Transmission Based Precautions – Literature Reviews

Disinfectants

April 2008
Search Strategy – Disinfectants

PRINCIPAL RESEARCH QUESTION/OBJECTIVE:

What is the evidence to support the use of disinfectants over detergents?

An additional literature search and review was carried out specifically on evidence to support the use of disinfectants over detergents. This was as a result of issues discussed at Transmission Based Precautions Steering Group meetings.

**Period of publication** | 1997-2007
---|---
**Strategy key words**
| disinfectant$ | spores/
| Disinfectants/ | spores, bacterial/
| detergent$ | spores, fungal/
| Hypochlorite | spores
| Nosocomial | infective pathogen
| healthcare associated infection | infective microorganism
| healthcare-associated infection | Environment/
| healthcare acquired infection | environment
| exp Hospitals/ | comparison
| hospital | assessment
| healthcare | evaluation
| bacterial infections/ | effectiveness
| Clostridium difficile | appraisal
| exp Norovirus/ | review
| norovirus | clostridium difficile/ or clostridium perfringens/
| bacteremia/ | gram-negative bacterial infections/
| gram-positive bacterial infections/ | 

**Electronic databases** (tick as appropriate)

| MEDLINE | X |
| Science Direct | |
| CINAHL | X |
| Cochrane Library | X |
| British Nursing Index | X |
## Additional Resources (tick as appropriate)
- References checked for relevant articles
- Review of abstracts of professional meetings/conferences
- Personal libraries consulted
- Experts consulted (give details if applicable)
- Handsearching of journals (name relevant journals e.g. Journal of Hospital Infection, Infection Control and Hospital Epidemiology)

## Websites (tick as appropriate)
- CDC
- Department of Health
- HPA
- WHO
- Scottish Government
- Scottish Government Health Dept.

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## How many papers found
- 533

## How many papers included
- 10 (+3 guidance documents)

## How many papers excluded
- 523

### ii) Selection criteria for inclusion of studies

#### Sample
- All health and social care workers.

#### Outcome measure(s)

#### Other inclusion criteria
- Any study or guidance document not reviewed within the CDC Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings 2007

#### Language Limitations
- English language only

### iii) Quality assessment

#### Study quality assessment

The newly published *CDC Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings 2007*, (Siegel et al., 2007) has been evaluated by five independent reviewers using the AGREE instrument (The AGREE Collaboration, 2001) which is designed to assess the methodological quality of guidelines. The results show the guidelines suitable for adaptation as primary reference source for literature review and formulation of recommendations.

A literature search was conducted using HPS ICT search strategies, based on agreed research questions. Identified studies, not already reviewed within the CDC guidelines, were assessed for relevance and critically appraised using SIGN-50 methodology (SIGN, 2004) to determine if additional information or considerations were required for production of transmission based precautions for healthcare settings in NHS Scotland.

The methodology for grading the supporting evidence is found on the Evidence Tables including Considered Judgment Section and available from the HPS Infection Control Team on request.

#### Category of Recommendation

The recommendations have been categorised based on a combination of the system used in the CDC/HICPAC (Siegel et al., 2007) and EPIC 2 National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England

- **Category IA** - Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies.
- **Category IB** - Strongly recommended for implementation and supported by some experimental, clinical, or epidemiologic studies and a strong theoretical rationale.
- **Category IC** - Mandatory or required for implementation
- **Category II** - Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale.
- **GPP (Good Practice Point)** – Is a recommendation for best practice based on the expert opinion or practical experience of the Model Policies Steering Group
- **No recommendation**, unresolved issue. Practices for which insufficient evidence or no consensus regarding efficacy exists.
Data collation and analysis

The SIGN 50 methodology including reviewing templates are available from the SIGN website (http://www.sign.ac.uk)

The AGREE Instrument which is used for assessment and evaluation of the quality of evidence-based guidelines can be found at www.agreecollaboration.org

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1 Disinfectants – a systematic review of the evidence

1.1 Disinfectants Vs Detergents

Guidance produced by the Medicines and Healthcare Products Regulatory Agency (MHRA) (2002) draws on all the evidence available and recommends the use of water and ‘general purpose detergent’ for the cleaning of environmental surfaces which are only likely to be in contact with healthy skin and are therefore considered low risk (e.g. floors, walls, table tops). For surfaces which become contaminated with blood and other body fluids, this guidance suggests that a disinfectant solution of 1000 ppm available chlorine should be applied and this is used within the standard infection control precautions on management of blood and body fluids (MHRA, 2002).

