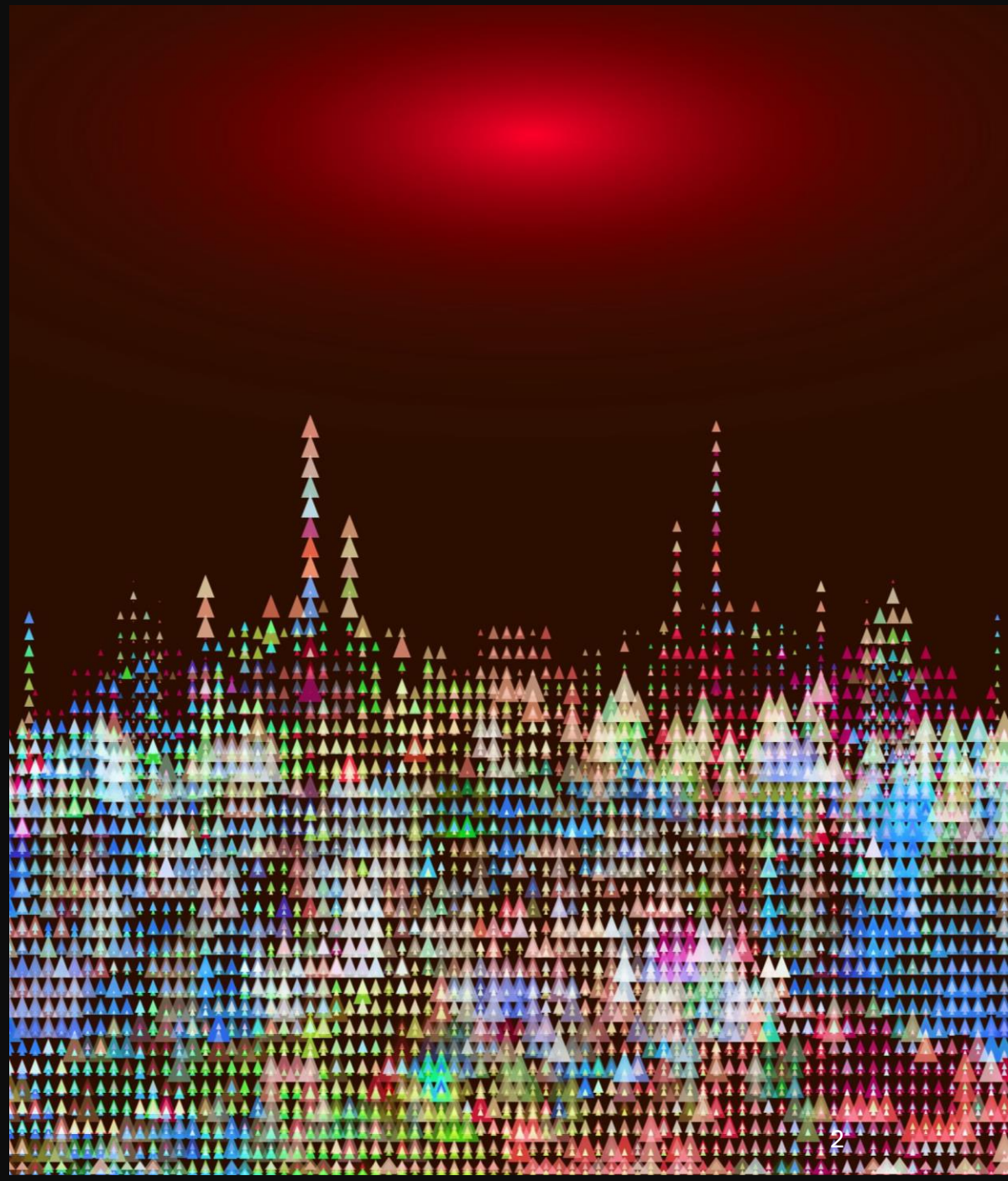
Disinfection and cleaning In 2024

Why can't we make a dent in HAIs/HACs?

