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Environmental decontamination 3: auditing cleaning and disinfection

Key points

Measuring the effectiveness of cleaning and disinfection is an integral part of the decontamination process

The aim of auditing cleaning and disinfection is to improve and sustain performance

Visual assessment measures the appearance of an item or surface, which may not correlate with microbial contamination

Microbiological surface cultures can be used to monitor the levels of microbes and are usually used in outbreak investigations

Fluorescent markers and adenosine triphosphate bioluminescence can be used for process evaluation

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Abstract The final article in our three-part series about the importance of environmental decontamination in healthcare settings explores how to audit cleaning and disinfection in order to maximise patient safety. It outlines different auditing methods and describes how they can be applied in practice to improve the quality of decontamination and patient outcomes.

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Measuring the effectiveness of cleaning and disinfection in healthcare is an integral part of the decontamination process (Fig 1). Auditing is used to assess, evaluate and improve patient care in a systematic way. In the context of healthcare decontamination, it means choosing appropriate methods, collecting audit data and developing effective ways to create a feedback loop to those performing cleaning and disinfection so the process improves.

Audit methods Visual assessment

Visual assessment is the most frequently used method to audit healthcare cleaning and disinfection, and measures the appearance of an item or surface against a checklist of standards (Mulvey, 2011; Griffith et al, 2000). While it is vital for a hospital to be visually clean, visual assessment can be a misleading way of measuring safety as it does not necessarily correlate with microbial contamination (Griffith et al, 2007).

One example of a visual assessment audit scheme is included in the National Patient Safety Agency's *The National Specifications for Cleanliness in the NHS: A Framework for Setting and Measuring Performance Outcomes* (NPSA, 2007). This framework is designed to be read in conjunction with other reports, including:

- *The NHS Cleaning Manual* by the NPSA (currently under review), which provides details of cleaning procedures and practices suitable for use in healthcare facilities;
- *A Matron's Charter: An Action Plan for Cleaner Hospitals* (Jones, 2004), which expands on the role of nurses in creating and maintaining a clean and safe environment for healthcare.

These documents support healthcare facilities in providing and maintaining a clean environment that facilitates the prevention and control of infection, which is a requirement of the Health and Social Care Act (2008).

The national specifications include a visual-assessment audit plan for healthcare facilities (NPSA, 2007). This revolves

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Fig 1. 'Ingredients' for successful cleaning and disinfection



Source: Adapted from National Patient Safety Agency (2007)

Process evaluation tools

Fluorescent markers and adenosine triphosphate (ATP) bioluminescence can be used as process evaluation tools.

Spots of fluorescent material can be applied to a surface in the form of gel, powder or lotion; their removal after cleaning is then assessed using an ultraviolet light (Fig 2). The percentage of spots removed is used to evaluate cleaning performance. The removal of spots has correlated with the removal of microbial contamination in some studies, for example, those by Munoz-Price et al (2012) and Carling et al (2008). This method was used by Carling et al (2008) to demonstrate that the proportion of surfaces in a room that are cleaned can be <50% before educational interventions are implemented.

ATP is the 'energy currency' of all living cells. Surfaces can be sampled for ATP using swabs, and a hand-held sensor can give a real-time quantitative measurement of ATP from the surface using a bioluminescence reaction. ATP is measured in relative light units (RLUs) – the higher the RLU value, the greater the level of ATP. Several quality standards have been set as RLU thresholds, ranging from 100-500 (Boyce et al, 2011; Mulvey et al, 2011). There is no direct correlation between the RLU value and microbial contamination but 'hygiene fails' (determined by aerobic colony count) and ATP do correlate; these sites are commonly hand-touch sites in the near-patient environment, such as bed rails and call buttons (Boyce et al, 2011; Mulvey et al, 2011).

Fluorescent markers need to be applied before cleaning and then examined afterwards to check for removal, whereas ATP bioluminescence can be used to compare the RLU levels before or after cleaning, or simply to assess cleanliness after cleaning. Although both methods can be used as

around a standard set of 49 elements including equipment, fixtures, fittings and buildings. A rolling audit programme is developed for these items in clinical and non-clinical areas, which is stratified by the level of risk:

- Very high risk – for example, intensive care units;
- High risk – for example, inpatient wards;
- Significant risk – for example, outpatient departments and laboratories;
- Low risk – for example, administrative departments.

Each audit item is scored using standardised criteria; scores are presented as percentages that can be viewed at various levels – for example, hospital or ward. These percentages can then be used to inform a quantitative performance management process of hospital cleaning. Infection prevention and control teams can also use the audit tool to perform ad-hoc audits in response to outbreaks or clusters.

Microbiological cultures

Microbiological surface cultures can be used to monitor the levels of bacteria (and other microbes) on surfaces to provide a measure of hospital cleaning and disinfection. Several different sampling methods are available – usually swabs or contact plates ('overfilled' agar plates that are squashed against surfaces and then incubated to culture bacteria) are used. These provide a semi-quantitative (pathogen presence or absence) or quantitative (aerobic colony count) assessment of bacteria on surfaces. Quality standards for both aerobic colony counts (<2.5 colony-forming unit [CFU]/cm²) and specific indicator organisms (<1CFU/cm²) have been proposed (Mulvey et al, 2011; Malik et al, 2003).

While microbiological cultures are used to provide a routine assessment of surface hygiene in sectors such as food production and the pharmaceutical industry, cost and practicality mean they are usually only used in healthcare settings for outbreak investigation or research purposes.