In recent years there has been a great deal of debate regarding the use of disinfectants versus detergent. This has been fuelled by publications detailing the efficacy of hypochlorite for dealing with \textit{Clostridium difficile} spores. Consequently there have been calls for the routine use of disinfectants for cleaning and maintenance of the patient environment. However, one recently published review (Dettenkofer and Spencer, 2007) challenges the use of disinfectants for routine decontamination citing safety concerns and also the potential for emerging resistance of pathogens to commonly used disinfectants. The authors carried out a systematic review to assess the current evidence and noted that few published studies included sufficient controls for inclusion and that many publications were based on expert opinion. The authors concluded that based on analysis of the four studies included that there was insufficient evidence to show that environmental cleaning with disinfectant versus detergent was associated with a drop in infections rates. It is clear that there are few good quality studies and the authors call for well-designed studies to properly evaluate the evidence surrounding the use of detergents versus disinfectants and to provide clear advice and guidance for healthcare settings.

Research on the efficacy of disinfectants and detergents indicate that certain routinely used disinfectants are ineffective against some emerging infectious agents such as \textit{Clostridium difficile}, rotavirus and noroviruses and therefore special consideration may have to be given to the choice of disinfectant used for decontamination of the environment during outbreaks of these pathogens (Siegel et al., 2007, Cheng et al., 2006, HPS, 2007). In recent years a number of disinfectants have been assessed within different studies, including; domestic bleach; acidified bleach; alcohols (e.g. aldehydes, propanol, phenolic compounds); chlorine dioxide accelerated hydrogen peroxide technology and super oxidized water. One published study demonstrated that bleach and acidified bleach were effective for inactivation of \textit{Clostridium difficile} spores (Perez et al., 2005), however the use of detergents and other disinfectants were not assessed for comparison as they have been previously described as ineffective for this purpose (Wilcox et al., 2003). Another study (Sattar, 2004) compared the efficacy of different disinfectants for inactivation of noroviruses and concluded that 1000ppm of available chlorine from sodium hypochlorite (domestic bleach) was required whereas further dilutions resulted in decreasing effectiveness, although it has been highlighted in this and other studies that the this treatment is not suitable for all surface types. (Malik et al., 2006) reported marked variation in inactivation of norovirus surrogate on a range of soft furnishing materials and concluded that contact time was an important factor. The authors recommended the use of activated aldehyde or phenolic compounds for this purpose, however there is no data to support repeated use of these products for carpets and soft furnishings. Some novel methods of disinfection have been recently trialled in small scale experimental studies such as super-oxidised oxygen and show some promise (Landa-Solis et al., 2005). However further evaluation will be required before these methods could be considered for use with the NHS.

The review of literature of this subject has revealed that there have only been a small range of surfaces assessed as to their ability to be disinfected. The most common surface used for laboratory testing of disinfectants is stainless steel however whether this represents an all encompassing view of materials
used in a healthcare setting is debatable (Perez et al., 2005). There is also considerable variation in contact times for disinfectants ranging from 1 to 10 minutes and therefore there is not clear indication in all cases what contact time is required to ensure effective disinfection of the surface. In addition, a number of studies have used the disinfectants at high concentrations which may be of health and safety concern to patients and staff and possibly detrimental to items being disinfected (Perez et al., 2005, Sattar, 2004, Malik et al., 2006).

