endurocide
INFECTION CONTROL

Endurocide® Antimicrobial PLUS Hospital Curtains

Protecting your staff & patients all day, everyday

endurocide.com

The facts

Hospital Acquired Infections (HAIs)

In 2016/17 NHS England hospitals had approximately 834,000 HAIs, accounting for an estimated 28,500 deaths[7]

Pathogens such as C.*difficile* spores, MRSA, COVID-19, Measles etc., can survive on surfaces anywhere from a few hours to up to five months[3,5,6]

Contamination of traditional Curtains can happen rapidly after installation, causing them to become potential sources of pathogenic transmission[1,4]

Traditional hospital laundering practices are not sufficient to remove all viable bacteria[2]

93% of tested laundered fabrics contained bacteria that could result in HAIs[2], with up to 92% of traditional (fabric) curtains becoming re-contaminated within one week[1]

21% of all bed days across NHS England hospitals in 2016/2017 were due to HAIs, costing some £2.7 billion per year[7]

1. Ohl, Michael; Schweizer, Marin; Graham, Maggie; Heilmann, Kristopher; Boyken, Linda; Diejema, Daniel "Hospital privacy curtains are frequently and rapidly contaminated with potentially pathogenic bacteria" American Journal of Infection Control (2012)
2. Karen McIntyre "Hospital Laundering Practices linked to HAI's" www.nonwoven-industry.com (May 2013)
3. Kramer, Axel; Schwebke, Ingeborg and Kampf, Günter "How long do nosocomial pathogens persist on inanimate surfaces? A systematic review" BMC Infectious Diseases (2006), 6:130
4. Madeo, Maurice; Green, David; McGregor, Eileen "A study to compare the microbiological contamination of 3 types of hospital privacy curtains with a district general hospital" www.endurocide.com
5. Centers for Disease Control & Prevention "Science Brief: SARS-CoV-2 and Surface (Fomite) Transmission for Indoor Community Environments", April 2021 https://www.cdc.gov/coronavirus/2019-ncov/more/science-and-research/surface-transmission.html
6. World Health Organisation "Measles Fact Sheet", December 2019
7. Guest JF, Keating T, Gould D, et al. Modelling the annual NHS costs and outcomes attributable to healthcare-associated infections in England. BMJ Open 2020;10:e033367. doi:10.1136bmjopen-2019-033367
8. Centers for Disease Control & Prevention "HAI and Antibiotic Use Prevalence Survey" https://www.cdc.gov/hai/eip/antibiotic-use.html
9. American Hospital Association "Fast Facts on U.S. Hospitals, 2022" https://www.aha.org/statistics/fast-facts-us-hospitals

The solution

Endurocide® Antimicrobial PLUS Hospital Curtains

Why Antimicrobial Plus?

Unlike other available antimicrobial curtains, **Endurocide® Antimicrobial Plus Curtains** are:

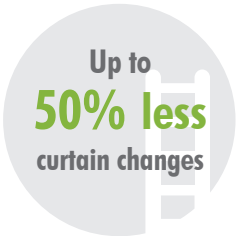
- Proven to remain active for up to two years*
- Silver additive free
- Tested and proven to be effective against the top five pathogen groups found in hospitals†

Tested against:†

- Bacteria
- Fungi
- Mycobacteria
- Spores
- Viruses

Other important benefits:

PATENTED COATING
for up to two year long life*



REDUCING RISK
& saving valuable time

OVERALL SAVINGS
over two years

PEER REVIEW TESTED
in over eight countries

* **Disclaimer:** Two year long life applies to Endurocide® Antimicrobial Plus Standard Curtains only and whilst Endurocide® Antimicrobial Plus Standard Curtains have been independently tested to remain antimicrobially and sporicidally effective for up to two years in-situ, the actual length of curtain use achieved will depend on a variety of factors, including, but not limited to: individual hospital practices; the natural longevity of polypropylene; the risk of the curtain being soiled from items such as blood, urine and general spills; etc. Curtains should always be replaced when visibly soiled. Any timescales provided/referenced are always offered as a guideline only and under no circumstances whatsoever constitute a guarantee. † See individual curtain testing pages for full details on pathogens tested against.

Our technology is different...

Whilst traditional polyester curtains, natural fibre or short-life disposable curtains can easily become **sources of pathogenic transmission within days of installation**, our curtains are different...