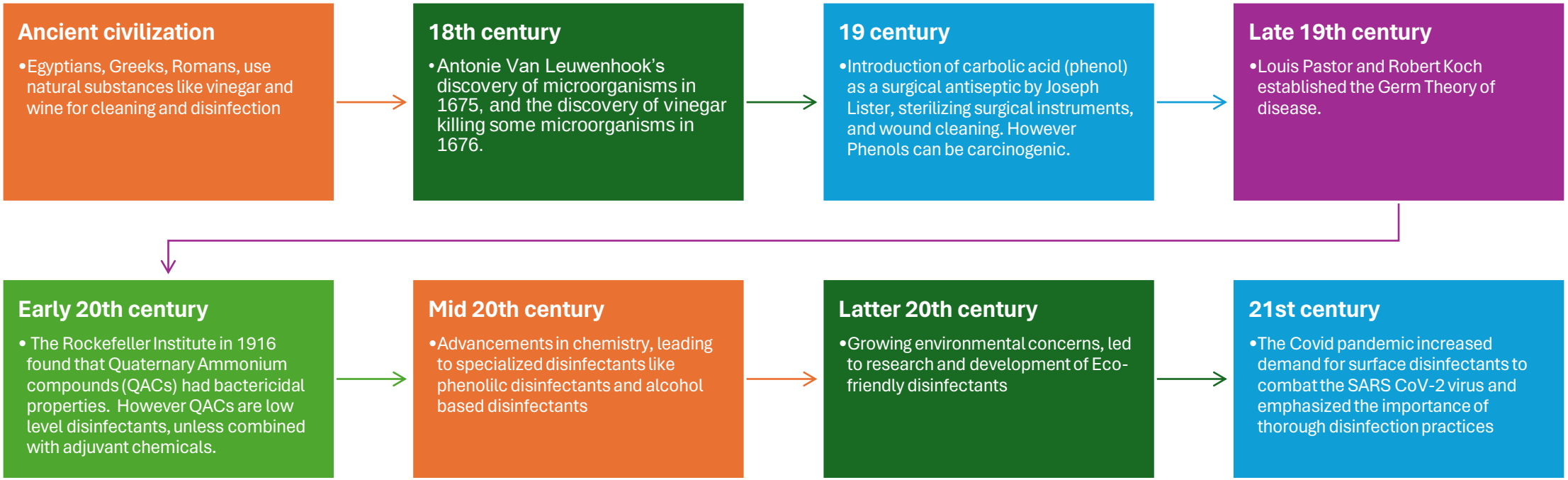
Dr. Martin Johns MD

DISCLOSURE

- CEO and owner of EraDOCate, LLC
- Developed a broad spectrum, eco-friendly one-step clean and disinfect total solution that neutralizes microbes in 60 seconds and leaves zero residue.
- EraDOCate also produces a 2 minute product that kills Monkeypox (mpox), *Clostridium difficile* and *Candida auris*.



Timeline of disinfectants in healthcare



QUATERNARY AMMONIUM COMPOUNDS

Definition: Quaternary Ammonium Compounds (Quats) are versatile cationic chemical compounds with four organic groups attached to a central nitrogen atom.

- **Applications:**
  - **Varying Contact Time:** 1-10 minutes contact time for disinfection against majority of viruses, bacteria, and fungi.

- **Effectiveness:**
  - **Limitations:** While effective against many microorganisms, they may not be suitable for all pathogens, such as bacterial spores and non-enveloped viruses.

- **Safety Considerations:**
  - **Proper Usage:** Users should follow safety guidelines and use Quats as directed to avoid skin and respiratory irritation.[4]
  - **Resistance:** Overuse can contribute to antimicrobial resistance, so careful application is essential.

TURI
TOXICS USE REDUCTION INSTITUTE
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Quaternary Ammonium Compounds (QACs)

The TURA Science Advisory Board (SAB) has recommended that certain Didecyl Dimethyl Ammonium Chloride (DDAC) and Alkyl Dimethyl Benzyl Ammonium Chloride (ADBAC) chemicals be added to the TURA list of Toxic or Hazardous Substances. In reviewing the science about DDAC and ADBAC, the SAB had concerns related to these substances, including respiratory system irritation and inflammation including outcomes consistent with occupational asthma and work-exacerbated asthma; corrosive effects; hazard for aquatic life; and environmental fate and persistence. The SAB had additional concerns for reproductive effects and neural tube development.

This policy analysis summarizes key scientific information on DDAC and ADBAC; estimates the number of facilities that are likely to enter the program as a result of the proposed listing; analyzes opportunities and challenges new filers are likely to face; and discusses the implications of this policy measure for the TURA program. Based on this analysis, the Toxics Use Reduction Institute supports the SAB's recommendation that DDAC and ADBAC be added to the TURA list of Toxic or Hazardous Substances.

OVERVIEW

Quaternary ammonium compounds ("QACs" or "quats") are a broad class of several hundred chemicals. QACs were first discovered in the early 1940s and used mainly as active ingredients in antimicrobials, disinfectants, sanitizers, and surfactants. QACs are used in many products, including wood preservatives, herbicides, eye drops, mouthwashes, nasal sprays, detergents and shampoos, dryer sheets and fabric softeners.

DISINFECTANT TYPE	PROPERTIES	COMMON USES
Alcohols	- Broad-spectrum antimicrobial activity. Used as disinfectants and antiseptics. Mixed with emollients and other biocides for efficacy improvement.	- Disinfection and antiseptic purposes.
Aldehydes	- Glutaraldehyde: Bactericidal, sporicidal, fungal coverage, virucidal. - Formaldehyde: Bactericidal, virucidal, and sporicidal but slower. - O-Phthalaldehyde (OPA): Bactericidal and sporicidal.	- Glutaraldehyde: Cleaning medical equipment. - Formaldehyde: Sterilization and disinfection, with carcinogenic properties. - OPA: Suggested glutaraldehyde replacement for endoscope disinfection.
Biguanides	- Chlorhexidine: Broad-spectrum antiseptic with rapid uptake.	- Skin preparation before catheter insertion.
Diamidines	- Inhibit oxygen uptake and induce amino acid leakage. - Effective against specific bacteria.	- Topical wound treatment.
Halogen-Releasing Agents	- Chlorine-releasing agents (e.g., sodium hypochlorite): Highly active, sporicidal, bactericidal, virucidal. -Iodine-based agents (e.g., povidone-iodine): Rapid action, antiseptic, and disinfectant. - Silver compounds (e.g., silver nitrate, silver sulfadiazine): Used in treating specific infections.	- Sodium hypochlorite: Surface disinfection. -Povidone-iodine: Antiseptic and disinfectant. Silver compounds: Treatment of warts, eye infections, and burn wounds.
Peroxygens	- Hydrogen peroxide (H_2O_2): Broad antimicrobial activity, environmentally friendly. -Peracetic acid (PAA): More potent than H_2O_2, used for sterilizing medical devices.	- Hydrogen peroxide: Disinfection, sterilization, and antiseptic uses. -Peracetic acid: Sterilization and disinfection of medical devices.
Quaternary Ammonium Compounds	- Used as preoperative skin antiseptics and disinfectants for hard surfaces. Can be applied to mucus membranes. - Also used in deodorants.	- Preoperative skin disinfection, surface disinfection, and deodorants.

