Balancing the critical areas associated with surface disinfectant selection

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BACKGROUND

Healthcare associated infections (HAIs) are a known risk, affecting up to 165,000 Australians every year[1]. The pathogens causing such infections are often multi-drug resistant organisms (MROs).

Previous research has demonstrated the ability for MROs to survive in biofilms on high touch surfaces and objects within healthcare facilities and remain viable for several years[2,3].

Management of surface cleaning practice is critical for the implementation of effective infection control strategies to mitigate pathogen transmission.

The South Australia "Cleaning Standards for Healthcare Facilities" (SA Standard), outlines standard operating procedures for environmental cleaning based upon risk assessment criteria[4]. High risk areas, such as operating theatres, are those that pose a high risk of infection transmission due to contamination and vulnerable patient exposures. Additional cleaning and disinfection is required whenever a patient is confirmed or suspected of infection or colonisation with "a multi-resistant organism, infectious respiratory pathogen, infectious gastroenteritis or *Clostridium difficile*" (transmission-based precautions)[4].

The SA Standard requires that disinfectants selected for use within healthcare settings must be "a TGA approved hospital-grade disinfectant, preferably with label claims against specific organisms or a chlorine-based product such as sodium hypochlorite"[4].

The selection of disinfection products that are preferred by cleaning staff have been associated with better surface hygiene. This is evident where a simpler alternative to a 3 stage chlorine based disinfectant was provided[5]. Therefore, it is important to select appropriate cleaning and disinfectant products that reduce pathogen transmission risk, are compatible with common materials within the facility in question, are cost effective and minimise occupational risk to staff and patients (Figure 1).

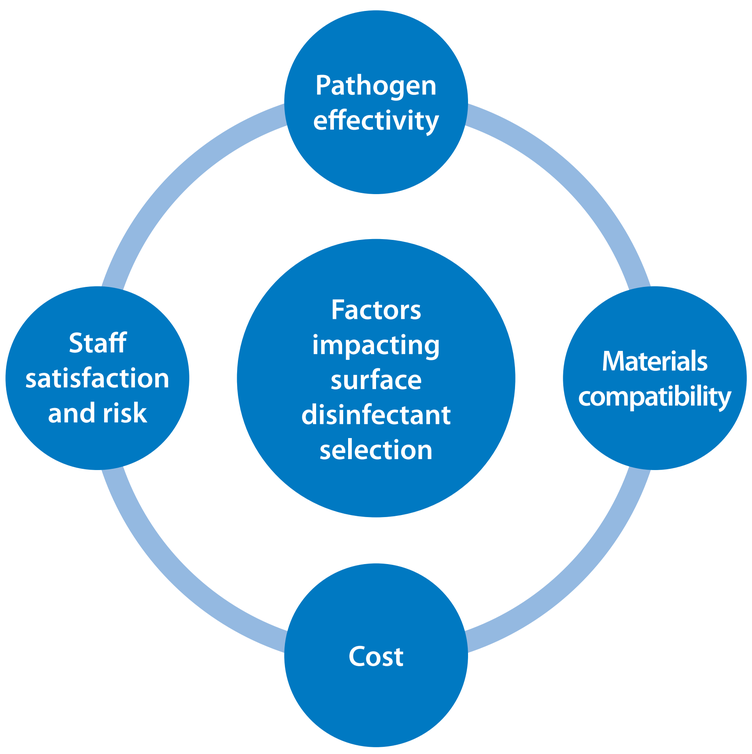

Figure 1. *Factors impacting surface disinfectant selection*

Due to a high incidence of *Clostridium difficile* infection within the operating theatre of a South Australian Hospital, the cleaning protocols were escalated to meet the requirement of transmission based precautions. This resulted in the need to select an appropriate disinfectant for regular cleaning and disinfection.

The core considerations for this hospital were to minimise safety and health risks to staff, reduce pathogen transmission risk, cleaning workload reduction and decrease cost whilst maintaining SA Standard compliance.

