recommendations for placement of patients with confirmed or suspected CDI are:

- Symptomatic patients with CDI represent a source of pathogens which can be transmitted to others, and should therefore be nursed in single rooms (i.e. isolation) whenever possible (IB).
- A designated toilet or commode (transportable toilet) should be provided for each patient with CDI (IB).

The isolated patient should preferably be nursed in a single-bedded room with hand washing facilities, en-suite toilet, dedicated care equipment and the door kept closed. Personal protective equipment should be put on before entering the isolation room (or area) with symptomatic CDI patient(s). Isolation of patients with CDI requires additional measures for hand hygiene and environmental decontamination described elsewhere in this guidance.

- If isolation in single rooms is not possible, isolation in cohorts should be undertaken (IB).
- Cohorted patients should be managed by designated staff, where possible, to minimise the risk of infection to other patients (or staff) (IB).
- Isolation precautions may be discontinued when the patient has been symptom-free for 48 hrs and bowel movements have returned to normal (II).
- Symptomatic CDI patients should not be moved between wards for bed management reasons to minimise the risk of cross-contamination (HPA 5.7) [23] (IB).

Isolation is an important measure to prevent transmission, but it is also important to recognise that patients in isolation may suffer detrimental effects as a consequence. Isolation can cause a patient's care experience to be one filled with anxiety and fear. Whenever patients are isolated the care team must ensure that both their physical and psychological needs, as a consequence of CDI and CDI isolation, are fully recognised and met.

2.2.5 Hand hygiene

The spread of *C. difficile* spores via direct and indirect contact is the major route of transmission of CDI in healthcare facilities.

Principles in the HPS model policies on hand hygiene and contact precautions should be followed. These can be accessed at:

<http://www.hps.scot.nhs.uk/haiic/ic/modelinfectioncontrolpolicies.aspx>

Further information for members of the public can be accessed at:

<http://www.washyourhandsofthem.com>

Specific recommendations for hand hygiene as a control measure to reduce the transmission of CDI are listed below.

- Meticulous hand washing with liquid soap and water is recommended for all staff after contact with body substances (including faeces), or following any other potential contamination of hands, e.g., contact with the environment in which a CDI patient is being nursed, when caring for known CDI patients (IB).
- Washing of hands using liquid soap and water is recommended after removal of gloves and aprons (IB).
- Alcohol-based hand rubs are not effective in removing *C. difficile* spores from hands and should therefore not be the only hand hygiene measure when caring for suspected or confirmed CDI patients (IB).
- Patients and visitors should be strongly encouraged to wash their hands with liquid soap and water, especially before eating, after using the toilet [24], and when entering and leaving the healthcare facility.

The use of liquid soap and water and the physical action of rubbing and rinsing is the only way to remove *C. difficile* spores from hands [12, 25].

2.2.6 Personal protective equipment (PPE)

Principles in the HPS model policies for the correct use of PPE and contact precautions should be followed. These can be accessed at:

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=31221>

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=37303>

Specific recommendations for use of PPE when caring for patients who have diarrhoea/symptomatic CDI patients are listed below.

- All staff should wear disposable gloves for contact with patients who have diarrhoea; this includes contact with body substances and contaminated environment, including the immediate vicinity of the patient (IB).

The appropriate use of gloves prevents the spread of *C. difficile* in the hospital/care environment and protects members of staff from contamination with spores [26-28].

Contamination of hands may occur during removal of contaminated gloves [29]. Therefore hand hygiene remains vital regardless of previous glove use (see section 2.2.5).

- Disposable plastic aprons should always be used for managing patients who have diarrhoea (IB).

Use of plastic aprons represents an additional step in Standard Infection Control Precautions to prevent contamination of regular working clothes. Uniforms (or gowns) have been found to be *C. difficile* positive even before duty, as laundry does not always eliminate spores [30]. The use of a disposable, fluid-repellent gown may be appropriate in order to gain fuller body protection in situations where environmental contamination may be present.

2.2.7 Environmental cleaning

Environmental contamination occurs as a result of *C. difficile* spores being expelled into the environment when patients have diarrhoea with large amounts of liquid stools or faecal incontinence. Heavy contamination can be found on floors, toilets, commodes and beds.

When spores have been spread in the environment they may persist for months or years due to their resistance to disinfecting agents, drying and heat.

Principles in the HPS model policies on 'Management of Blood and Body Fluid Spillages', 'Control of the Environment' and 'Contact Precautions' should be followed.

These policies can be accessed at:

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=31222>

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=31229>

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=37303>

There is good evidence that environmental contamination plays a role in the transmission of *C. difficile* [31, 32].

Specific recommendations for areas with CDI patients are listed below.

- Regular environmental disinfection of rooms/areas of CDI patients (including frequently touched objects (and surfaces) such as tables, chairs, telephones, door handles and hand sets, e.g., call bells and bed controls) should be undertaken using sporocidal agents with 1000 ppm hypochlorite (IB).
- Hospital wards (and other settings where CDI patients are cared for) should be cleaned regularly (at least once a day) concentrating on frequently touched surfaces (IB).
- Staff with responsibility for cleaning should be notified immediately when environmental faecal contamination has occurred. Cleaning (and decontamination) needs to be undertaken as soon as possible (IB).

- Toilets, commodes and items which are likely to be contaminated with faeces should be cleaned meticulously after use (IB).
- After discharge of a CDI patient, the patient area/room should be cleaned and disinfected thoroughly (IB).
- Culture of *C. difficile* from environmental samples is not recommended for routine monitoring of environmental contamination.

An increase in the frequency of environmental cleaning must be considered if patients are experiencing diarrhoea.

Products containing a combination of a detergent and hypochlorite are considered the most effective, as hypochlorite alone is not suitable for removing organic matter.

For equipment, for example electrical items, that cannot withstand hypochlorite, use other chemical cleaning agents approved by the Medicines and Healthcare products Regulatory Agency (MHRA).

Equipment such as mops and buckets used for cleaning should be labelled (colour coded) and dedicated to rooms/areas of CDI patients.

There is currently no evidence suggesting that agents with higher concentrations of hypochlorite (above 1000 ppm) are more effective at reducing environmental contamination. Corrosion of metal objects (and surfaces) is more likely at higher concentrations of hypochlorite, and vapours can cause respiratory problems. Therefore, the use of concentrations of hypochlorite above 1000 ppm is not recommended.

2.2.8 Use of care equipment

Spores of *C. difficile* can be transmitted from patient to patient via contact with contaminated care equipment. Care equipment can in some instances be the single source of transmission of *C. difficile* within a unit.

Principles in the HPS model policies on 'Management of Care Equipment' and 'Contact Precautions' should be followed. These can be accessed at:

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=31226>

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=37303>

Recommendations for care equipment used for CDI patients are listed below.

- Care equipment (such as commodes, blood pressure cuffs and stethoscopes) should be dedicated to a single patient (IB).
- All care equipment should be carefully cleaned and disinfected using a sporocidal agent (with 1000 ppm hypochlorite) immediately after use on a CDI patient (IB).