1.2 Clostridium difficile

The organism, Clostridium difficile, which causes Clostridium difficile associated diarrhoea (CDAD) is fast becoming recognised as one of the most important causes of HAI, particularly with the emergence of the virulent strain 027. Scotland, in common with the picture elsewhere in the UK and worldwide, has shown a steady increase in the number of cases reported and this has included a rise in the number of reported outbreaks. This disease is an important cause of morbidity and mortality within the patient population and the cause of additional financial burden to the NHS due to the costs associated with increased treatment and length of stay. A mandatory surveillance system is currently being put into place in Scotland in order to detect and monitor rates of CDAD within healthcare settings as this is considered essential to prevent and control CDAD and to monitor the emergence of the virulent strain 027 within healthcare settings in Scotland (SEHD, 2006). The causative organism is an anaerobic gram positive spore forming bacterium. The spores have the ability to survive for long periods of time within the environment and there is evidence to show that the spores are resistant to routinely used disinfectants. The organism is a normal component of the gut flora, however certain antibiotic therapy can allow overgrowth of the organism, which can then lead to CDAD. This term covers a range of disease from mild diarrhoea to serious disease of colitis and pseudomembranous colitis and even toxic megacolon which can result in perforation of the gut caused by two toxins A & B which are excreted by the organism.


Research on the efficacy of disinfectants and detergents shows that certain routinely used disinfectants are ineffective against some emerging infections agents such as Clostridium difficile, rotavirus and noroviruses and therefore special consideration may have to be given to the choice of disinfectant used for decontamination of the environment when cases are of disease caused by these pathogens are known or suspected (Wilcox and Fawley, 2000). There have been a number of publications specifically looking at the efficacy of detergents versus hypochlorite cleaning for management of cases of CDAD. A two year ward-based cross over study (Wilcox et al., 2003) evaluated the effects of environmental cleaning with hypochlorite versus detergent on the incidence of cases of CDAD. The results demonstrated a statistically significant decrease in incidence on the ward utilising hypochlorite. The results demonstrated have been substantiated by further studies reporting similar findings. (Fawley et al., 2007) compared 5 commonly used cleaning agents including neutral detergent and hydrogen peroxide and demonstrated that only hypochlorite was effective at inactivation Clostridium difficile spores. The use of chlorine based solutions have been studied within a multi-factorial intervention study and the results showed significant decrease in HAI cases of CDAD.

The efficacy of sodium hypochlorite at a concentration of 1000ppm available chlorine for inactivation of Clostridium difficile spores has been reported in a number of publications with the recommendation that this should be used for environmental cleaning within the patient area for management of CDAD (Cheng et al., 2006, HPS, 2007, Siegel et al., 2007, Vonberg, 2007). For the purposes of application of transmission based precautions to prevent onward transmission of CDAD therefore, it is recommended that the use of 1000ppm hypochlorite be used for environmental cleaning and disinfection of the patient area due to the nature of the potential environmental contamination with spores.
2 Conclusions

2.1 Disinfectants Vs Detergents

2.1.1 Guidance produced by the Medicines and Healthcare Products Regulatory Agency (MHRA) (2002) recommends the use of water and ‘general purpose detergent’ for the cleaning of low risk environmental surfaces e.g. which are only likely to be in contact with healthy skin.

2.1.2 In recent years there has been a great deal of debate regarding the use of disinfectants versus detergent. This has been fuelled by publications detailing the efficacy of hypochlorite for dealing with Clostridium difficile spores.

2.1.3 Consequently there have been calls for the routine use of disinfectants for cleaning and maintenance of the patient environment.

2.1.4 However, there are concerns regarding this universal use due to health and safety issue and potential for emerging resistance of pathogens to commonly used disinfectants.

2.1.5 One systematic review concluded that there was insufficient evidence to show that environmental cleaning with disinfectant versus detergent was associated with a drop in infections rates.

2.1.6 It is clear that there is a dearth of well conducted studies in this area to properly evaluate the evidence surrounding the use of detergents versus disinfectants and to provide clear advice and guidance for healthcare settings.

2.1.7 Research on the efficacy of disinfectants and detergents indicate that certain routinely used disinfectants are ineffective against some emerging infectious agents such as Clostridium difficile, rotavirus and noroviruses.

2.1.8 Therefore special consideration may have to be given to the choice of disinfectant used for decontamination of the environment for the management of cases and outbreaks of these pathogens.

2.1.9 The results of some studies have shown that some commonly used disinfectants are ineffective for deactivating Clostridium difficile spores.

2.1.10 There is also some evidence to show that certain commonly used disinfectants and detergents are less effective against noroviruses.

