



# **Literature Review and Practice Recommendations: Existing and emerging technologies for decontamination of the health and care environment**

## **Microfibre**

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Version	Date	Summary of changes	Changes marked
2.0	July 2020	Review of the extant scientific evidence on microfibre using the NIPCM methodology.  New recommendations added.	
1.1	December 2016	Addition of categories for recommendations. No changes made to the content of the literature review.	
1.0	May 2015	Final for publication	

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2.0	June 2020	National Infection Prevention and Control (NIPC) steering and consensus groups		

**Literature Review and Practice Recommendations: Existing and emerging technologies for decontamination of the health and care environment: Microfibre**

<b>HPS ICT Document Information Grid</b>	
<b>Purpose:</b>	To inform the existing and emerging technologies used for decontamination of the health and care environment section on microfibre products.
<b>Target audience:</b>	All NHSScotland staff involved in the prevention and control of infection in Scotland.
<b>Circulation list:</b>	Infection Control Managers, Infection Prevention and Control Teams, Public Health Teams.
<b>Description:</b>	This literature aims to review the evidence base for using microfibre products for decontamination of the health and care environment.
<b>Update/review schedule:</b>	Updated as new evidence emerges with changes made to recommendations as required.
<b>Cross reference:</b>	National Infection Prevention and Control Manual <a href="http://www.nipcm.hps.scot.nhs.uk/">http://www.nipcm.hps.scot.nhs.uk/</a>
<b>Update level</b>	<p>Practice – The implications for practice are updated based on a review of the extant scientific literature on microfibre products used for decontamination of the health and care environment.</p> <p>Research - The implications for research are updated based on a review of the extant scientific literature on microfibre products used for decontamination of the health and care environment.</p>

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## Objectives

The aim of this review is to examine the extant scientific literature regarding the use of microfibre products for decontamination of the health and care environment to form evidence-based recommendations for practice.

The specific objectives of the review are to determine:

- Is microfibre currently in use in UK health and care settings?
- What is the actual or proposed mechanism of action of microfibre?
- What is the procedure for using microfibre?
- When should microfibre products be used in health and care settings?
- What is the scientific evidence for effectiveness of microfibre for decontamination of the healthcare environment?
- Are there any safety considerations associated with using microfibre in health and care settings?
- Are there any practical or logistical considerations associated with using microfibre in health and care settings?
- What costs are associated with using microfibre in health and care settings?

## Methodology

This systematic literature review was produced using a defined methodology as described in the [National Infection Prevention and Control Manual: Methodology](#).

Supplementary sections to the applied methodology for this specific literature review can be found in [Appendix 1](#).

## Discussion

### 1.1 Implications for practice

#### Is microfibre currently in use in UK health and care settings?

The NHSScotland National Cleaning Services Specification<sup>1</sup> state that microfibre products may be used for cleaning a wide variety of surfaces including hard flooring, walls and doors, curtains and bed screens, sanitary fixtures and fittings, and furniture.

The National Patient Safety Agency (NPSA) and Association of Healthcare Cleaning Professionals (AHCP) Revised Healthcare Cleaning Manual<sup>2</sup> provide guidance on microfibre cloths and mops. In 2009, NPSA recommended that NHS Trusts in England should consider implementing the routine use of microfibre technology. In addition, background information on microfibre technology is provided, including its strengths and limitations, as well as referring to published reports on its implementation for routine use.

These findings suggest that microfibre products are widely in use within UK health and care settings.

The Rapid Review Panel (RRP) is a panel of UK experts established by the Department of Health to review new technologies with the potential to aid in the prevention and control of healthcare-associated infections.<sup>3</sup> To date, no microfibre products have been reviewed by the RRP.<sup>3</sup>

#### What is the actual or proposed mechanism of action of microfibre?

Microfibres are composite synthetic fibres typically made from polyesters, polyamides or a conjugation of polyester and polyamide. These fibres measure less than one denier, which is approximately one hundredth of the size of a human hair.<sup>4</sup> These fibres are woven into a fabric that provides approximately 40 times more surface area than a fabric made of cotton.<sup>4</sup> Microfibre cleaning products can hold more water than conventional cleaning cloths.<sup>5</sup>