Rectal thermometers play a significant role in transmission of *C. difficile*. Even electronic thermometers with disposable sheaths are sometimes contaminated with *C. difficile* [33]. Change to tympanic or disposable rectal thermometers has been associated with 40-50% risk reductions [33, 34].

- Rectal thermometers should not be shared, and use of electronic thermometers with disposable sheaths should be avoided (IA).
- Single-use items (including thermometers and other care equipment) should be used when possible (IB).

Even though there have been no reports of endoscopes transmitting *C. difficile*, endoscopes can become contaminated after use in CDI patients [35]. National guidance on 'Endoscope Reprocessing' should be followed:

<http://www.hps.scot.nhs.uk/Search/guidedetail.aspx?id=31261>

2.2.9 Safe management of linen and waste

It is important that linen and waste which could be contaminated with *C. difficile* spores is managed safely. This includes the use of the appropriate receptacle, PPE and hand hygiene. Soiled linen should be sent labelled as 'infected'.

Principles in the HPS model policies on 'Safe Management of Linen Policy and Procedure' and 'Contact Precautions' should be followed. These can be accessed at:

<http://www.hps.scot.nhs.uk/haic/ic/guidelinedetail.aspx?id=31230>

<http://www.hps.scot.nhs.uk/haic/ic/guidelinedetail.aspx?id=37303>

2.2.10 Antimicrobial stewardship

Use of antimicrobial agents, for therapy or prophylaxis, is the most important predisposing factor for developing CDI.

Exposure to antimicrobial agents leads to disturbance of the normal gut flora, allowing *C. difficile* to proliferate and reach high densities in the colon and cause infection.

Good antimicrobial stewardship should always be promoted as standard in combination with other infection prevention and control measures. Good antimicrobial stewardship minimises the antimicrobial exposure of patients in healthcare settings (and elsewhere) and thereby reduces the number of patients predisposed to CDI, even if *C. difficile* transmission occurs.

The general recommendations for good antimicrobial stewardship given in the 'Antimicrobial Prescribing Policy and Practice in Scotland' [36] should be followed:

<http://www.hps.scot.nhs.uk/haic/ic/guidelinedetail.aspx?id=38553>

In addition, the more specific recommendations given in the 'Guidance to Optimise Antibiotic Use and Reduce CDI in Scottish Hospitals' [37] should also be followed. This document can be accessed at:

<http://www.documents.hps.scot.nhs.uk/hai/sapg/sapg-cdad-v1-2008-07.pdf>

In particular, note should be taken of the role of Antimicrobial Management Teams (AMT) in promoting good antimicrobial practice.

Specific recommendations on good antimicrobial stewardship to limit the spread of *C. difficile* include:

- Stop any non-*Clostridial* antimicrobial treatment in patients with CDI as soon as possible (IA).
- Perform good antimicrobial stewardship. Review **frequency, duration** and type of **antimicrobial used**, and avoid the use of high-risk agents (e.g. cephalosporins, broadspectrum penicillins, fluoroquinolones and clindamycin) in patients at risk. Use these agents only when medically needed (IB).
- Audit and feedback are efficient tools in changing the prescribing habits of medical and nursing staff [38] (IA).ⁱ

ⁱ This recommendation is from IDSA-SHEA guidelines on stewardship.

- Antimicrobial prophylaxis should not be continued beyond 24 hours following an operative procedure [39]. AMTs should audit administration of surgical prophylaxis [37] (1A).

Recording of compliance with this recommendation should be undertaken as part of the routine data collection for the mandatory surgical site infection surveillance.

The Scottish Intercollegiate Guidelines Network (SIGN) guideline on 'Antibiotic Prophylaxis in Surgery' (SIGN 104) can be accessed at:

<http://www.sign.ac.uk/pdf/sign104.pdf>

Recommendations for the development of institutional antimicrobial stewardship programs have been published by the Infectious Diseases Society of America (IDSA) and the Society of Healthcare Epidemiology of America (SHEA) in 2007 [38].

In principle any antimicrobial agent can predispose for CDI, but some agents have been more frequently implicated in CDI than others [40].

High-risk antimicrobial agents:

- 3rd generation cephalosporins (ceftriaxone, cefotaxime)
- broadspectrum penicillins
- clindamycin
- fluoroquinolones

Improved use of antimicrobial agents in hospital can be achieved by defining 'alert antimicrobial agents' that require authorisation for use from either a pharmacist or microbiologist [41].

Surveillance of hospital consumption of (as a minimum) the high-risk agents, by pharmacists in close cooperation with microbiologists, is recommended [42, 43].

Control measures during an outbreak are the same as for individual cases.

There is evidence that concurrent implementation of key infection control measures and antimicrobial stewardship can lead to a reduction in CDI incidence [44].

2.2.11 Specific measures in CDI outbreaks

The key to reducing risk of infection (or controlling an outbreak) is prevention of transmission of *C. difficile* in conjunction with reducing the number of susceptible patients by antimicrobial stewardship.

When an increased number of cases of CDI is identified, the infection control strategy should be informed by risk assessment that takes into account the background epidemiological pattern and the risk status of the patients involved.

Outbreaks require immediate action!

All infection control measures adhered to in non-outbreak situations need to be strengthened. Local policy for outbreak management should be followed.

Key measures in outbreak situations are:

- Infection control staff should always be informed where there is an increased number (or severity) of CDI cases (IB).
- All contact precautions should be reinforced in case of an outbreak (IB).
- Review standard of environmental cleaning to ensure high quality and frequency of decontamination (II).
- Perform good antimicrobial stewardship. Antimicrobial prescribing (frequency, duration and type of drugs) should be reviewed as soon as possible with emphasis on avoiding the use of high-risk drugs (including 3rd generation cephalosporins, broadspectrum penicillins, fluoroquinolones and clindamycin) (IB) (see also section 2.2.10).
- Faecal samples should be stored (at -20°C), so that they can be cultured and typed retrospectively if necessary (IB).
- In order to elucidate the epidemiology of *C. difficile*, isolates from CDI cases should be compared by molecular methods (IB).
- Implement interim policies for patient admission, placement and staffing as needed to prevent *C. difficile* transmission (IB).
- Isolation precautions should be implemented (see section 2.2.4) (IB).
- When transmission continues despite isolation of patients and assignment of dedicated staff, close the unit or facility to new admissions (IB).
- When transmission continues despite all of the above measures (e.g. re-opened unit), vacate the unit for intensive environmental cleaning to eliminate all potential reservoirs of *C. difficile* (II).

Antimicrobial management during outbreaks (see also section 2.2.10)

Stop any non-*Clostridial* antimicrobial treatment in patients with CDI as soon as possible (IA).

Review **frequency, duration** and **type of antimicrobial**, and avoid the use of high-risk agents (e.g. cephalosporins, broad-spectrum penicillins, fluoroquinolones and clindamycin) in patients at risk. Use these agents only when medically needed (IB).

Carry out audits of antimicrobial treatments (including appropriate/inappropriate use of antimicrobial agents against given indications) and feedback the results to medical and nursing staff with prescribing rights [38] (IA).ⁱ

ⁱ this recommendation is from IDSA-SHEA guidelines on stewardship.