HIGHLIGHTS

- **When selecting an appropriate disinfectant it is important to consider pathogen effectivity, materials compatibility, cost and staff satisfaction**
- **A high incidence of *Clostridium difficile* infection prompted an increase in cleaning protocol, resulting in the need for appropriate disinfectant selection**
- **Two trialled products resulted in increased occupational risk: adverse reactions from staff and an increase in WHS incidence reporting**
- **The implementation of the peracetic acid based product provided a solution to the operational risk experienced and improved ward cleanliness as recorded through auditing**

CASE STUDY

In 2011, a chlorine based disinfectant (Actichlor™ Plus, Ecolab, Macquarie Park, NSW. ARTG 17432) was implemented as the principle disinfectant within this facility at a usage concentration of 1,000ppm.

Mount Gambier and Districts Health Services

Its use was discontinued following reports of five staff members having adverse reactions to the product. An assessment by an occupational hygienist indicated the reaction was due to odour of the product. The affected staff were reassigned, whilst several required worker's compensation leave prior to reassignment. Safe work measures were implemented for affected staff remaining within the ward, limiting its use or the use of an alternative whilst on duty if required.

A replacement product comprised of hydrogen peroxide (Oxivir® TB, Diversey, Lane Cove, NSW Australia. ARTG 165058) was selected for trial. However, due to a lack of evidence of efficacy against *C. difficile* spores, staff vigilance was required for infected and colonised patients. The use of the chlorine based disinfectant was reinstated for terminal cleaning following procedures on such patients.

The use of the hydrogen peroxide disinfectant resulted in an increase of WHS reports relating to slip and near slip incidents within the ward. This was due to the accumulation of product residue on the floor which was sticky when dry and slippery when wet. This residue increased cleaning staff workload, with additional cleaning steps using a detergent required for removal on a weekly basis.

From April 2017, a buffered peracetic acid based cleaner/disinfectant was trialled for use (Surfex®, Whiteley Corporation, Tomago NSW Australia. ARTG 257360). Approval for trial was granted through both the Country Health South Australia Local Health Network (CHSALHN) Product Standardisation Committee and the local hospital Work Health Safety (WHS) committee prior to commencement.

RESULTS

The use of the buffered peracetic acid based product was accepted as suitable for cleaning/disinfection under transmission based precautions according to the SA standard criteria.

Staff present within the trial ward noted visible improvements of cleanliness. This was supported by internal audits, with floor residue from the hydrogen peroxide based product no longer reported. No respiratory concerns or issues were reported with its use, including from staff originally affected by the chlorine based product.

Staff feedback was collected regarding the use of the product and demonstrated a positive response to peracetic acid use. This was highlighted in the areas of fragrance, directions for use and WHS benefits (Table 1).

Table 1. *Staff survey responses to Surfex® following 5 months of implementation*

	Excellent	Very Good	Good	Average	Below Average
Appearance	1	13	2	3	0
Fragrance	10	6	0	1	2
Directions for use	15	1	3	0	0
Product training	13	3	3	0	0
Overall response	11	3	4	0	1
WHS Benefits	14	3	1	1	0
TOTAL	64	29	13	5	3

A cost analysis of the original chlorine based product, hydrogen peroxide based product and peracetic acid product was conducted (Table 2). The peracetic acid based product was considered to be an economically viable alternative.

Table 2. *Cost analysis of trialled disinfectant products at time of study*

	Actichlor™ Plus	Oxivir® TB	Surfex®
Active ingredient	Chlorine	Hydrogen peroxide	Peracetic acid
Cost per unit	16 cents/ tab	$8.81	$3.80
Units per day	1 tablet/L	12	7
Direct cost/day	$3.20	$105.72	$26.60

CONCLUSION

When selecting an appropriate surface disinfectant it is critical to evaluate candidates from all applicable aspects. Demonstrated efficacy against MROs is important as surface contamination with pathogenic microorganisms has been previously demonstrated. However the management of occupational risk is of equal importance.

Adverse reactions such as these observed within this facility have been previously reported[6,7]. Therefore, the selection of an appropriate high level disinfectant must also include staff satisfaction and risk during evaluation.

The trial of the peracetic acid based product provided a balance between the important aspects of infection control: effective surface disinfection and minimised operational risk in a cost effective manner.

References

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Conflict of Interest

Dr Jessica Farrell is employed by Whiteley Corporation in combination with the University of Sydney regarding a collaborative research grant not related to this manuscript.