At the curtain manufacturing stage, the polypropylene curtain fabric is impregnated with our unique, patented **Endurocide® Curtain Liquid**.

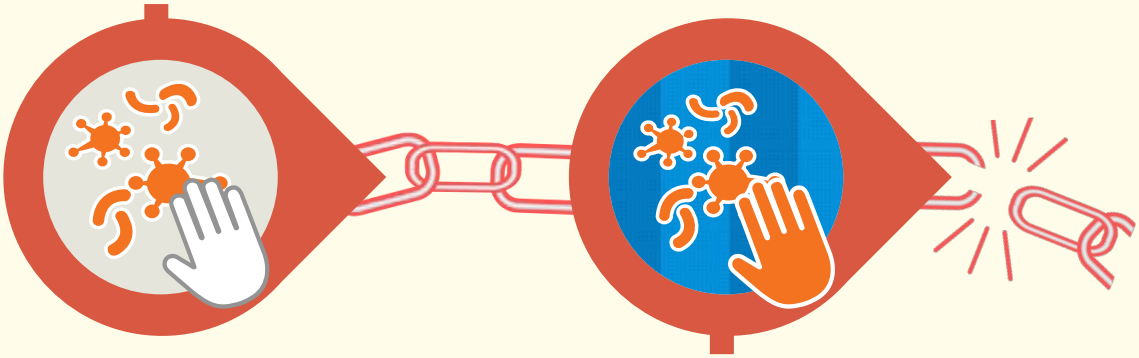
This impregnation coats the curtain fabric creating a polymer layer which has a **dual 'static' and 'cidal' action**.

The 'static' action allows the curtain fabric to **trap pathogens** on the surface of the fabric and prevent them from multiplying, whilst the 'cidal' action then **kills the pathogens - helping to break the chain of infection!**

The dual mechanism of trapping and killing the top healthcare pathogen groups on the curtain surface is key - and what makes Endurocide® Antimicrobial Plus Curtains so unique

Breaking the Chain of Infection...

Hand touches contaminated patient, item or surface and **picks up pathogens**



Contaminated hand touches curtain - **pathogens may be transferred to curtain surface**

Our technology in action...

Endurocide® Antimicrobial Plus Curtains kill the top 5 pathogen groups:*

Bacteria & fungi

are killed by both preventing their respiration and rupturing their cell membrane, then disrupting their cell metabolism and finally inhibiting the cell from reproducing

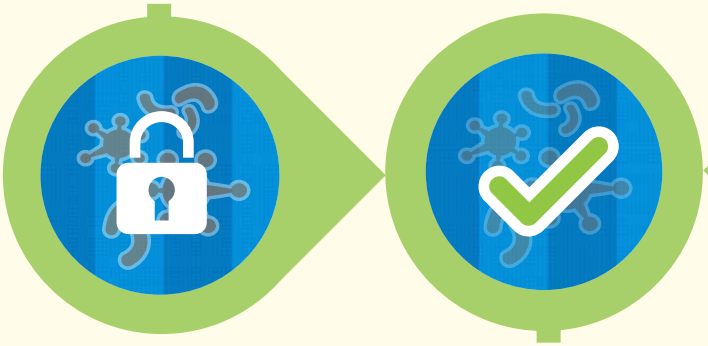
Spores

are killed by piercing through the spore coats and cortex, so causing lethal DNA damage

Enveloped viruses

are inactivated by attacking and damaging the virus's protein and lipid structures, so stopping their ability to cause infections

Endurocide® Antimicrobial Plus Curtains trap pathogens on the fabric surface, preventing their escape or multiplication



Once trapped on the curtain surface, the unique impregnation action **kills the pathogens** - and continues to act for up to **two years***

Endurocide® Antimicrobial Plus Curtains prevent potential retransmission of pathogens to staff, patients, visitors, equipment, surfaces and any other items - **breaking the chain of infection!**

* See Disclaimer on page 3

Antimicrobial **PLUS**
Hospital Curtains – Standard Colours

Laboratory testing

1. Fabric Testing - Trapping pathogens

We use **qualitative** 'Zone of Inhibition' tests to prove that our Endurocide® Curtains both trap pathogens on the surface of our fabric and then prevent the pathogens from growing and reproducing further whilst they are trapped.