Microfibres accumulate organic matter as a result of electrostatic attraction, capillary action or a combination of the two.<sup>6</sup> As the fibres are very small, they are able to reach into crevices that might be inaccessible to conventional cleaning materials.<sup>5, 6</sup> Ultramicrofibres are finer than traditional microfibrils (< 0.3 decitex or < 30 km/g) designed to be used with low volumes of water without chlorine-based detergent or disinfectant but have a similar mechanism of action.<sup>5, 7</sup>

#### What is the procedure for using microfibre?

A method statement outlining the integrated use of microfibre cloths in health and care settings is described in the Revised Healthcare Cleaning Manual from the NPSA.<sup>2</sup> Microfibre products are designed to be part of a well coordinated and integrated cleaning regime which must be followed correctly to see the desired effects.<sup>6</sup> Microfibre cloths and mops are typically designed to be used dry or dampened with low volumes of water that do not contain disinfectants.<sup>4, 7</sup> As a result, microfibre products would not be recommended for use in situations where disinfectants are considered essential.<sup>6</sup> However, some manufacturers explicitly market their microfibre products as safe to use with bleach.<sup>8</sup> Reusable microfibre cloths and mops that can be used with bleach also come with manufacturer guidelines on how many times they can be laundered – this tends to

approximate 100 times with bleach and 250 times without bleach.<sup>8</sup> Disposable single-use microfibre cloths are also available.<sup>9</sup>

### When should microfibre products be used in health and care settings?

Microfibre cloths are intended for use in general purpose cleaning either with or without water. The use of disinfectants is not recommended as these may degrade the microfibrils.<sup>5</sup> As a consequence, microfibre materials are not suitable for cleaning up blood or body fluids, or for use in areas where the use of disinfectants is essential.<sup>22</sup> However, as mentioned previously, there are some manufacturers which explicitly state that their products are suitable for use with bleach.<sup>8</sup>

### What is the scientific evidence for effectiveness of microfibre for decontamination of the healthcare environment?

Two interrupted time series,<sup>10, 11</sup> five non-randomised controlled clinical trials<sup>12-16</sup> and three non-randomised controlled laboratory trials<sup>17-19</sup> evaluated the efficacy of microfibre for decontamination of the healthcare environment.

Two studies compared the efficacy of microfibre cleaning products and standard cleaning products without any use of cleaning agents and found that the use of microfibre cloths was marginally more effective than cotton cloths in terms of removing contaminants on surfaces.<sup>18, 19</sup> Assanta *et al.* evaluated the efficacy in relation to the presence and absence of soil; only in the presence of soil it was found that the microfibre cloths were more effective.<sup>19</sup>

Five studies<sup>10, 13, 14, 16, 18</sup> compared the efficacy of microfibre in combination with a disinfectant to standard cleaning products using a disinfectant, the outcome measures included evaluations of the effectiveness of removing and/or transferring microorganisms on surfaces, such as floors and high-touch areas in intensive care units, as well as an assessment of cleaning efficacy using ATP assay. Results from these studies were contradictory. One study found that the use of microfibre cloths in combination with a disinfectant, a quaternary ammonium solution, was less effective than standard cleaning products with disinfectant.<sup>16</sup> The other four studies<sup>10, 13, 14, 18</sup> found that microfibre cloths with disinfectant (hydrogen peroxide 0.01%, 300 ppm copper-based biocide, 500mg/L hypochlorite and a quaternary ammonium solution) were more effective than standard cleaning products in combination with these disinfectants. Two of these studies looked at ultramicrofibre cloths and the use of copper-based biocides which are not recommended in the National Infection Prevention and Control Manual (NIPCM).<sup>13, 14</sup> Gan *et al.*<sup>10</sup> combined multiple intervention components and therefore it is not possible to determine whether this impact was solely from the use of microfibre cloths.