2.2.12 CDI in the community

This section of the guidance provides advice on prevention and control of CDI in community settings.

Please note that roles and responsibilities for Service Managers in adult care homes, Health Protection Teams and General Practitioners are outlined in section 2.1.

Community settings (in this document) include:

- Private residences
- Day care centres
- Adult care homes

Early diagnosis

Early diagnosis is essential for preventing and controlling CDI in the community.

Healthcare staff working in community settings should be aware that certain people are at increased risk of developing CDI. The possibility of developing CDI should be considered when persons with diarrhoea also have one or more of the following risk factors:

- Current or recent (within at least the past 12 weeks) use of antibiotics
- Increased age
- Prolonged current or recent hospital stay
- Serious underlying diseases/poor physical health
- Surgical procedures
- Immunocompromising conditions
- Use of proton pump inhibitors (gastric acid reducing agents)

When persons in the community have severe diarrhoea (and fever/other symptoms) and any of the risk factors listed above, admission to hospital should be considered as early as possible.

The Bristol Stool Chart [21] (appendix D) may assist in assessing the bowel movement.

Definition of diarrhoea:

Diarrhoea is defined as the passage of 3 or more loose or liquid stools per day, or as more frequently than is normal for the individual (WHO).

- Stool specimens should be obtained from any person with diarrhoea, aged 15 years or over, in the community as early as possible (IB). The stool specimen should either be delivered immediately, or posted to the General Practice, or posted to the Laboratory on the same day it was collected.

Instructions on when and how to obtain a faecal (stool) specimen from a patient/resident can be accessed at:

For patients/residents or carers at home:

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=40383>

For healthcare staff:

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=40382>

Cases of CDI in the community should be identified according to the Scottish CDI case definition.

Case definition of CDI:

A case of CDI is defined as someone in whose stool *C. difficile* toxin has been identified at the same time as they have experienced diarrhoea not attributable to any other cause.

- Exclude other causes of diarrhoea before giving the diagnosis CDI (following the case definition of CDI).
- Norovirus infection is not a reason to exclude CDI as diagnosis, as co-infection with norovirus and *C. difficile* is possible. In some cases norovirus infection can predispose the person to developing CDI as the normal gut flora is disturbed by the norovirus infection. When a person has tested positive for both *C. difficile* toxin and norovirus, a clinical assessment is required to determine the most likely diagnosis.

Monitoring CDI

- Residential facilities in the community, such as adult care homes, should have, or create, a system for recording all cases by date and location to aid recognition of an increased number of cases (i.e. incidence) of CDI or an outbreak in a facility (adapted from HPA 9.5 [23]). The recording of cases may be a part of an existing incident or infection monitoring programme.
- When two or more cases have occurred within 28 days in the same area of the facility the manager should report this to the NHS board Infection Control Team or Health Protection Team (adapted from HPA 9.6 [23]).
- When a facility in the community has observed an increased number of CDI cases, further investigations should be initiated in collaboration with the NHS board Health Protection Team (or in some areas, the NHS board Infection Control Team).

For further information, see section below on 'Investigation of CDI cases in the community'.

Use of antibiotics and proton pump inhibitors

Use of antimicrobial agents (for therapy or prophylaxis) is the main

predisposing factor for developing CDI. Prolonged use of proton pump inhibitors and other agents may also predispose for CDI.

'Prudent use' of antimicrobial agents is the single most important factor in preventing CDI in the community (see also section 2.2.10 on Antimicrobial Stewardship).

- Prescribers in the community setting should follow local guidance on prescribing antibiotics in the community (usually issued by the NHS board) (HPA 9.11 [23]).
- Proton pump inhibitors should only be used when there is a clear indication (HPA 9.11 [23]).

Infection control

Guidance on 'Infection Prevention and Control Guidance for NHS and non-NHS Community and Primary Care Settings' can be accessed from:

<http://www.hps.scot.nhs.uk/haic/ic/publicationsdetail.aspx?id=42152>

Private residences

- Where a symptomatic CDI patient is in their own home (private residence), the risks to others are minimal, given good environmental and personal hygiene and thorough hand washing after using the toilet. NHS staff and social carers providing care in the home should adhere to Standard Infection Control Precautions (SICPs).

Day care centres

- Persons with diarrhoea should not attend any communal group, including day care centres, until they have been symptom free for at least 48 hours.
- Day care centres should follow SICPs at all times. Further infection control advice can be sought from local Health Protection Teams (HPTs)7.

Adult care homes

- Where a resident in an adult care home is diagnosed with CDI, the manager should immediately notify the local HPT who will advise on enhanced infection control measures. There may be situations where the local HPT contacts the adult care home, as they have been notified about the infected resident(s) by a local General Practitioner or laboratory.

Contact precautions

Symptomatic CDI patients shed hardy spores of *C. difficile* via their stools into the environment. The spores can resist various detergents and disinfectants (and heat), and are able to survive for months to years in the environment. *C. difficile* is transmitted between persons when the spores are picked up from the environment (and ingested), either by direct contact with an infected or contaminated person or by indirect contact with a contaminated surface. Thorough hand hygiene and environmental hygiene are essential measures to minimise the spread of *C. difficile* (see section 1.2).

Adhering to contact precautions prevents the spread of *C. difficile* to others in adult care homes.

- Staff in care homes should wear disposable gloves and disposable aprons for all contact with persons with diarrhoea (HPA 9.8 [23]).
- After contact staff should dispose of the gloves and aprons, and wash their hands with liquid soap and water whether or not their hands are visibly soiled (HPA 9.8 [23]).
- If possible, persons with diarrhoea and/or confirmed CDI should be nursed in single rooms (IB).

Healthcare staff in the community should inform visitors and relatives of persons with CDI about the disease, how it is transmitted, and how they can protect themselves and others from getting infected.

The HPS leaflet on '*Clostridium difficile* infection: Information for Clients and Visitors of Care Homes' can be accessed at:

<http://www.hps.scot.nhs.uk/haic/ic/guidelinedetail.aspx?id=39108>

Environmental cleaning

Contamination of the environment with *C. difficile* spores occurs as a result of CDI, especially if patients/residents have large amounts of liquid stool or stool incontinence. Susceptible persons in the community can ingest *C. difficile* spores picked up from the environment and develop CDI (and persons recovered from previous episodes of CDI can get re-infected by picking up new spores).

Keeping facilities in the community clean by adhering to strict cleaning protocols can prevent and reduce transmission of *C. difficile* between residents (or patients), carers and staff members.

- Rooms/areas with symptomatic CDI patients should be cleaned thoroughly at least once a day concentrating on frequently touched surfaces (including tables, chairs, telephones, door handles, telephones, call bells and bed controls) (IB).
- Toilets, commodes and items which are likely to be contaminated with faeces should be cleaned meticulously after use (IB).

Most commonly used household detergents do not kill the *C. difficile* spores. The use of warm water and detergent physically remove faecal matter, but cleaning with detergents only is insufficient for environments contaminated with *C. difficile* [45]. Areas with symptomatic CDI patients should therefore be frequently disinfected with sporocidal products containing bleach.