These are known as 'static' tests:

- AATCC 147
- CG 147

2. Fabric Testing - Killing pathogens

We use **quantitative** fabric tests to prove that, once pathogens are trapped on the curtain surface, they are then killed – completing our unique dual-action patented protection technology.

These are know as 'cidal' tests:

- AATCC 100
- ISO 20743
- JIS Z 2801

3. One Year & Two Year Testing*

Tests conducted on the Endurocide® Curtain fabric one year and two years after manufacture, to demonstrate that the treated fabric remains active and effective.

- CG 147
- AATCC 100

4. Liquid Testing

Fabric tests against certain viruses, such as Measles and Coronavirus, do not yet exist.

In this situation, to demonstrate our virucidal effectiveness, we instead use quantitative suspension tests against the liquid used to impregnate our Endurocide® Curtains:

- EN 14476

* See website for further details on our one and two year testing

Spores	International Standards	
Clostridium difficile	CG 147 AATCC 100	AATCC 147 JIS Z 2801

Mycobacteria	International Standards
Mycobacterium tuberculosis	CG 147

Bacteria	International Standards	
Acinetobacter baumannii	CG 147	
Acinetobacter baumannii (CRA)	CG 147	
Acinetobacter baumannii (MDRA)	CG 147	
Enterococcus hirae	CG 147	
Escherichia coli	CG 147	AATCC 100
Extended Spectrum Beta-lactamase (ESBL) *Escherichia coli*	CG 147	AATCC 100
Extended Spectrum Beta-lactamase (ESBL) *Klebsiella pneumoniae*	CG 147	
Klebsiella pneumoniae	CG 147	ISO 20743
Methicillin-resistant *Staphylococcus aureus* (MRSA)	CG 147 AATCC 100	AATCC 147 JIS Z 2801
Pseudomonas aeruginosa	CG 147	
Salmonella choleraesuis	JIS Z 2801	
Salmonella typhimurium	CG 147	AATCC 100
Staphylococcus aureus	ISO 20743	JIS Z 2801
Vancomycin resistant *Enterococcus* faecalis (VRE)	CG 147	

Fungi	International Standards	
Aspergillus niger	CG 147	AATCC 147
Candida albicans	CG 147 JIS Z 2801	AATCC 147
Candida auris	CG 147	AATCC 147

Liquid treatment testing

Enveloped viruses	International Standards
Human Coronavirus	EN 14476
H1N1 Influenza A virus (Swine Flu)	EN 14476
Measles virus	EN 14476

Fire retardant standards

Our curtains have been tested to the following International fire retardant standards:

Country/Region	International Standards
UK & Europe	BS 5867 Part 2 Types B & C: 2008
USA & Canada	CAN/ULC-S109; NFPA 701: 2010
Australia & New Zealand	AS 2755.2-1985; AS 1530.2-1993 Part 2

TESTED AGAINST CORONAVIRUS

Independent Peer Review Trials

Endurocide® Antimicrobial Plus Standard Curtains have been extensively tested in independent international trials and peer reviews:

Scan here to find out more about our international trials:

American Journal of Infection Control 24 month trial[1]

In 2016, a report was published in the American Journal of Infection Control testing the antibacterial efficacy of Endurocide® Antimicrobial Plus Standard Curtains 24 months after installation.

Organised by one of Australia's largest public health services, every six months over a period of **24 months** Zone of Inhibition and Contact Inhibition testing was carried out against a range of multi-resistant microorganisms, including:

- Gram positive bacteria (MRSA, VRE *E.faecium*)
- Gram negative bacteria (*Pseudomonas aeruginosa*, ESBL *E.coli*)
- Fungi (*Candida albicans*)
- Spores (*Clostridium difficile*)

COST REDUCTION 50%

"Excellent results were achieved... when tested at baseline, **6, 12, 18 and 24 months**.

There were cost benefits for replacing standard fabric curtains with Endurocide® Curtains... cutting the overall cost by more than 50%.*"

* The cost savings were based on comparing the use of Endurocide® Antimicrobial Plus Standard Curtains with traditional cotton cubicle curtains, not only in regards to the initial purchasing costs but to the saving of labour and laundering over two years.