One study compared the efficacy of removing *Staphylococcus aureus*, *Acinetobacter baumannii* and *Clostridioides difficile* spores on surfaces between microfibre cloths with and without the use of quaternary ammonium compound-based detergent/disinfectant or sporicidal products.<sup>17</sup> Microfibre cloths in combination with detergent/disinfectant or sporicidal products was more effective at removing the number of bacteria from surfaces following wiping than the use of microfibre cloths with water only.<sup>17</sup>

In three studies that evaluated the efficacy of microfibre products it was not possible to draw any conclusions as it was impossible to determine whether the impact of the intervention was truly associated to the use of microfibre or due to the additional components of the intervention.<sup>11, 12, 15</sup>

Current evidence demonstrates that microfibre products are marginally more effective at removing soiling and debris and at preventing cross-transmission of spores than standard cleaning products. However, these findings should be interpreted with caution as the included studies were laboratory-based, rather than clinically-based, and it may therefore not be appropriate to extrapolate the findings of this study to the clinical setting. Limited evidence suggests that to control microorganisms or spores on surfaces microfibre cloths should be used in combination with detergent/disinfectant or sporicidal products as opposed to the use of water alone. This was however not compared to a standard cleaning methodology and these conclusions should therefore be carefully considered.

This review identified insufficient evidence demonstrating superior effectiveness of microfibre products used with disinfectant over standard cleaning products used in combination with disinfectant. Findings of the studies cannot be extrapolated directly to UK health and care settings, as the disinfectants included are not established in the UK and/or the study methodology did not allow for an assessment of the relative contribution of microfibre.

No evidence was found demonstrating the effectiveness of microfibre products with detergent compared to standard cleaning products with detergents.

### **Are there any safety considerations associated with using microfibre in health and care settings?**

Microfibre products have the ability to store particles including microorganisms and contaminants in their fibres, hence microfibre cloths and mops can become contaminated with viable micro-organisms after use, potentially making them capable of contaminating the healthcare environment with these micro-organisms.<sup>5-7</sup> It is therefore recommended to use new microfibre cleaning materials when moving from one patient care area to another, and when crossing between patient and health care environments. It may also be necessary to change the microfibre cloths between different areas within a patient environment.<sup>5</sup> In addition, disposable microfibre cloths and mops are available for single-use purposes to avoid cross-contamination.<sup>11</sup>

The performance of microfibre cleaning products varies and depends on the type and brand of microfibre, therefore manufacturers' instructions should be followed.<sup>5, 20</sup>

A key issue with many of the microfibre products included in this review is the incompatibility with chlorine-based products, i.e. disinfectants that are recommended for environmental decontamination in some circumstances and widely used in the hospital environment.<sup>5, 21</sup> Reusable mops and cloths also need to be laundered in purpose-built and validated washing machines that clean the materials using heat and water to avoid degradation of the microfibrils.<sup>6, 20</sup>

There is conflicting evidence on the issue of whether microfibre performs best when new or after repeated washing. One study found that the advantage of using new microfibre mops and cloths was lost after repeated washing.<sup>4</sup> However, another study showed that the performance of microfibre mops and cloths improved with repeated washing, implying that they could be re-used many times assuming that adequate decontamination could be assured.<sup>22</sup> These microfibre mops and cloths came with guidance on how many times they could be laundered before their cleaning efficacy deteriorated.<sup>4, 22</sup> As it can be challenging to keep track of the number of times microfibre cleaning cloths and mops have been laundered, there might be a risk that microfibre cleaning materials that have reached their laundering capacity are still in circulation.<sup>4</sup>

Manufacturer's instructions should be followed on how to reprocess microfibre products and training should be provided to those who are responsible.<sup>5</sup>

### **Are there any practical or logistical considerations associated with using microfibre in health and care settings?**

Microfibre tends not to perform as well on old and damaged surfaces because the fibres are more likely to snag on surface defects, making it more difficult to wipe these surfaces.<sup>6</sup> However, microfibre cloths are able to reach into crevices that might be inaccessible to conventional cleaning materials, as the fibres are very small.<sup>5, 6</sup> It is worth taking such factors into consideration when deciding what kind of cloth to use for cleaning. It is also important to keep in mind that the materials are designed to be part of a total cleaning system and must be used as such to see the desired effects.<sup>6</sup>

Cleaning and disinfection protocols should be implemented outlining the use of the microfibre cleaning products. Manufacturer's instructions should be followed on how to use the microfibre products and training should be provided to those who are using these.<sup>5</sup>