- After cleaning with warm water and detergent, hard surfaces in residents room(s) and toilet (including frequently touched objects such as tables, chairs, telephones, door handles, telephones, call bells and bed controls), that will tolerate bleach, should be wiped with a bleach (hypochlorite) based disinfectant diluted to 1000 ppm (IB).
- Consider using a carpet cleaning machine that injects hot water and detergents into the carpet and vacuum the water into a tank. This will remove solid matter [46]. Dilute bleach (1000 ppm) can be used to disinfect hard flooring surfaces.

Corrosion of metal objects (and surfaces) is more likely to occur at higher concentrations of hypochlorite, and vapours can cause respiratory problems. Therefore, the use of concentrations of hypochlorite above 1000 ppm is not recommended. Soft furnishing may be able to be steam cleaned.

Risk assessment of the use of bleach should take into consideration the general health and risk factors of the co-residents/co-patients and health and safety of the staff in the community facility.

Staff illness

- Staff in the community who have diarrhoea should not work until they have been symptom-free for at least 48 hours. If CDI is confirmed and treated, the staff should not return to work until treatment is completed and symptoms (i.e. diarrhoea) have been absent for at least 48 hours (see also section 2.4).

Investigation of CDI cases

This **section is directed at NHS board Infection Control Teams and Health Protection Teams** that have been contacted by an adult care home or other facility in the community for assistance (see also section above on 'Monitoring CDI').

- When an increase in the number of cases (or severity) of CDI is detected investigations of the cases identified in the community should be initiated (adapted from HPA 9.4 [23]).
- Clusters of cases (or outbreaks) of CDI should be investigated in the same way as in the acute setting (HPA 9.7 [23]).
- The local Health Protection Team, Infection Control Team and primary care staff should jointly prepare local protocols on the investigation and management of cases according to national guidance (HPA 9.10 [23]).

The investigations should contain the following elements:

- Local Health Protection Team/Infection Control Team should identify where the patient **was when the stool specimen was taken** (adapted from HPA 9.2 [23]).
- Local Health Protection Team/Infection Control Team should for each case obtain information on:
 - 1) Hospital stays within the past 12 weeks.
 - 2) Current or recent use of antibiotics (within at least the past 12 weeks).
 - 3) Clinical diagnosis of other underlying or chronic diseases.
 - 4) Severity of CDI (mild, moderate or severe).
- Based on patient location and history of hospitalisation in the past 12 weeks cases can be categorised into one of three categories: community associated CDI, healthcare associated CDI or unknown CDI cases (see definitions below and Figure 2).
- Understanding the source and causes of the *C. difficile* infections can help targeting efforts to reduce infections (HPA 9.4 [23]).

Definition of community associated CDI

This is a CDI patient with onset of symptoms while outside a hospital and without discharge from a hospital within the previous 12 weeks – or with onset of symptoms within 48 hours following admission to a hospital without stay in a hospital within the previous 12 weeks (European definition [15]).

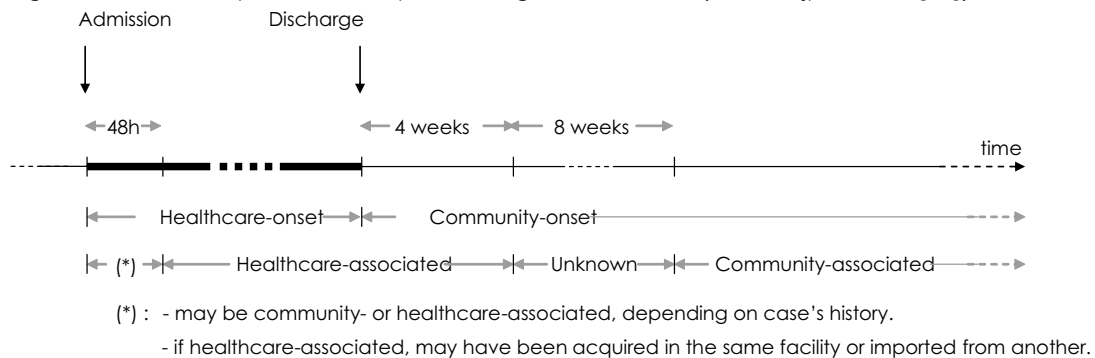
Definition of healthcare associated CDI

Healthcare associated CDI is defined as when a CDI patient has had onset of symptoms at least 48 hours following admission to a hospital or up to 4 weeks after discharge from a hospital (European definition [15]).

Definition of an unknown cases of CDI

This is a CDI case who was discharged from a healthcare facility 4–12 weeks before the onset of symptoms (European definition [15]).

Figure 2. Relationships between epidemiological definitions (as in Kuijper et al. [15])



2.3 Best practice on antimicrobial treatment of CDI

Though not formally considered an element of infection prevention and control measures, advice on antimicrobial treatment of CDI is given in this document.

2.3.1 Treatment and management of CDI

Advice on treatment and management of CDI is based on a combination of evidence based recommendations and expert consensus.

Due to the complexity of CDI and its concurrence with other conditions, most clinical trials on CDI treatment are associated with many confounding factors, and unambiguous conclusions are therefore difficult to make. Furthermore, patient safety issues related to experimental treatment of an already very frail patient population makes randomised prospective clinical trials very difficult to conduct.

The best practice on treatment of CDI presented in this document is primarily based on recent literature reviews by Gerding et al. [40] and the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) guidance document on *Clostridium difficile* Infection (CDI) Diagnosis and Treatment: Treatment Guideline [47], and the Health Protection Agency (HPA) guidance on CDI [23], and references within these documents.

2.3.2 Algorithm 1 – Treatment of first and second episodes of CDI

Treatment of first episode

- Treatment of CDI should be initiated based on assessment of symptoms and severity of disease while taking into account individual risk factors of the patient (II).

See algorithm 1 (chart) for severity markers. The Bristol Stool Chart may also be used to assess the severity of diarrhoea [21] (see appendix D).

- Stop any non-*Clostridial* antimicrobial treatment in patients with CDI if possible (IA).
- Stop any use of anti-motility agents and gastric acid suppressant agents (including proton pump inhibitors) if possible (II).

Treatment and implementation of prevention and control measures should be started as soon as CDI is suspected. The role of laboratory tests (toxin testing) is to confirm CDI and/or prompt further examinations of the patient.

- It is essential that CDI patients are closely monitored until they are symptom free (II).

The white blood cell count, temperature, findings of abdominal examination, bowel movements and overall clinical status of patients with CDI should be evaluated daily [40].

- CDI patients with mild to moderate disease who show improvement during initial metronidazole therapy, as evidenced by decreased number of bowel movements, improvement in WBC, fever and abdominal symptoms should continue to receive this regimen (II).
- For CDI patients whose clinical condition worsens (at any time) or those who fail to improve after 5 days of metronidazole administration, treatment should be switched to oral vancomycin, 125 mg q.d.s. for 10-14 days (II).

The usual duration of therapy is 10 days for patients who are responding to the treatment. Some patients may require up to 14 days of therapy, but it is recommended to stop the treatment as soon as possible to allow the reconstitution of the normal flora of the gut [40].