1. Kotsanas, Despina; Gillespie, Elizabeth "Disposable antimicrobial and sporicidal privacy curtains: Cost benefit of hanging longer" American Journal of Infection Control, February 25, 2016; DOI:https://doi.org/10.1016/j.ajic.2016.01.009

Hong Kong joint Universities & Government study on bacterial contamination of hospital curtains[2]

This study, published in the Journal of Infection Control & Hospital Epidemiology, evaluated both bioburden and hanging times of three types of curtain – Endurocide® Antimicrobial Plus Standard Curtains, curtains with built-in silver additives and traditional fabric curtains.

Organised jointly between eight hospitals and three government departments in Hong Kong, the study collected culture samples weekly from 12 rooms across 10 hospitals over 12 months to amass significant data before publishing their findings.

The results overwhelmingly supported the continued use of Endurocide® Curtains to improve patient safety by eliminating sources of Multi-drug Resistant Organism (MDRO) transmission.

Using Endurocide® Curtains in place of standard curtain:

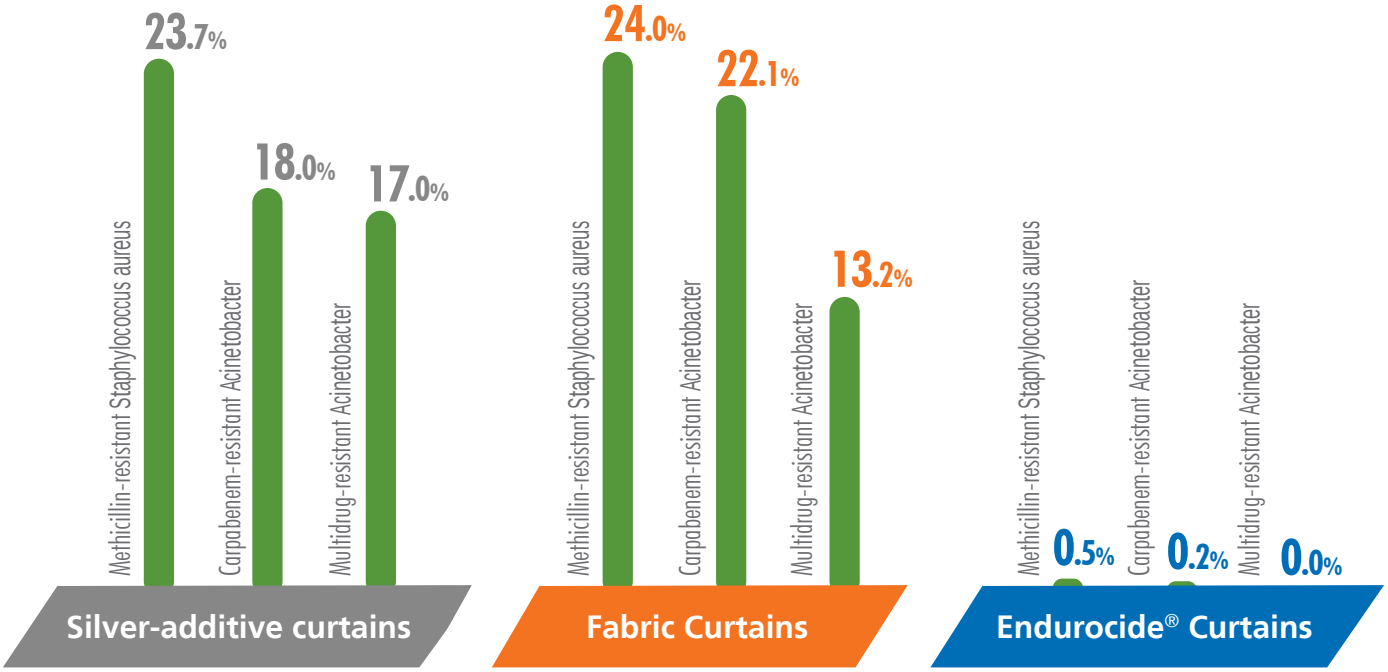
"could avert the costs related to curtain changing, laundering, and revenue loss, in addition to improving patient care by removing an environmental source of MDROs."