Sporicidal Performance	A 15% PAA	A 6% PAA	Bleach	Hypochlorous Acid
Clostridioides difficile (ATCC 43598), Candida Auris		2	5	
Bactericidal Performance				
Acinetobacter baumanii (ATCC 19606)	1	2	5	
Bordetella bronchiseptica ((ATCC 10580))		10		
Bordetella pertussis ((ATCC 12743))		2	5	
Clostridium perfringens (ATCC 13124)	1			
Corynebacterium ammoniagenes ((ATCC 6872))		10		
Enterococcus faecalis Vancomycin-Resistant (VRE) (ATCC 51575)	3	2	5	
Escherichia coli O157:H7 (ATCC 35150)	1	10	5	
Escherichia coli ((ATCC 11229))		2		
Escherichia coli ((Extended Spectrum B-Lactamase)) ((ESBL)) ((BAA-196))		2		
Klebsiella pneumoniae (ATCC 4352)	1	2		
Klebsiella pneumoniae (Carbapenem Resistant) ((BAA-1705))		2	5	
Listeria monocytogenes (ATCC 19111)	1	10		
Mycobacterium bovis (Tuberculosis surrogate) ‡	10	10	5	
Proteus mirabilis ((ATCC 9240))		2	5	
Pseudomonas aeruginosa (ATCC 15442)	1	2	5	9.5
Salmonella enterica (ATCC 10708)	1	2	5	10
Salmonella enterica serovar Typhimurium (ATCC 13311)	1	10		
Serratia marcescens (ATCC 13880)	1		5	
Shigella dysenteriae serotype 1 (ATCC 29026)	1		5	
Shigella sonnei ((ATCC 25931))		10		
Staphylococcus aureus (ATCC 6538)	1	2	5	9.5
Staphylococcus aureus Community-Associated Methicillin Resistant (CA-MRSA) (Genotype USA300) (CI 08001	1	2	5	
Staphylococcus aureus Methicillin-Resistant (MRSA) (ATCC 33592)	3	1		
Staphylococcus aureus Vancomycin-Intermediate (VISA) (ATCC 700787)	1	2		
Staphylococcus epidermidis Methicillin-Resistant (MRSE) (ATCC 51625)	1		5	
Streptococcus pneumoniae (ATCC 6304)§	1	2	5	
Streptococcus pyogenes (ATCC 19615)	1	2	5	
Vibrio cholerae (ATCC 14035)	1		5	
Yersinia enterocolitica (ATCC 35669)	1		5	
Virucidal Performance				
Enterovirus Type 68 (ATCC VR-561)		2		
Hepatitis B Virus (HBV) (Duck Hepatitis B Virus) (Hepanda Virus Testing)	1		5	
Hepatitis C Virus (HCV) (Bovine Viral Diarrhea Virus) (American Bioresearch Laboratories)	1		5	
Herpes Simplex Type 1 Virus (ATCC VR-260)	1	2	5	
Herpes Simplex Type 2 Virus (ATCC VR-734)	1	2	5	
Human Coronavirus Strain 229e (ATCC VR-740)	1		5	2.75
Human Immunodeficiency Virus Type 1 (HIV-1) (Zeptometrix Corporation)	1	2	5	
Human Rotavirus (ATCC VR-2018)	1			
Influenza A (A/Hong Kong/8/68-H3N2) Virus (SPAFAS)	1	2	5	
Norovirus (Norwalk-like Virus) (Feline Calicivirus) (University of Ottawa)	1	2		
Poliovirus Type 1 (ATCC 1562) ‡	10			
Respiratory Syncytial Virus (RSV) (ATCC VR-26)	1	2	5	
Rhinovirus Type 37 (ATCC 1147) (Organon Teknika Corp)	1	2		
Rotavirus (Strain WA)		2	5	
SARS-CoV-2 (SARS Coronavirus 2) (USA-WA1/2020) (BEI NR52281) (COVID-19 virus) (2019-nCoV)	1	2	10	
Vaccinia Virus (ATCC VR-156)	1	2		
Animal Virucidal Performance				
Avian Adenovirus ((VR-280))		10		
Avian Infectious Bronchitis Virus ((Strain Baudette IB42))		10		
Avian Influenza A Virus (Turkey/Wis/66-H9N2) (SPAFAS)	1			
Canine Parvovirus ǂ ((CPV)) ((VR-2017))		5	10	
Infectious Bursal Disease Virus		10		
Infectious Laryngotracheitis Virus ((Strain LT-IVAX))		10		
Murine Norovirus ((MNV-1))		2		
Newcastle Disease Virus ((VR-108))		10	5	
Porcine Epidemic Diarrhea Virus ((Clinical Isolate))		2		
Porcine Respiratory & Reproductive Syndrome Virus ((Strain NVSL))		10		
Porcine Rotavirus ((VR-893))		10		
Pseudorabies Virus ((VR-135))		10		
Transmissible Gastroenteritis Virus ((TGE))		10		
Vesicular Stomatitis Virus ((VR-158))		10		
Fungicidal Performance				
Candida albicans (ATCC 10231)	1	2	5	
Trichophyton interdigitale (formerly mentagrophytes) (ATCC 9533)	1	2	5	
Food Contact Surface Sanitizing Performance				
Aeromonas hydrophila ((ATCC 23213))		1		
Clostridium perfringens - vegetative ((ATCC 13124))		1		
Enterobacter aerogenes (ATCC 13048)	1			
Enterobacter sakazakii ((ATCC 29544))		1		
Escherichia coli ((ATCC 11229))		1		
Escherichia coli O26:H11 ((BAA-1653))		1		
Escherichia coli O45:K-:H- ((ECL 1001))		1		
Escherichia coli O103:K-:H8 ((ATCC 23982))		1		
Escherichia coli O111:H8 ((BAA-184))		1		
Escherichia coli O121:K-:H10 ((ECL 39W))		1		
Escherichia coli O157:H7 ((ATCC 35150))		1		
Klebsiella pneumoniae ((ATCC 4352))		1		
Listeria monocytogenes ((ATCC 19111))		1		
Salmonella enterica ((ATCC 10708))		1	2	
Salmonella enterica serotype enteritidis ((ATCC 4931))		1		
Salmonella typhi ((ATCC 6539))		1		
Shigella dysenteriae ((ATCC 11835))		1		
Shigella sonnei ((ATCC 25931))		1		
Staphylococcus aureus (ATCC 6538)	1	1		
Xanthomonas axonopodis ((Citrus Canker)) ((ATCC 49118))		1		
Yersinia enterocolitica ((ATCC 23715))		1	2	