Continued worsening of symptoms, especially an increase in WBC and hypotension, is an indication for surgical, gastroenterology and microbiology consultations. Continued increase in WBC and hypotension are indications for consideration of colectomy (Figure 1 in [49]).

In patients whose gastrointestinal tract function is compromised, delivery of orally administered drugs to the colon is not reliable.

- In the presence of ileus, consensus opinion is that 500 mg i.v. t.d.s metronidazole should be added to the oral vancomycin treatment until ileus is resolved [50, 51] (II).

Severe CDI is not always associated with diarrhoea. Clinicians should therefore consider CDI in patients who have sepsis and some of the major risk factors.

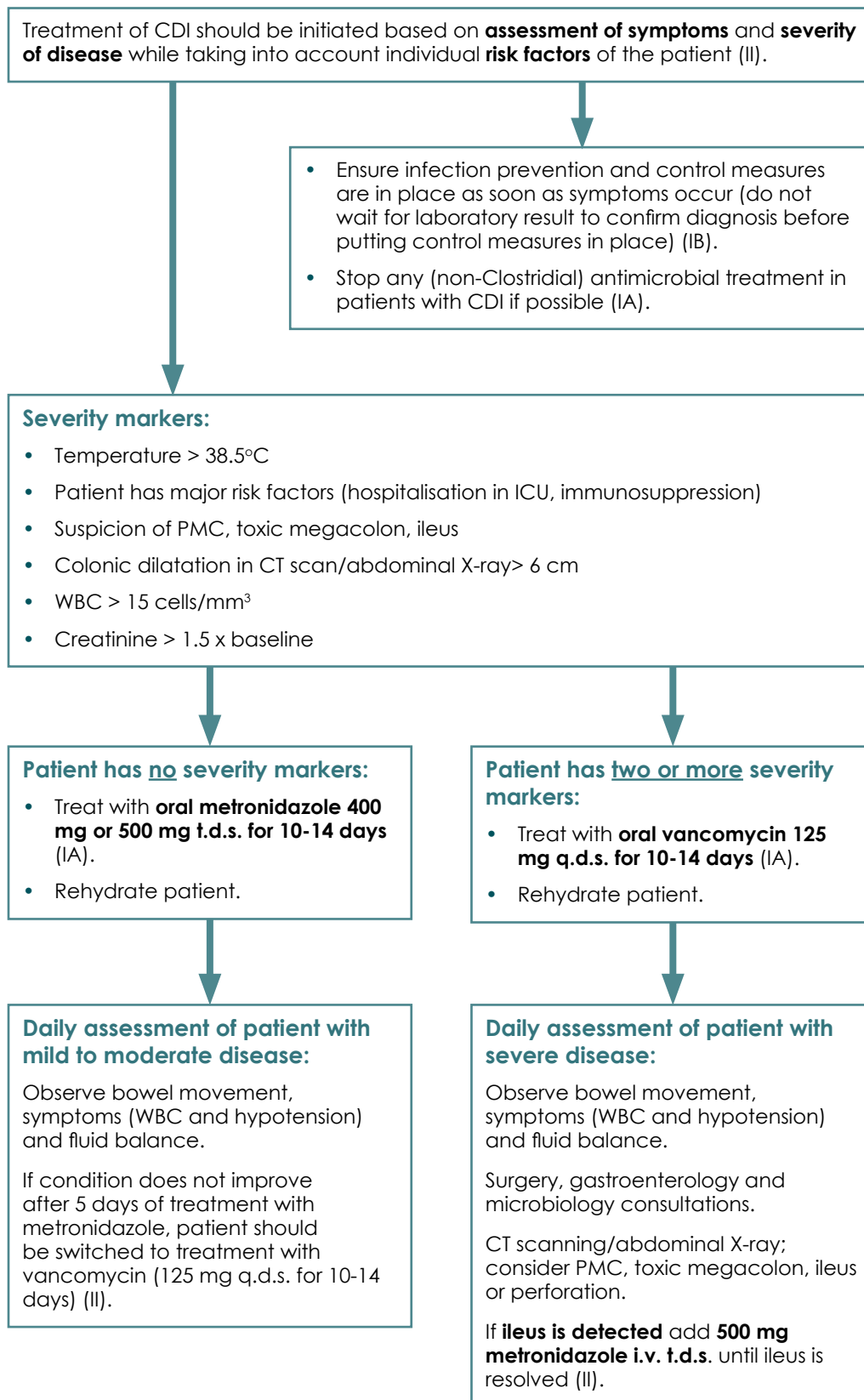
Treatment of second episode

- If a patient develops a second episode after apparently successful treatment of the first episode (i.e. the case has had symptom free days), anti-clostridial antimicrobial treatment should be based on severity markers (II).

Often treatment with the same drug used to treat the first episode is effective in treating the second episode [52, 53].

However, complication rates associated with second episodes are higher than those associated with first episodes [52].

Algorithm 1: Treatment of first and second episodes of CDI



2.3.3 Algorithm 2 - Treatment of recurrent disease from third and subsequent episodes

Recurrent disease

In this document the term 'recurrent disease' refers to the third and subsequent episodes.

Recurrent disease is caused by either **reinfection** from a contaminated environment or poor hand hygiene, or **relapse** from germinating spores in the gut [52].

Poor immune response and persistent disruption of the gut flora appear to be the most important factor in developing multiple episodes of CDI [54, 55].

A vicious cycle can be created when the antimicrobial drug prescribed for CDI disturb the normal flora of the gut leaving the patient more vulnerable to recurrent infection [40].

Treatment of recurrent disease (≥ 3 episodes)

First-line treatment for recurrent disease (≥ 3 episodes) is vancomycin 125 mg q.d.s. given orally for 10-14 days [49].