Results:

Contamination detected on curtains after:*

Silver-additive curtains	Fabric curtains	Endurocide® Curtains
4 DAYS	5 DAYS	138 DAYS

Percentage of contamination detected in this period:



*Median

2. Shik Luk MBBS, MRCP, FRCPath, FHKCPath, FHKAM1 et al, "Effectiveness of antimicrobial hospital curtains on reducing bacterial contamination - A multicenter study," Infection Control & Hospital Epidemiology (2019), 40, 164–170; DOI:10.1017/ice.2018.315

Antimicrobial PLUS
Hospital Curtains – Printed Colours

Laboratory testing

1. Fabric Testing - Trapping pathogens

We use a **qualitative** 'Zone of Inhibition' test to prove that our Endurocide® Curtains both trap pathogens on the surface of our fabric and then prevent the pathogens from growing and reproducing further whilst they are trapped.

This type of test is known as a 'static' test (*see image 1*):

- **CG 147**

2. Fabric Testing - Killing pathogens

We use a **quantitative** fabric test to prove that, once pathogens are trapped on the curtain surface, they are then killed – completing our unique dual-action patented protection technology.

This type of test is known as a 'cidal' test (*see image 2*):

- **ISO 20743**

3. Liquid Testing

Fabric tests against certain viruses, such as Measles and Coronavirus, do not yet exist.

In this situation, to demonstrate our virucidal effectiveness, we instead use quantitative suspension tests against the liquid used to impregnate our Endurocide® Curtains:

- **EN 14476**

Spores	International Standards
Clostridium difficile	**CG 147**

Bacteria	International Standards
Enterococcus hirae	**CG 147**
Escherichia coli	**CG 147**
Klebsiella pneumoniae	**CG 147** **ISO 20743**
Methicillin resistant *Staphylococcus aureus* (MRSA)	**CG 147**
Salmonella typhimurium	**CG 147**
Staphylococcus aureus	**ISO 20743**
Vancomycin resistant *Enterococcus* faecalis (VRE)	**CG 147**

Fungi	International Standards
Candida albicans	**CG 147**

Liquid treatment testing

Enveloped viruses	International Standards
Human Coronavirus	**EN 14476**
H1N1 Influenza A virus (Swine Flu)	**EN 14476**
Measles virus	**EN 14476**

Fire retardant standards

Our curtains have been tested to the following International fire retardant standards:

Country/Region	International Standards
UK & Europe	BS 5867 Part 2 Types B & C: 2008
USA & Canada	CAN/ULC-S109; NFPA 701: 2010
Australia & New Zealand	AS 2755.2-1985; AS 1530.2-1993 Part 2

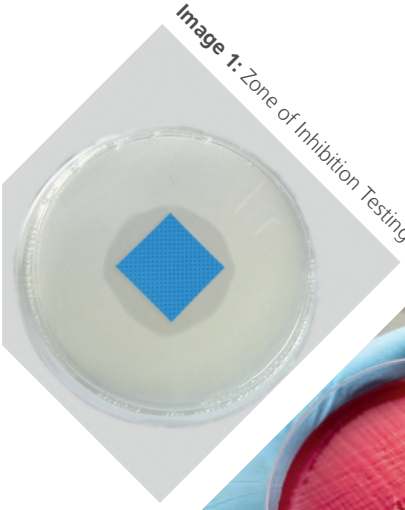


Image 1: Zone of Inhibition Testing

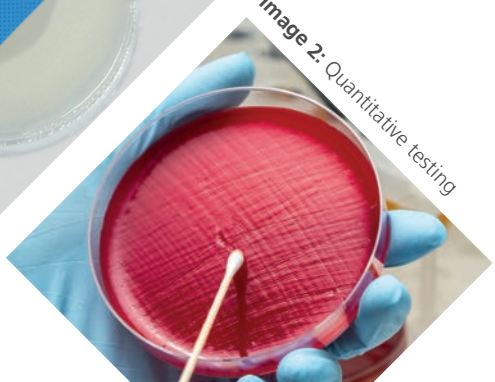


Image 2: Quantitative testing

TESTED AGAINST CORONAVIRUS

American Journal of Infection Control ■■ (2016) ■■-■■

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Letters to the editor

Disposable antimicrobial and sporicidal privacy curtains: Cost benefit of hanging longer

To the Editor:

The patient environment may harbor potential pathogens making it a possible source for cross-transmission to the hands of health care workers, patients, and visitors.[1]

Privacy curtains surrounding patient beds are constantly touched and may become a reservoir for dissemination.[2,3] A recent outbreak in an ear, nose, and throat ward revealed 10 fabric curtains were contaminated with the same strain of group A *Streptococcus* as were 3 affected patients in the cancer ward.[4]

Disposable antimicrobial and sporicidal privacy curtains have been marketed over the past few years as a passive infection prevention strategy. New technologies have delivered a variety of treated and embedded substances onto the surfaces of synthetic curtains.[5] Silver-impregnated curtains were hung in our intensive care unit in 2012 and had excellent antimicrobial and sporicidal activity for 6 months.[6] Recent formulations have extended protective activity for 2 years, thus providing extra savings related to laundering and labor.