### **What costs are associated with using microfibre in health and care settings?**

The introduction of a microfibre system requires a capital investment to purchase and stock cleaners' trolleys, with possible costs if storage facilities and laundry equipment need modification. Other costs to consider include laundering the mops and cloths, and replacement of these on reaching the end of their life cycle.<sup>6</sup> The number of times the mops and cloths can be washed should also be taken into account when calculating overall costs.<sup>22</sup> It is also worth considering that, although a microfibre system might require many additional items, as the cloths and mops weigh less than conventional ones, more of them can be accommodated in a wash-load if the mops and cloths are being reused.<sup>6</sup> The use of a microfibre system may reduce the amount of water and disinfectant products resulting in lower cost and reduced exposure to disinfectant chemicals.<sup>5, 23</sup> One study found that both the annual budget for consumables, as well as the cleaning time needed in each operating room decreased considerably after introducing microfibre cleaning technology.<sup>23</sup>

There are a number of factors involved in using conventional and microfibre materials, with many types of mops and cloths, all with different laundry requirements and expected service life; therefore, it is difficult to directly compare the costs involved.<sup>6</sup>

## **1.2 Implications for research**

Limited robust literature was identified by this review in relation to microfibre products for decontamination of the health and care environment. There remains a need for high quality primary studies related to microfibre products. Much of the evidence base is composed of experimental investigations, the results of which may not be readily extrapolated; and research focussed predominantly upon the efficacy of microfibre products in reducing environmental bioburden which may not be valid under normal clinical working conditions.

Further studies are necessary to demonstrate the effectiveness of microfibre products for decontamination of the health and care environment considering practical and safety issues including its use with disinfectants and reprocessing methods, before conclusions on the efficacy of microfibre can be reached.

## Recommendations

This review makes the following recommendations based on an assessment of the extant scientific literature on microfibre products used for decontamination of the healthcare environment:

### Is microfibre currently in use in UK health and care settings?

The use of microfibre products is recommended in The Revised Healthcare Cleaning Manual from the National Patient Safety Agency. Microfibre products may be used as specified in the NHSScotland National Cleaning Services Specification.

**(Category C recommendation)**

### What is the actual or proposed mechanism of action of microfibre?

Microfibre products can be used for cleaning areas that might be inaccessible to conventional cleaning materials as the fibres are very small.

**(Category A recommendation)**

Ultramicrofibres have a similar action as microfibrils, but should be used with low volumes of water without chlorine- based detergent or disinfectant.

**(Category A recommendation)**

### What is the procedure for using microfibre?

The method statement outlined in The Revised Healthcare Cleaning Manual from the National Patient Safety Agency should be considered to ensure proper use of microfibre cloths in health and care settings.

**(Category C recommendation)**

The compatibility of microfibre cloths and mops with disinfectants should be established with manufacturers, taking into account the product properties and laundry specific guidance for reusable mops and cloths.

**(Category B recommendation)**

### When should microfibre products be used in health and care settings?

Microfibre cloths can be used in general purpose cleaning either with or without water. In areas where the use of disinfectant is essential, the compatibility of microfibre cloths and mops with disinfectants should be established with manufacturers prior to its use

**(Category C recommendation)**

### Are there any safety considerations associated with using microfibre in health and care settings?

Following an environmental contamination risk assessment; microfibre cleaning items should be changed between different areas within a patient zone to avoid cross-contamination.

**(Category B recommendation)**

Disposable microfibre cleaning items can be used in outbreaks and during isolation cleans instead of reusable materials to avoid cross-contamination.

**(Category C recommendation)**

Manufacturers' instructions should be followed to ensure proper use of microfibre materials.

**(Category A recommendation)**

Reusable microfibre cloths and mops must be washed in purpose-built laundries with validated washing machines that clean the materials using heat and water to avoid degrading the microfibres, ensuring that products are laundered in line with the manufacturers' recommendations.

**(Category C recommendation)**

Manufacturers' instructions must be followed, ensuring adherence to the maximum number of wash cycles; therefore, a system for product re-use must be in place and monitored for compliance.

**(Category B recommendation)**

### What is the scientific evidence for effectiveness of microfibre for decontamination of the healthcare environment?

The compatibility of microfibre cloths with chlorine-releasing agents should be established prior to its use to ensure suitability for routine and terminal cleaning under transmission-based precautions.