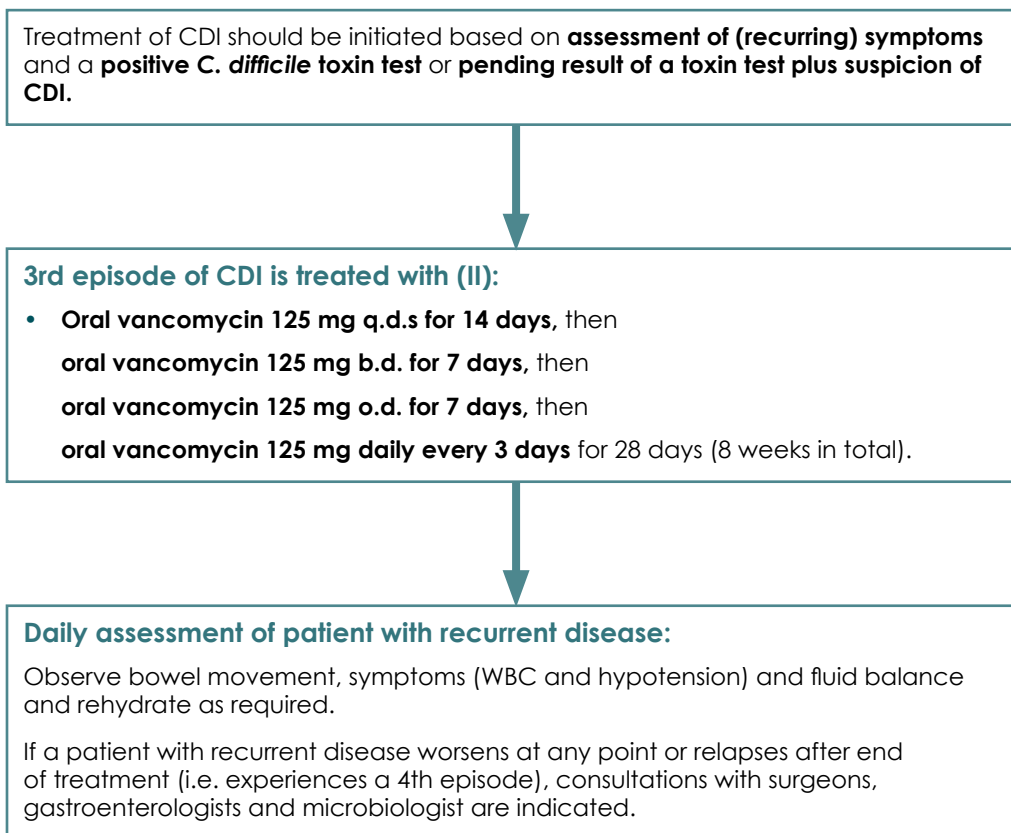
Data from observational studies suggest that tapered and pulse-dosed regimens of vancomycin can be effective in reducing recurrences [56, 57].

The background for this is that vancomycin and metronidazole are only effective against the vegetative form of *C. difficile* (but not the spores). The periodical lower drug concentrations in tapered and pulsed dosing regimens are believed to allow the normal gut flora to recover while suppressing the growth of *C. difficile* vegetative forms [40].

Algorithm 2 contains the recommendations for antimicrobial treatment of third and subsequent episodes of CDI. The extended period of exposure to vancomycin in this combined treatment regimen poses a risk of selection for vancomycin resistant enterococci (VRE) and staphylococci.

Continued monitoring of the patient is essential to the treatment of any episode of CDI (II).

Algorithm 2 - Treatment of recurrent disease from third and subsequent episodes



2.4 Special contact precautions for members of staff with diarrhoea and/or confirmed CDIⁱⁱ

Special contact precautions for members of staff with diarrhoea and/or confirmed CDI:

As members of healthcare staff could potentially infect vulnerable patients (and co-workers and visitors) special precautions apply to staff members with CDI.

Staff who have diarrhoea should not work, and if CDI is confirmed and treated, should not return to work **until treatment is completed** and **symptoms (i.e. diarrhoea) have been absent for at least 48 hours**.

If a member of healthcare staff is diagnosed with *C. difficile*, this must be reported to Occupational Health.

If the infection was acquired at work the incident should be reported by the employing healthcare facility/care home to the Health and Safety Executive under RIDDOR;

See link for instructions:

<http://www.hse.gov.uk/riddor/riddor.htm>

ii These recommendations are not evidence-based but should be implemented to protect the health of staff members, patients and visitors.

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4. Appendices

Appendix A: Grading of evidence and categories for implementation in clinical practice

The level of evidence for the key recommendations listed in section 2.2 of this guidance was graded in the systematic literature review by the ESGCD [2].

For the section on 'Best practice on antimicrobial treatment of CDI' (section 2.3) the level of evidence was graded by HPS according to the approach described in the review by ESGCD 2008 [2] (and in this appendix).

The quality of each study (i.e. level of evidence) was determined according to standards of the Oxford Centre for Evidence Based Medicine.

Levels of evidence	
1a	Systematic review (with homogeneity) of randomised controlled trials.
1b	Individual randomised controlled trial (with narrow confidence interval).
1c	Studies with the outcome 'all or none'.
2a	Systematic review (with homogeneity) of cohort studies.
2b	Individual cohort study (including low-quality randomised controlled trials; e.g. <80 % follow-up).
2c	Outcomes research, ecological studies.
3a	Systematic review (with homogeneity) of case-control studies.
3b	Individual case-control study.
4	Case series (and poor quality cohort and case-control studies).
5	Expert opinion without explicit appraisal, or based on physiology, bench research or 'first principles'.

Grades of recommendation:

- A** is given when consistent with level 1 studies.
- B** is given when consistent with level 2 or 3 or extrapolations from level 1.
- C** is given when consistent with level 4 or extrapolations from level 2 or 3.
- D** (or II) is given when consistent with level 5 or where there are troubling inconsistent or inconclusive studies of any level.

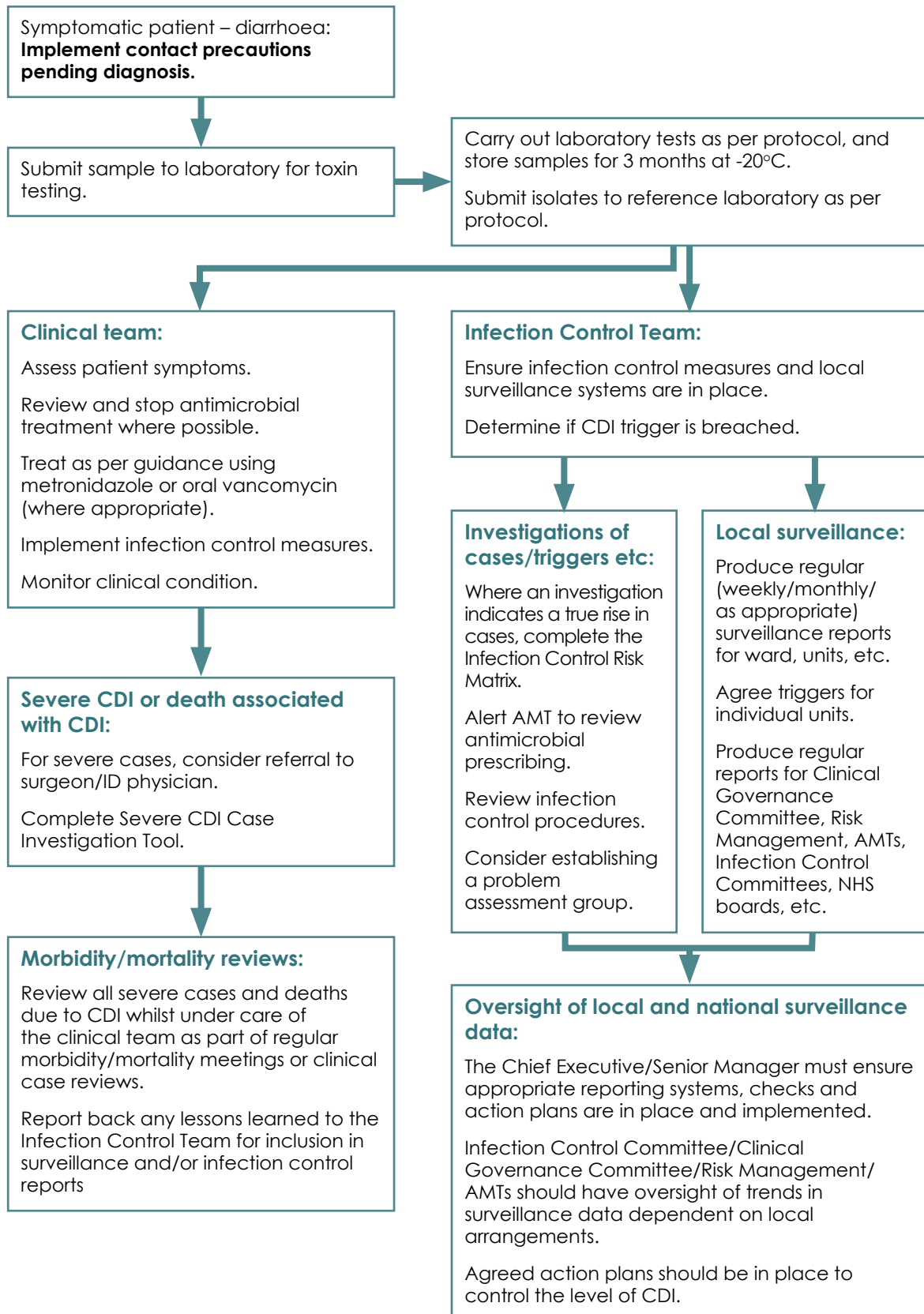
Further explanations of this grading system can be accessed at:

<http://www.cebm.net/index.aspx?o=1025>

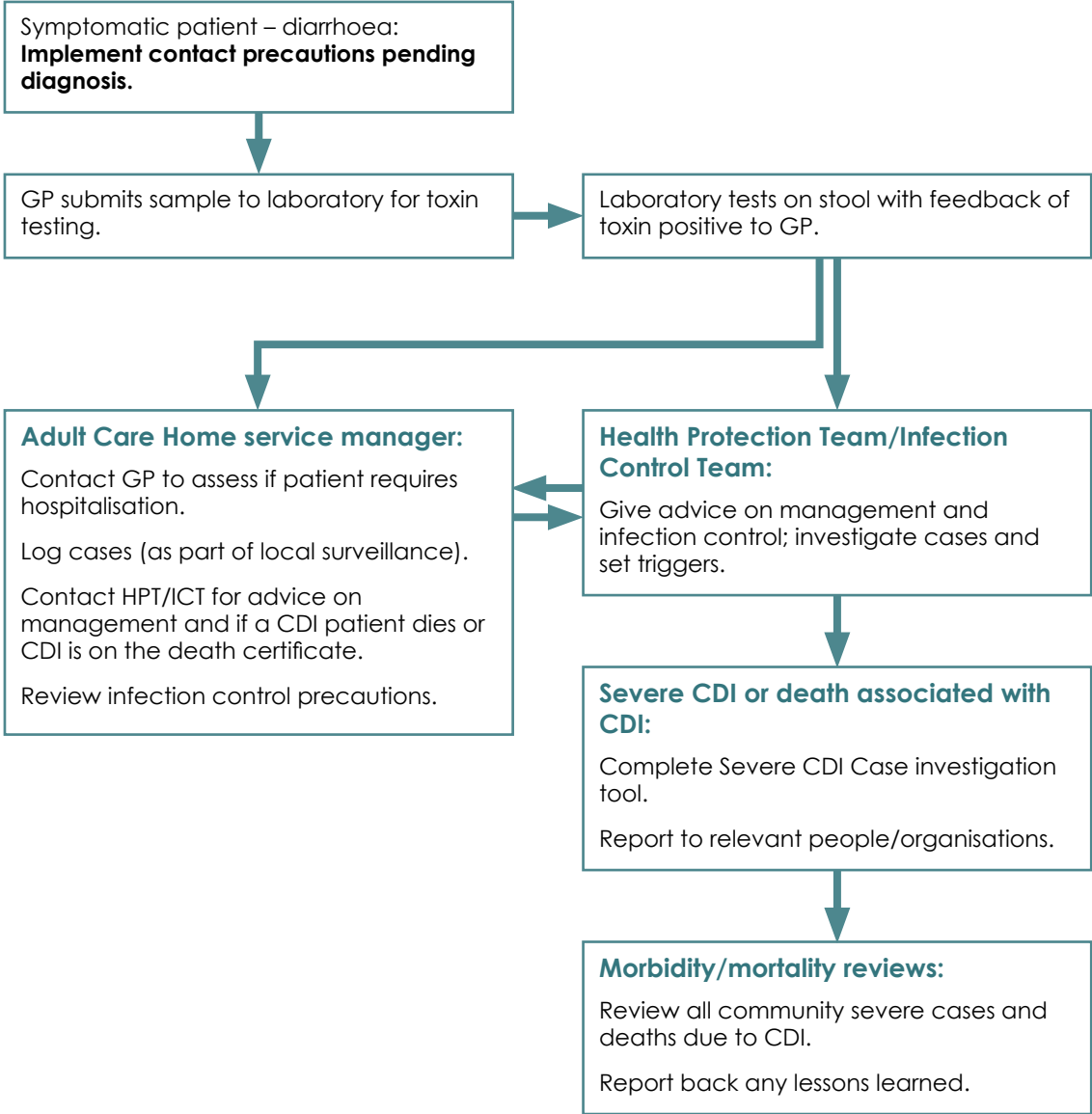
Categories for implementation in clinical practice were (in the review by ESGCD [2]) generated based on the HICPAC guidelines - see table below.

HICPAC Categories for implementation in clinical practice	
IA	Strongly recommended for implementation and strongly supported by well-designed experimental, clinical or epidemiological studies.
IB	Strongly recommended for implementation and strongly supported by some experimental, clinical or epidemiological studies and a strong theoretical rationale.
IC	Required for implementation, as mandated by state regulation or standard (may vary among different states/countries).
II	Suggested for implementation and supported by suggestive clinical or epidemiological studies or a theoretical rationale.
Unresolved issue	Practices for which insufficient evidence exists or no consensus regarding efficacy exists (no recommendation).

Appendix B: Short guide to managing CDI in healthcare settings



Short guide to managing CDI in the community



See also, the Regulation of Care (Scotland) Act 2001 which can be accessed from:

http://www.opsi.gov.uk/legislation/scotland/acts2001/asp_20010008_en_1

Appendix C: Links to associated documents

Standards

NHS QIS Standards on Healthcare Associated Infection (NHS QIS, 2008):

<http://www.nhshealthquality.org/nhsqis/4099.html>

Infection Control Standards for Adult Care Homes: Final Standards

<http://www.scotland.gov.uk/Publications/2005/03/19927/42762>

National Care Standards:

<http://www.infoscotland.com/nationalcarestandards/52.html>

Regulation of Care (Scotland) Act 2001:

http://www.opsi.gov.uk/legislation/scotland/acts2001/asp_20010008_en_1

CDI surveillance

Protocol for the Scottish surveillance programme for CDI:

<http://www.hps.scot.nhs.uk/haic/sshaip/guidelinedetail.aspx?id=40899>

HPS 'Information on SPC Charts':