We sought to test antimicrobial activity for 1 antimicrobial and sporicidal product (Endurocide, Aberdeenshire, Scotland), against a range of multiresistant microorganisms to establish activity for the claimed 24-month period.[7] These curtains are composed of nonwoven, extruded polypropylene with 0.5 mm thickness (100 gsm). They are impregnated with a blend of quaternary ammonium chlorides and polyorganosiloxane (a repellent negatively charged silicone) as well as being fire retardant. The biostatic and biocidal properties also prevent bacteria from penetrating or multiplying on the curtain.

Testing followed the same methodology as previously, wherein zone of inhibition and contact inhibition was determined against a range of microorganisms (gram negative: extended-spectrum β-lactamase *Escherichia coli*, *Stenotrophomonas maltophilia*, carbapenemase-producing *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa*; and gram positive: methicillin-resistant *Staphylococcus aureus*, vancomycin-resistant *Enterococcus faecium*, and coagulase-negative staphylococci), *Candida albicans*, and spores of *Clostridium difficile*.[6]

Excellent results were achieved for both zone of inhibition and contact inhibition when tested at baseline, 6, 12, 18, and 24 months with no visible loss of activity (Fig 1).

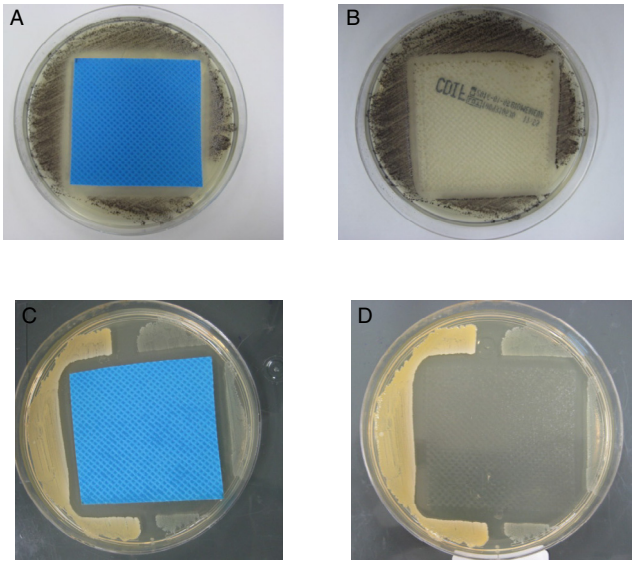


Fig 1. Images from 24-month testing for (A) *Clostridium difficile* (zone of inhibition), (B) *Clostridium difficile* (contact inhibition), (C) methicillin-resistant *Staphylococcus aureus* and vancomycin-resistant *Enterococcus faecium* (zone of inhibition), and (D) methicillin-resistant *S aureus* and vancomycin-resistant *E faecium* (contact inhibition).

There were cost benefits for replacing standard fabric curtains with the newer formulation (Endurocide) sporicidal and antimicrobial curtains. The cost of laundering fabric curtains was AUS$4 per screen with a labor cost of AUS$10 to remove and rehang. Based on a routine schedule of 3 months this would mean 8 changes over 2 years at a total cost of AUS$112. If ad hoc changes were required due to patients discharged from contact precautions, then an additional cost of AUS$19 (due to extra setup requirements) would be incurred per episode. The disposable curtains cost AUS$45 to purchase and AUS$10 to hang for the 2-year duration, thus cutting the overall cost by more than 50%. In addition, the curtains provide sporicidal and antimicrobial protection to all patients, staff, and visitors accessing the patient area. Another advantage includes a safety advantage for staff members changing the curtains because they are only required to climb ladders once instead of 8 times during a 2-year period.

The final consideration is the environment-related effect of transporting, washing, and reusing fabric curtains compared with the disposable polypropylene curtains that can be recycled via the plastic recycling stream.