**(Category B recommendation)**

In the presence of soiling or debris, moistened microfibre cloths should be used over moistened cotton cloths.

**(Category B recommendation)**

Manufacturer's instructions should be followed in selecting compatible cleaning and disinfecting agents when microfibre cleaning products are used.

**(Category B recommendation)**

A coordinated cleaning system should be implemented as microfibre cleaning products should be part of an overall cleaning system.

**(Category B recommendation)**

### **Are there any practical or logistical considerations associated with using microfibre in health and care settings?**

Manufacturer's instructions should be followed on how to use microfibre products and all staff involved in the use of microfibre cloths and mops should be trained on how to use the product effectively.

**(Category A recommendation)**

### **What costs are associated with using microfibre in health and care settings?**

An assessment in each health and care setting should be carried out to estimate the costs involved in using conventional and microfibre materials, as numerous factors are involved that depend on the overall cleaning regime specific to each setting.

**(Category B recommendation)**

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## Appendix 1: Methodology

### Search strategy

V1.0: searches were run between 24/06/2014 and 01/07/2014 with date limits: 2004-2014

V1.1: search performed on 30/08/2016 with date limits: 2014-2016

V1.2 (current update): search performed on 18/03/2020 with date limits: 2016-2020

The following search strategy was applied in all versions.

### Embase/Medline

- S1 microfibre\*.mp (225)
- S2 microfiber\*.mp (1562)
- S3 ultramicrofiber\*.mp (3)
- S4 ultramicrofibre\*.mp (3)
- S5 sterilization/ (18132)
- S6 sterilisation/ (0)
- S7 decontamination/ (4538)
- S8 disinfection/ (13662)
- S9 housekeeping, Hospital/ (2284)
- S10 clean\*.mp (81578)
- S11 1 or 2 or 3 or 4 (993) Using \* for S1-S4 (1779)
- S12 5 or 6 or 7 or 8 or 9 or 10 (113242)
- S13 11 and 12
- S14 Limit to English language

### CINAHL

- S1 Microfibre\*
- S2 Microfiber\*
- S3 Ultramicrofibre\*
- S4 Ultramicrofiber\*
- S5 Sterilization and Disinfection
- S6 decontaminat\*
- S7 Housekeeping
- S8 Hospital\*
- S9 Health facilit\*
- S10 clean\*
- S11 S1 or S2 or S3 or S4

S12 S5 or S6 or S7 or S8 or S9 or S10

S13 S11 & S12

Limit to English language

### **Databases and resources searched**

The databases and resources searched for this literature review are specified in the [NIPCM methodology](#). The following online resources were searched additionally to identify any relevant policy or guidance documents or any significant grey literature:

- NHS Evidence (<http://www.evidence.nhs.uk/>)
- Health Technology Assessment (HTA) database (<http://www.crd.york.ac.uk/CRDWeb/>)
- Database of Abstracts of Reviews of Effects (DARE) (<http://www.crd.york.ac.uk/CRDWeb/>)
- National Patient Safety Agency (NPSA) (<http://www.npsa.nhs.uk/>)
- National Institute for Health and Care Excellence (NICE) (<http://www.nice.org.uk/>)
- Medicines & Healthcare products Regulatory Agency (MHRA) (<http://www.mhra.gov.uk/>)
- Rapid Review Panel (RRP): product evaluation statements (<http://www.gov.uk/government/groups/rapid-review-panel/>)

## Appendix 2: Grades of recommendation

Grade	Descriptor	Levels of evidence
<b>Mandatory</b>	'Recommendations' that are directives from government policy, regulations or legislation	N/A
<b>Category A</b>	Based on high to moderate quality evidence	SIGN level 1++, 1+, 2++, 2+, AGREE strongly recommend
<b>Category B</b>	Based on low to moderate quality of evidence which suggest net clinical benefits over harm	SIGN level 2+, 3, 4, AGREE recommend
<b>Category C</b>	Expert opinion, these may be formed by the NIPC groups when there is no robust professional or scientific literature available to inform guidance.	SIGN level 4, or opinion of NIPC group
<b>No recommendation</b>	Insufficient evidence to recommend one way or another	N/A