- **Sporicidal Performance:**
  - eraDOCator-60: Clostridium difficile: 2
  - eraDOCator-120: Clostridium difficile: 2 minutes
  - Peroxide Cleaner: 7-10
  - Bleach: 7-10

HAZARDS OF DISINFECTANTS

	Inorganic alcohols (e.g. phenols or thymols)	Chlorine products including bleach	Ammonium products	eraDOCator 60 and 120
Has inorganic active components	✓	✓	✓	
Leaves toxic byproducts	✓	✓	✓	
Produces toxic gas	✓	✓	✓	
Skin irritant	✓	✓	✓	
Skin pigmentation changes	✓	✓		
Increases cancer risk (skin, reproductive, lung etc)	✓	✓	✓	
Can create water toxicity	✓	✓	✓	
Contributes to Ozone depletion		✓		
Affects aquatic life/coral reefs		✓	✓	
COPD, bronchitis, asthma and rhinitis	✓	✓	✓	
Chronic chemical pneumonitis		✓	✓	
Fetal damage during pregnancy or fertility issues in men	✓		✓	
Dental cavities/dental loss		✓		

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Research Article

New Advances in Brain & Critical Care

Can Eradocator-60 Decrease MDRs and HAIs? An Evaluation of the Efficacy of Eradocator-60 in a Randomized Clinical Trial in a Community Hospital

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Abstract

Background: *There is a significant transmission of contaminants in the healthcare setting. Daily disinfection utilizing ammonium and chlorine-based products can lead to adverse health effects such as asthma, cancer, and other serious health issues.*

Methods: *This study evaluated the effectiveness of eraDOCator-60 in a health care facility. This randomized trial took place at Copley Hospital in Morristown, Vermont. Separate areas of the hospital were cleaned and disinfected in one step with eraDOCator-60. A Charm analyzer was utilized to evaluate the efficacy of disinfection before and after 1-minute application of eraDOCator-60. The Charm analyzer detects Adenosine Triphosphate (ATP) presence measured in Relative Light Units (RLUs).*

Results: *The median number of RLUs decreased from 52,874 s to 0 RLUs after one-minute eraDOCator-60 dwell time in the emergency room; 18.611 RLUs to 0 RLUs in the medical- surgical unit, 41,507 RLUs to 0 RLUs in the cafeteria; 24,932 RLUs to 0 RLUs in the birthing center.*

Conclusions: *EraDOCator-60 reduced contamination levels on all surfaces in the acute care setting down to a value of zero following a 1-minute dwell time in less than 5% soil load.*

Disinfectants:https://www.ncbi.nlm.nih.gov/books/NBK574540

CLINICAL SIGNIFICANCE

- **Healthcare Associated Infections (HAIs) become evident 48 hours after admission to the hospital.**
- **Persistent pathogens in the hospital setting include Clostridium difficile (C. diff.), vancomycin-resistant enterococci (VRE), and methicillin-resistant Staphylococcus aureus (MRSA).**
- **Strategies to reduce HAI rates:**
  - **Easy to read labels with DWELL time, expiration date and date created/opened**
  - **Increase access to effective products**
  - **Cleaning and disinfection in less steps, removing barriers, and decreasing time requirements**
  - **Ensure clear communication among healthcare teams.**
  - **Educate healthcare workers on effective disinfectants.**
  - **Understand different disinfectant types and their coverage.**
  - **Implement scheduled cleaning and maintenance.**
- **Everyone in the healthcare setting, including healthcare professionals and patients, can innovate ways to reduce HAI risk.**

175 YEARS LATER:
HAIs REMAIN A TOP-10 CAUSE OF DEATH

- **HAIs were discovered in 1846 by Ignaz Semmelweis due to poor hand hygiene practices.**
- **In the 1950s, infection control became a discipline in US hospitals.**
- **The CDC established hand hygiene guidelines in the 1980s.**
- **Electronic hand hygiene compliance monitoring (EHHCM) systems were introduced about a decade ago.**
- **EHHCM uses connected dispensers to collect real-time hand hygiene data.**
- **HAIs remain a leading cause of death in the US.**
- **There are many questions on how quickly innovations can reduce or eradicate HAIs.**

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https://www.infectioncontroltoday.com/view/175-years-later-hais-remain-top-10-cause-death

Hierarchy of Pathogen Resistance to Disinfectants

Environments have microorganisms that are quick to spread, resistant to kill, and harmful to people and pets.

Standard chemicals require longer dwell times to render microorganisms inactive

Long standing products left on surfaces are more likely to cause respiratory ailments and dermatological reactions.

Factors such as limited time, limited staff, and large amounts of square footage to cover risk inadequate disinfection.