Fig 2. Evaluating the cleaning process with fluorescent markers



Table 1. Comparison of audit methods for cleaning and disinfection in healthcare facilities

Method	Ease of use	Quantitative	Correlation with microbial contamination	Identifies pathogens	Identifies 'dirty' surfaces	Cost
Visual	High	No	Poor	No	Yes	Low
Microbiological cultures	Low-moderate	Yes/No	Accurate	Yes/No	No	High
Adenosine triphosphate bioluminescence	High	Yes	Indirect	No	Yes	Moderate
Fluorescent markers	High	No	Indirect	No	No	Low

effective training aids to improve cleaning performance, fluorescent markers provide a powerful visual cue for cleaning staff, and are less expensive (Dramowski et al, 2016).

Finding the best way to audit

The various methods that can be used to audit cleaning and disinfection in healthcare settings are compared in Table 1. The most effective approach is to use multiple audit methods. Visual assessment must be performed to provide assurance that healthcare facilities and equipment are clean and acceptable to patients, visitors and staff. Other tools – including fluorescent markers/ATP bioluminescence and, on occasion, microbiological cultures – should be used to supplement visual assessment, especially where cleaning or disinfection has taken place following the discharge of a patient with a high-risk pathogen.

Performing audits

Cleaning and disinfection of healthcare facilities is a multiprofessional process and multiple staff groups – including nursing staff – should be involved in collecting audit data.

It is suggested that nursing staff, together with cleaning staff, periodically perform visual assessments with senior management involved in auditing. Audit data collection also gives an opportunity to involve patient and public representatives. For example, the Patient-Led Assessments of the Care Environment (PLACE) scheme (Bit.ly/PLACEAudit) involves patients and patient representatives in collecting audit data on a range of metrics around the healthcare environment – including cleanliness – in conjunction with ward staff. Peer audits involving experts from external organisations, who observe and audit cleaning practice, can also be an effective way of improving cleaning standards.

Process evaluation tools can be used by nursing staff, cleaning supervisors or other staff groups, such as facilities or infection prevention and control. The collection and interpretation of microbiological surface cultures should be performed by members of the infection prevention and control team or by microbiologists.

The items included in an audit programme should include a mixture of:

- High-touch items that are located in the near-patient environment (Fig 3);
- Fixtures and fittings;
- Furniture;
- General surfaces (such as floors).

It is vital for a multiprofessional group including ward-based nurses and nursing managers to be involved in selecting the items that are included in an audit schedule.

The frequency of audit data collection will depend on the local specifications of the cleaning services; in general, a monthly schedule of regular visual assessments is agreed. Process evaluation tools can be:

- Integrated into a schedule of regular audit;
- Used regularly as visual aids to improve the quality of staff training;
- Used occasionally to support specific activities, for example, outbreak investigation.

Audit data should be presented and shared in a format that can be easily understood; this may require it to be presented in different ways to different staff groups. It is important the data reaches the staff performing the task that is being audited. The use of various mobile apps supporting the collection, analysis and sharing of audit data can save time and improve the quality and ease of interpretation of the data.

Using audit data to drive improvement

The ultimate aim of auditing cleaning and disinfection in healthcare is to improve

performance and sustain those improvements. Targets are an important part of using audit data to drive and maintain improvement. They should be realistic and achievable but challenging, and regularly reviewed by a multiprofessional group to ensure they remain fit for purpose. Although the NPSA does not recommend target levels of cleanliness in its national specifications (NPSA, 2007), the following target percentages are suggested for the different risk category areas in the visual-assessment audit scheme plan:

- Very high: 98%;
- High: 95%;
- Significant: 85%;
- Low: 75%.

The best approach to using audit data in order to drive improvement is to establish a persuasive improvement culture, so realistic audit data will be valued and used to target focused improvement in areas that need support. Box 1 provides an example of how audit can be used to drive improvement in the cleaning and disinfection of an item that nurses are responsible for cleaning.

Improving patient outcomes

There is evidence from clinical studies that using audit data can improve standards of decontamination in healthcare, and that this translates into improved patient outcomes (Hayden et al, 2006). Part 1 of this series cited evidence that admission into a room where the previous occupant was infected or colonised with a pathogen increases the patient's risk of acquiring a pathogen that could go on to cause an infection. Datta et al (2011) found that improved cleaning methods and education combined with audit with fluorescent markers meant that the occupant of a room previously occupied by a patient with methicillin-resistant *Staphylococcus aureus* was no longer at increased risk.

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Fig 3. Examples of high-touch sites in the near-patient environment to include in an audit programme



3a. Patient bed-space



3b. Patient bathroom

Box 1. Using data to drive improvement

- Audit data from a routine monthly visual assessment identified that the cleaning of intravenous (IV) stands was a problem in a number of ward areas
- The audit data was fed back to senior nursing staff, who spoke to ward staff to find out why the IV stands were not being cleaned properly
- The ward nurses explained there is confusion about who is responsible for cleaning these items, with some nursing staff thinking ward cleaners are responsible for doing so
- The senior nursing staff worked with facilities staff, cleaning staff and ward nurses to improve understanding of the cleaning responsibilities
- The audit scores improved the following month

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Summary

Effective auditing of cleaning and disinfection in healthcare facilities should be an integral part of the decontamination process. Like all aspects of the decontamination process, audit should be multiprofessional and use the experience and expertise of nursing staff. Various audit methods should be employed to create a clinically informed and sustainable audit plan, including visual inspection, process-evaluation tools such as fluorescent markers and ATP bioluminescence, and microbiological cultures where required. Audit data should be used to improve performance through persuasive methodology, which has been shown to improve patient outcomes. Nurses should be aware of the

audits that take place in their area of work and know the outcome and any subsequent actions required. **NT**

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