<http://www.hps.scot.nhs.uk/haic/ic/publicationsdetail.aspx?id=42507>

How to collect stool specimens

For patients/residents or carers at home:

<http://www.hps.scot.nhs.uk/haic/ic/guidelinedetail.aspx?id=40383>

For healthcare staff:

<http://www.hps.scot.nhs.uk/haic/ic/guidelinedetail.aspx?id=40382>

Reporting

The Healthcare associated infection (HAI) outbreak/incident risk matrix can be accessed at (on page 73):

<http://www.scotland.gov.uk/Resource/Doc/47021/0013914.pdf>

RIDDOR reporting of illness among staff members

<http://www.hse.gov.uk/riddor/riddor.htm>

Infection Control

HPS model policies on Standard Infection Control Precautions (SICPs):

<http://www.hps.scot.nhs.uk/haiic/ic/standardinfectioncontrolprecautions-sicps.aspx>

HPS 'Contact Precautions Policy and Procedure - Transmission-Based Precautions':

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=37303>

Guidance on 'Infection Prevention and Control Guidance for NHS and non-NHS Community and Primary Care Settings':

<http://www.hps.scot.nhs.uk/haiic/ic/publicationsdetail.aspx?id=42152>

HPS model policy on Hand Hygiene:

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=31220>

HPS model policy for the correct use of PPE:

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=31221>

HPS model policy on 'Management of Blood and Body Fluid Spillages':

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=31222>

HPS model policy on 'Control of the Environment':

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=31229>

HPS model policy on 'Management of Care Equipment':

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=31226>

HPS model policy 'Safe Management of Linen':

<http://www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=31230>

HPS 'CDI Trigger Tool':

<http://www.hps.scot.nhs.uk/haiic/ic/publicationsdetail.aspx?id=42508>

National guidance on 'Endoscope Reprocessing':

<http://www.hps.scot.nhs.uk/Search/guidedetail.aspx?id=31261>

Infection prevention and control quality improvement tools:

HPS 'CDI Cross Transmission Minimisation Bundle':

<http://www.hps.scot.nhs.uk/haiic/ic/CDADCareBundle.aspx>

HPS/QIS 'CDI Severe Case Investigation Tool':

Weblink is not currently available

HPS 'Checklists for preventing and controlling CDI':

<http://www.hps.scot.nhs.uk/haiic/sshaip/publicationsdetail.aspx?id=38848>

Antimicrobial Management

The Scottish Medicines Consortium (SMC)/Scottish Executive Healthcare Associated Infection Task Force (HAITF) 'Antimicrobial Prescribing Policy and Practice in Scotland':

<http://www.scotland.gov.uk/Publications/2005/09/02132609/26119>

Scottish Antimicrobial Prescribing Group (SAPG) 'Guidance to Optimise Antibiotic Use and Reduce CDI in Scottish Hospitals':

<http://www.hps.scot.nhs.uk/haic/ic/guidelinedetail.aspx?id=38553>

Education

The NES Cleanliness Champions Programme:

<http://www.nes.scot.nhs.uk/hai/champions/>

The Royal Environmental Health Institute of Scotland (REHIS) courses on control of infection:

http://www.rehis.org/uploads/attachments/1248786636___REHIS21-1Spring2009WebVersion.pdf

Public information leaflets

HPS information leaflets on 'Clostridium difficile Infection: Information for Hospital Patients and Visitors':

<http://www.hps.scot.nhs.uk/haic/ic/guidelinedetail.aspx?id=38654>








HPS information leaflet on 'Clostridium difficile Infection: Information for Clients and Visitors of Care Homes':

<http://www.hps.scot.nhs.uk/haic/ic/guidelinedetail.aspx?id=39108>

HPS information leaflet on 'Washing Clothes at Home: Information for People in Hospitals or Care Homes and Their Relatives':

<http://www.hps.scot.nhs.uk/haic/ic/guidelinedetail.aspx?id=39120>

Appendix D: Bristol Stool Chart

<p>Type 1</p>		<p>Seperate hard lumps, like nuts (hard to pass)</p>
<p>Type 2</p>		<p>Sausage-shaped but lumpy</p>
<p>Type 3</p>		<p>Like a sausage but with crakes on its surface</p>
<p>Type 4</p>		<p>Like a sausage or snake, smooth and soft</p>
<p>Type 5</p>		<p>Soft blobs with clear cut edges (passed easily)</p>
<p>Type 6</p>		<p>Fluffy pieces, a mush stool</p>
<p>Type 7</p>		<p>Watery, no solid pieces ENTIRELY LIQUID</p>

Adapted from: Lewis, S.J., Heaton, K.W., *Stool form scale as a useful guide to intestinal transit time*. Scand. J. Gastroenterol, 1997. **32** (9): 920–4.

Appendix E: Glossary

Anaerobic

living or active in the absence of free oxygen.

Antimicrobial

a substance that kills or inhibits the growth of microorganisms such as bacteria, viruses, fungi, or protozoans. This includes antibiotics, antivirals, antifungals and antiparasitics.

Antimicrobial (antibiotic) prescribing policy

a set of guidance for the careful and sensible use of antibiotics and other antimicrobial drugs.

Cohort

a group of individuals with some characteristics in common (in this case, infection with CDI).

Endemic

the constant presence of an agent or health condition (such as CDI) in a particular geographical location or population.

Endoscope

a medical instrument for examining the interior of a hollow body organ or for minor surgery.

Epidemiology

the study of the determinants and distribution of health related events in a population and the application of that study in the prevention and control of health problems.

Hypochlorite

a chemical compound containing chlorine; used for disinfection.

Immunocompromised

any condition in which the body is unable to develop a normal immune response.

Incidence

a measure of the frequency with which new cases of illness, injury or other health condition occurs among a population during a specified period.

Normal gut flora (microflora)

the microorganisms that normally live inside the digestive tract of animals.

Peritonitis

inflammation of the membrane (peritoneum) that lines the abdominal cavity.

Polymerase chain reaction

a molecular technique for amplifying and creating multiple copies of nucleic acids (such as DNA and RNA) from a sample.

Primary care

a term for health services provided at the local community level, including GPs, pharmacists, dentists and midwives. Primary care is usually the first point of contact with the healthcare system by a patient.

Proton pump inhibitor

a group of drugs whose main action is to reduce the production of stomach acid.

Pseudomembranous colitis (PMC)

inflammation of the large intestine (colon) characterised by the presence of pseudomembranes, which are raised yellow plaques on the intestinal surface.

Ribotype

a term used to describe different strains of an organism based on molecular methods which examine differences in the nucleic acid of the ribosome (the protein making machinery of the cell).

Risk factor

an aspect of personal behaviour or lifestyle, an environmental exposure, or a hereditary characteristic that is associated with an increase in the occurrence of a particular disease, injury, or other health condition.

Root cause analysis

a process for identifying the basic or causal factor(s) that underlie a problem.

Spores

a highly resistant, resting phase displayed by some types of bacteria.

Sporicidal

the ability to kill bacterial spores.

Toxic megacolon

acute, severe inflammation of the colonic wall accompanied by extreme dilatation of the colon.

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