	Pathogen Class	Pathogen*	Associated Diseases	Surface Survival‡ [1,2]
Easier to Kill	Enveloped Viruses	SARS-CoV-2	COVID-19	Up to 8 days
		Human Immunodeficiency Virus	AIDS	More than 7 days
		Hepatitis B Virus	Hepatitis	More than 7 days
		Hepatitis C Virus	Hepatitis	Up to 5 days
		Influenza A Virus	Flu	Up to 2 weeks
		Influenza B Virus	Flu	Up to 24 hours
		Respiratory Syncytial Virus	RSV	Up to 7 hours
		Ebola Virus	Hemorrhagic fever (Ebola)	Up to 4 days
	Bacteria	Methicillin-Resistant *Staphylococcus aureus* (MRSA)	Skin, lung and bloodstream infections	Up to 3 years
		Escherichia coli	Diarrhea, urinary tract and lung infections (pneumonia)	Up to 10 months
		Pseudomonas aeruginosa	Blood and lung infections (pneumonia)	Up to 8 weeks
		Streptococcus pyogenes	Strep throat and impetigo	Up to 4 months
		Acinetobacter baumanii	Blood, urinary tract, wound and lung infections (pneumonia)	Up to 5 months
		Bordetella pertussis	Whooping cough	Up to 5 days
	Fungi	*Candida auris*	Bloodstream and wound infections	Up to 4 months
		Candida albicans	Yeast infections	Up to 4 months
		Trichophyton interdigitale	Athlete's foot	Up to 20 months
	Large, Non-Enveloped Viruses	Adenovirus	Cold and flu-like illnesses	Up to 3 months
		Rotavirus	Severe diarrhea	Up to 60 days
	Small, Non-Enveloped Viruses	Coxsackievirus	Hand, foot and mouth disease	More than 2 weeks
		Norovirus	Stomach flu	Days to weeks
		Poliovirus	Polio	Up to 8 weeks
		Rhinovirus	Common cold	Up to 25 hours
	Bacterial Spores	*Clostridium difficile*	Large intestine infection	Up to 5 months
Harder to Kill	Prions	Prion protein	Creutzfeldt-Jakob disease (CJD)	May maintain infectivity for years

*Within pathogen classes, some species may be harder to kill than others. For example, pathogens that are known to create biofilms, such as *Pseudomonas aeruginosa* and *Candida auris*, can be much more difficult to disinfect than other pathogens in the same class. †Always check the product master label for approved kill claims and follow directions for use regarding contact times and any required precleaning steps. Not all disinfectants will have claims against all of these pathogens. ‡Surface survival is dependent on a number of factors, including temperature and relative humidity.

References:
1. Kramer A., Schwebke I., Kampf G. How long do nosocomial pathogens persist on inanimate surfaces? A systematic review. BMC Infect. Dis. 2006; 6:130.
2. Wißmann, J. E., Kirchhoff, L., Brüggemann, Y., Todt, D., Steinmann, J., & Steinmann, E. (2021). Persistence of pathogens on inanimate surfaces: A narrative review. Microorganisms, 9(2).

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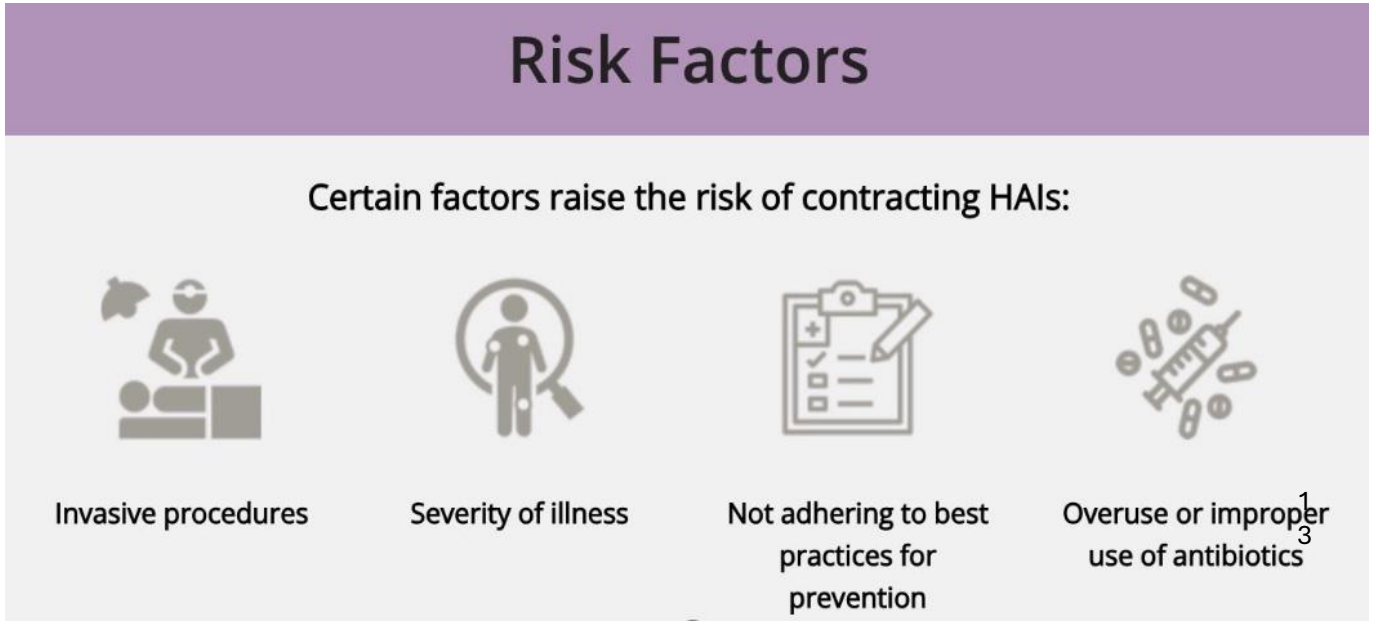
HEALTHCARE-ASSOCIATED INFECTIONS, HEALTHCARE ASSOCIATED CONDITIONS & MULTI-DRUG RESISTANT ORGANISMS

Hard Surface Cleaning/Disinfection practices are an untapped area for IP improvement



- https://www.cdc.gov/policy/polaris/healthtopics/hai/index.html#:~:text=HAIs%20in%20U.S.%20hospitals%20have,least%20%2428.4%20billion%20each%20year.