2.1.11 1000ppm of available chlorine from sodium hypochlorite (domestic bleach) was shown to be effective for inactivation of surrogate noroviruses and Clostridium difficile spores although it has been highlighted in this and other studies that the this treatment is not suitable for all surface types.

2.1.12 One study recommended the use of activated aldehyde or phenolic compounds for this purpose, however there is no data to support repeated use of these products for carpets and soft furnishings.
2.1.13 Some novel methods of disinfection have been recently trialled in small scale experimental studies such as super-oxidised oxygen and show some promise. However further evaluation will be required before these methods could be considered for use with the NHS.

2.1.14 Many of the published studies have considerable variation in contact times examined and also the concentration of disinfectants used and therefore there is not always possible to form a firm conclusion.

2.1.15 High concentrations of disinfectants may be possibly be a health and safety concern to patients and potentially detrimental to items being disinfected particularly soft furnishings and carpets.

2.2 Clostridium difficile

2.2.1 The organism, Clostridium difficile, which causes Clostridium difficile associated diarrhoea (CDAD) is fast becoming recognised as one of the most important causes of HAI.

2.2.2 Scotland, in common with the picture elsewhere in the UK and worldwide, has shown a steady increase in the number of cases reported and this has included a rise in the number of reported outbreaks.

2.2.3 This disease caused is an important cause of morbidity and mortality within the patient population and the cause of additional financial burden to the NHS due to the costs associated with increased treatment and length of stay.

2.2.4 The causative organism is an anaerobic gram positive spore forming bacterium. The spores have the ability to survive for long periods of time within the environment and there is evidence to show that the spores are resistant to routinely used disinfectants.

2.2.5 The organism is a normal component of the gut flora, however certain antibiotic therapy can allow overgrowth of the organism, which can then lead to CDAD.

2.2.6 Research on the efficacy of disinfectants and detergents shows that certain routinely used disinfectants are ineffective against some emerging infections agents such as Clostridium difficile, rotavirus and noroviruses and therefore special consideration may have to be given to the choice of disinfectant used for decontamination of the environment.

2.2.7 There have been a number of publications specifically looking at the efficacy of detergents versus hypochlorite cleaning for management of cases of CDAD.

2.2.8 A two year ward-based cross over study evaluated to compare the effects of environmental cleaning with hypochlorite versus detergent on the incidence of cases of CDAD demonstrated a statistically significant decrease in incidence on the ward utilising hypochlorite.

2.2.9 The results demonstrated have been substantiated by further studies demonstrating similar findings.
2.2.10 The efficacy of sodium hypochlorite at a concentration of 1000ppm available chlorine for inactivation of Clostridium difficile spores has been reported in a number of publications with the recommendation that this should be used for environmental cleaning within the patient area for management of CDAD.

2.2.11 For the purposes of application of transmission based precautions to prevent onward transmission of CDAD therefore, it is recommended that the use of 1000ppm hypochlorite be used for environmental cleaning and disinfection of the patient area due to the nature of the potential environmental contamination with spores.

2.2.12 There is not sufficient evidence to recommend widespread use of disinfectants for general environmental cleaning.

2.2.13 There is evidence to support the use of hypochlorite at a concentration of 1000ppm available chlorine for cleaning of the patient area for management of cases of CDAD in the reduction of incidence.

2.2.14 There is some evidence that routine detergents and disinfectants are ineffective in inactivating norovirus, although it is clear that further studies are required to fully elucidate this. Use of hypochlorite may be advisable in the case of outbreaks of norovirus and other non-enveloped viruses.

3 Recommendations –Precautions

3.1 Hypochlorite should be used at a concentration of 1000ppm available chlorine for cleaning of the patient area for management of cases of CDAD. (Category II)

3.2 Consideration may be given to the use of hypochlorite in the case of outbreaks of norovirus and other gastrointestinal viruses. (GPP)

4 Practical Application

A recommendation has been established from the literature that hypochlorite should be used at a concentration of 1000ppm available chlorine for cleaning of the patient area for management of cases of CDAD. There will be no significant change to practice required (COSHH / manufacture’s instructions and any local guidance should be referred to when using disinfectants), however, the standards set down must be achieved.

5 Resource Implications

As per current policies. All resources required for disinfection should already be in place.
6 References