Our health service promotes the implementation of the new formulation Endurocide privacy curtains from both a cost-effectiveness and safety perspective.

References

1. Cheng VC, Chau PH, Lee WM, Ho SK, Lee DW, So SY, et al. Hand-touch contact assessment of high-touch and mutual-touch surfaces among healthcare workers, patients, and visitors. J Hosp Infect 2015;90:220-5.

2. Ohl M, Schweizer M, Graham M, Heilmann K, Boyken L, Diekema D. Hospital privacy curtains are frequently and rapidly contaminated with potentially pathogenic bacteria. Am J Infect Control 2012;40:904-6.
3. Das I, Lambert P, Hill D, Noy M, Bion J, Elliott T. Carbapenem-resistant *Acinetobacter* and role of curtains in an outbreak in intensive care units. J Hosp Infect 2002;50:110-4.
4. Mahida N, Beal A, Trigg D, Vaughan N, Boswell T. Outbreak of invasive group A *Streptococcus* infection: contaminated patient curtains and cross-infection on an ear, nose and throat ward. J Hosp Infect 2014;87:141-4.
5. Schweizer M, Graham M, Ohl M, Heilmann K, Boyken L, Diekema D. Novel hospital curtains with antimicrobial properties: a randomized, controlled trial. Infect Control Hosp Epidemiol 2012;33:1081-5.
6. Kotsanas D, Wijesooriya WR, Sloane T, Stuart RL, Gillespie EE. The silver lining of disposable sporicidal privacy curtains in an intensive care unit. Am J Infect Control 2014;42:366-70.
7. Endurocide. Antimicrobial and sporicidal curtains. Available from: http://www.endurocide.com/infection-control/hospital-curtains/antimicrobial-and-sporicidal-curtains/. Accessed February 18, 2016.

Conflicts of Interest: None to report.

Despina Kotsanas, MClinEpi, BSc (Hons)*
Monash Infectious Diseases, Monash Health
Clayton, Victoria, Australia

Elizabeth Gillespie, MPubHlth(Melb), BN, SIC, RM
Infection Control and Epidemiology Unit, Monash Health
Clayton, Victoria, Australia

* Address correspondence to Despina Kotsanas, MClinEpi, BSc (Hons), Monash Infectious Diseases, Monash Health Clayton, Victoria, Australia.
E-mail address: despina.kotsanas@monashhealth.org (D. Kotsanas).

http://dx.doi.org/10.1016/j.ajic.2016.01.009

Features & benefits

- Long lasting (up to 24 months)
- Fitted with tiebacks
- 100% recyclable
- Breaks the chain of infection
- Lightweight
- No track conversion
- No laundry costs
- Self-auditing & privacy labels
- Fire retardant*

* Meets international standards: NFPA 701, AS 2755.2 - 1985, BS 5867 Part 2 Types B & C 2008, AS 1530.2-1993 Part 2: Test for Flammability of Materials and CAN/ULC-S109

Where to use

Designed for critical hospital and healthcare environments where patient care cannot be compromised.

Suitable for use in hospital departments such as:

- Burns units
- Oncology wards
- Operation suites
- General surgery wards
- Cardiology wards
- Renal units
- Obstetrics
- Isolation wards
- Intensive care units
- Maternity & neonatal
- Rheumatology
- Infectious disease units
- High dependency units
- Gynaecology

Curtain dimensions

	Standard	Mesh top	Mesh cut	Longdrop
Height	**2.0m**	**2.55m (includes 0.55m mesh)**	**2.55m**	**2.6m**
Full width	**7.5m**	**7.5m**	**7.5m**	**7.5m**
Medium width	**5.55m**	**5.55m**	**5.55m**	**5.55m**
Half width	**3.75m**	**3.75m**	**3.75m**	**3.75m**
Pleat width	**0.15m**	**0.15m**	**0.15m**	**0.15m**

New Zealand Distributor

Kenco Ltd

Kendyl Carikas Mobile: 021 029 66718

Email: kendyl.carikas@kenco.nz

Manufactured by

BIOTECHNICS

Bio Technics Ltd. Linton Business Park, Gourdon, Aberdeenshire, Scotland, UK DD10 0NH

Tel: +44 (0) 1561 361515 info@endurocide.com endurocide.com

REV1.707.19