ECONOMIC IMPACT OF HAIS

Healthcare-Associated Infections (HAIs) not only lead to increased morbidity and mortality but also impose a significant financial burden on the healthcare system.

The estimated direct annual cost of treating HAIs in the United States ranges from $28.4 billion to $45 billion, with a portion of this cost being preventable, estimated between $5.7 billion and $31.5 billion.

HAIs also account for an additional $12.4 billion in costs to society due to early deaths and lost productivity.

On any given day, 1 in 31 hospital patients has an HAI, and additional infections occur in other healthcare settings.

Many HAIs are caused by antibiotic-resistant bacteria, increasing the risk of severe conditions like sepsis or death.

The Centers for Medicare & Medicaid Services (CMS) reported that national health spending reached $4.5 trillion in 2022, constituting just over 17% of the gross domestic product (GDP).

https://www.kff.org/other/perspective/the-two-health-care-cost-crises/#:~:text=We%20work%20on%20all%20of,of%20the%20CMS%20annual%20report

HTTPS://WWW.JSTOR.ORG/STABLE/25750596

HTTPS://WWW.CDC.GOV/POLICY/POLARIS/HEALTHTOPICS/HAI/INDEX.HTML#:~:TEXT=HAIS%20IN%20U.S.%20HOSPITALS%20HAVE,LEAST%20%2428.4%20BILLION%20EACH%20YEAR.

HTTPS://WWW.NCBI.NLM.NIH.GOV/PMC/ARTICLES/PMC9949640/#:~:TEXT=HAIS%20NOT%20ONLY%20LED%20TO,PUBLIC%20HEALTH%20SYSTEM%20%5B8%5D.

LESS THAN HALF OF HAIs INVOLVE DEVICES OR SURGERIES

Less than half (47.4%) of Healthcare-Associated Infections (HAIs) are associated with devices or surgical procedures.

Device-associated infections (e.g., CAUTI, ventilator-associated pneumonia, CLABSI) make up 25.6% of all HAIs.

Surgical-site infections account for 21.8% of HAIs.

The bacterium Clostridioides difficile (C. difficile) is a significant contributor to HAIs, making up 12.1% of cases.

C. difficile is easily transmitted from person to person.

In 2017, C. difficile caused an estimated 223,900 HAI cases and 12,800 deaths, according to the CDC.

C. difficile is resistant to multiple antibiotics commonly used in clinical settings.

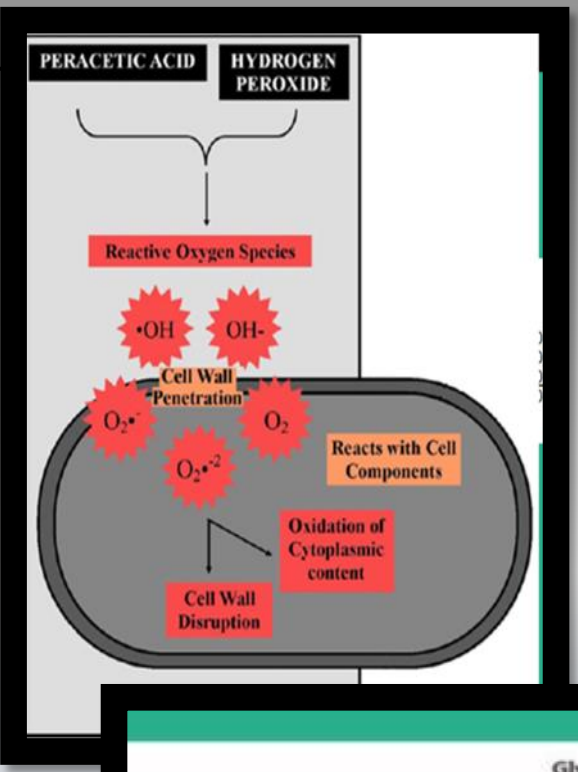
Treatment with antimicrobials increases the risk of developing a C. difficile infection, creating a complex challenge in healthcare settings. [15]

https://www.wolterskluwer.com/en/expert-insights/five-ways-an-infection-prevention-program-reduces-hais-and-protects-patients

PERACETIC ACID: THE ULTIMATE SOLUTION

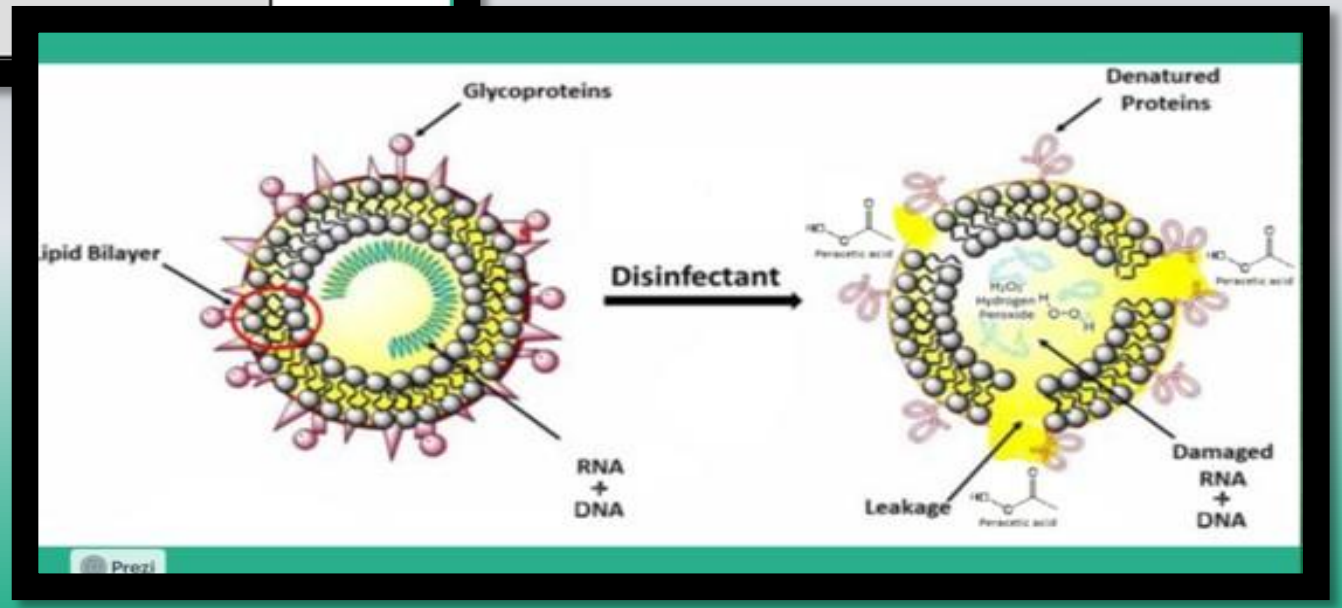
- Peracetic solutions are considered to be a more potent disinfectant than hydrogen peroxide, sporicidal, bactericidal, virucidal & fungicidal at low concentrations, & are environment friendly. They have replaced traditional disinfectants for medical devices, endoscopes & haemodialysers.
- PAA also acts as an environmental surface sterilant, behaves similarly to other oxidising agents, disrupting cell wall permeability & oxidising sulphur bonds in proteins, enzymes and other metabolites.
- The FDA has cleared Steris 20 Sterilant (Steris) for use with Steris System 1, an automated liquid chemical sterilisation processor for endoscopes, arthroscopes and other surgical instruments.

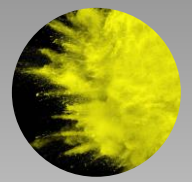
https://www.hospitalmanagement.net/features/featureppc-disinfectants-hai-globaldata/?cf-view



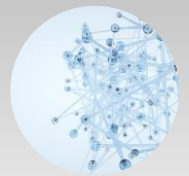
The Secret

Potent Microbe Oxidizer





Acts as microscopic explosive



Kills then evaporates into carbon dioxide and water

Peracetic acid destroys phospholipid bilayer, allowing both hydrogen peroxide and additional peracetic acid molecules to attack organism from the inside

NO HARMFUL RESIDUE

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COVID-19 AND *CANDIDA AURIS* ARE CONTINUED THREATS TO WATCH

- **Contact tracing for healthcare personnel with occupationally acquired COVID-19 is essential for clinician safety and preventing transmission to patients.**

- **Candida auris is increasingly causing infections, especially in patients who received care in areas with high C. auris transmission rates. This emphasizes the need to track and understand community transmission's impact on healthcare facilities.**

- **Mortality rates for C. auris infections can be significant, with estimates suggesting 30-60% mortality among infected individuals.**

- **Infection control programs should be prepared to handle surge capacity during COVID-19 and other outbreaks, ensuring the ability to rapidly expand healthcare services and resources.**

- **Outbreak responses, like those seen during the COVID-19 pandemic, can affect existing Healthcare-Associated Infections (HAI) prevention and control processes, procedures, and outcomes. Adaptation and assessment are crucial during such situations.**

https://www.wolterskluwer.com/en/expert-insights/five-ways-an-infection-prevention-program-reduces-hais-and-protects-patients

INFECTION CONTROL PLANS SHOULD CONSIDER RISKS OF HAIs BEYOND HOSPITALS

- **Key areas of concern for infection control leaders:**
  - **Long-term Care**:
    - National infection rate in long-term care: 1.07 infections per 1,000 resident days.
    - Increase in respiratory tract infections observed in 2019-2020.
  - **Outpatient Surgery**:
    - Ambulatory surgery centers and outpatient settings often lack dedicated infection control personnel.
    - Challenges in oversight and prevention in these settings.
  - **Dialysis**:
    - Increased risk of HAIs due to factors like blood exposure, proximity to other patients, and frequent hospitalization.
    - Specialized infection control measures needed in hemodialysis settings.
- As the population ages, outpatient surgeries increase, and antimicrobial resistance grows, infection control will require more specialized resources, research, and personnel dedicated to IPC efforts.

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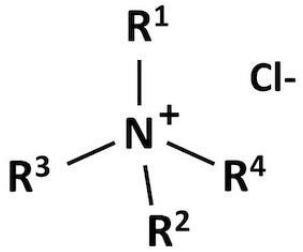
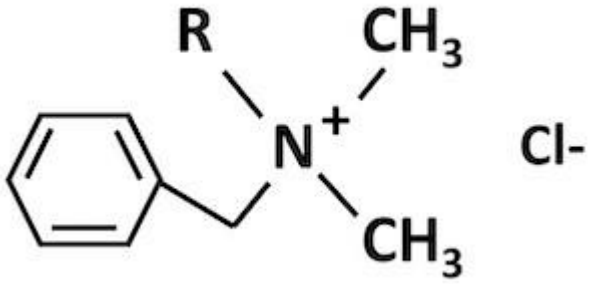
QUATERNARY AMMONIA COMPOUNDS

Quaternary ammonium compounds, also called quats, are chemicals made of two basic parts. The first part is a central nitrogen atom.[1] The second part is made up of four clusters of atoms[2] that are attached to the nitrogen atom (Figure 1). The U.S. Environmental Protection Agency (EPA) currently classifies quats into four different groups based on the structure of the four clusters attached to the central atom. The physical and chemical properties of the quats contribute to the behavior of the quat and how toxic it is.





Identification of QACs There are many different QACs found in disinfectants or cleaning products. The most commonly used QAC disinfectants are the benzalkonium chlorides, also known as alkyl dimethyl benzyl ammonium chlorides.

- Higher toxicity and risk for asthma, malignancies

RECENT STUDY 12/23 AIMED TO EXAMINE THE IMPACT OF PRIVATE EQUITY ACQUISITIONS ON US HOSPITALS' CLINICAL QUALITY AND PATIENT OUTCOMES.

- **Data from 662,095 hospitalizations at 51 private equity-acquired hospitals.**
- **Compared to 4,160,720 hospitalizations at 259 non-private equity hospitals (2009-2019).**
- **Private equity hospitals saw a 25.4% increase in hospital-acquired conditions.**
- **Increase driven by higher falls (27.3%) and bloodstream infections (37.7%).**
- **Surgical site infections doubled in private equity hospitals.**
- **Patients at private equity hospitals were younger and had fewer Medicare/Medicaid dual eligibility.**
- **More transfers from private equity hospitals after shorter stays.**
- **In-hospital mortality slightly decreased in private equity hospitals.**
- **Study raises concerns about private equity's impact on healthcare delivery.**

https://jamanetwork.com/journals/jama/article-abstract/2813379?guestAccessKey=e0cef9be-d55c-4bcf-8892-412af8f24355#:~:text=After%20private%20equity%20acquisition%2C%20Medicare,004).

SUMMARY

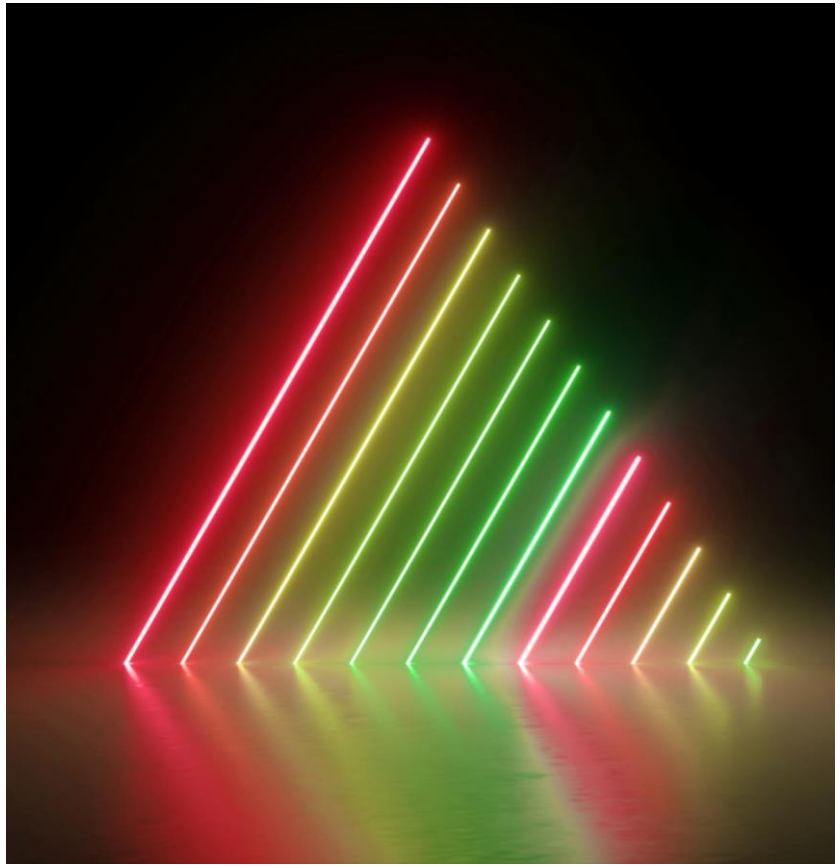
- **Historical Use:** Disinfectants have been used since ancient times, with significant advancements in the 19th and 20th centuries, including eco-friendly alternatives. – Most hospitals are still using “Quats”

- **Current Challenges:** Healthcare-associated infections (HAIs) persist as a top cause of death, with substantial economic impacts, particularly in the U.S. Pathogens like C. difficile, VRE, and MRSA remain significant challenges.

- **Innovations and Strategies:** Notable innovations include eco-friendly disinfectants and Electronic Hand Hygiene Compliance Monitoring systems. However, addressing HAIs requires a multifaceted approach across various healthcare settings. PAA is a crucial system consideration

- **Future Directions:** Continued innovation and stringent infection control measures are crucial. Factors like device-associated infections, antibiotic-resistant bacteria, and emerging threats such as COVID-19 and Candida Auris need continued attention.

- MOST hospital disinfectants are not effective due to long dwell times at diluted ppm, causticity, sub lethal residues, and harm to staff and the environment.



Q&A

THANK YOU